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TELECOMMUNICATIONS—
A PROGRAM FOR PROGRESS

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A Report by the
President's Communications Policy Board

February 1951

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LETTER OF TRANSMITTAL

February 16, 1951

Dear Mr. President:

We have the honor to transmit the report on policies and practices recommended to be followed by the Federal Government in the communications field, which was called for by Executive Order 10110 of February 17, 1950, establishing the President's Communications Policy Board.

During the year since our appointment, we have examined many phases of the problems of national telecommunications policy and practice. We have consulted the best-qualified Government and private sources. A small professional staff has studied special phases of the field. The major results of these consultations and special studies are embodied in our report.

The Board is in unanimous agreement on the conclusions expressed.

Respectfully submitted,

Lee A. DuBridge

William L. Everitt

James R. Killian, Jr.

David H. O'Brien

Irvin Stewart, Chairman

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INTRODUCTION

THE PROBLEM POSED

Pressing problems in the operation of the nation's wire and radio communications facilities led to the creation of the President's Communications Policy Board on February 17, 1950.

In his letter of that date to our Chairman, the President declared that there is "a major public interest in assuring the adequacy and efficiency" of this "vital resource." He noted the close relationships of the telecommunications services--radio, telephone, and telegraph--and the influence of governmental operations on the system. The President therefore asked for a comprehensive inquiry that would view the specific problems as parts of the "broader problem of developing a total national communications policy." The text of the President's letter follows:

"My dear Dr. Stewart:

"Communications services represent a vital resource in our modern society. They make possible the smooth functioning of our complex economy. They can assist in promoting international understanding and good will; they constitute an important requirement for our national security. There is, accordingly, a major public interest in assuring the adequacy and efficiency of these services.

"Developments in this field during and since the war have created a number of problems which require careful consideration at this time. The extent to which the Government should, in time of peace, continue to operate its own communications facilities is one such problem of current importance. The question of merging the overseas operations of our commercial communications companies also requires objective review. The

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claims for frequencies, and possible administrative arrangements within the Government for assuring, on a continuing basis, a sound and equitable allocation of the limited frequency supply.

"I believe that the studies to be undertaken by the Board are of vital importance to the economy of this Nation, to our international relations, and to our national security. I am sure that you will receive the full cooperation and assistance of all parties concerned.

Sincerely yours,

HARRY S. TRUMAN"

The Executive Order referred to in the President's letter reads as follows:

"EXECUTIVE ORDER # 10110

- - - - -

"PRESIDENT'S COMMUNICATIONS POLICY BOARD

"By virtue of the authority vested in me as President of the United States, it is hereby ordered as follows:

"1. There is hereby created a board to be known as the President's Communications Policy Board which shall be composed of a chairman and four other members to be designated by the President.

"2. It shall be the function of the Board to study the present and potential use of radio and wire communications facilities by governmental and non-governmental agencies and to make and present to the President evaluations and recommendations in the national interest concerning (a) policies for the most effective use of radio frequencies by governmental and non-governmental users and alternative administrative arrangements in the Federal Government for the sound effectuation of such policies, (b) policies with respect to international radio and wire communications, (c) the relationship of government communications to non-government communications, and (d) such related policy matters as the Board may determine.

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"3. The Board is authorized to hear and consult with representatives of industry and the Federal Government concerned with the subjects under study by the Board. All executive departments and agencies of the Federal Government are authorized and directed to cooperate with the Board in its work and to furnish the Board such information as it may require in the performance of its duties. The Board shall protect the security of any classified information submitted to it.

"4. Each member of the Board shall, while away from his home or regular place of business and engaged in the official business of the Board, receive actual traveling expenses and per diem allowances in lieu of subsistence in accordance with rates established by the Standardized Government Travel Regulations, as amended.

"5. During the fiscal year 1950 the expenditures of the Board and the traveling expenses and per diem allowances of the members thereof shall be paid out of an allotment made by the President from the appropriation appearing under the heading "Emergency Fund for the President" in the Independent Offices Appropriation Act, 1950 (Public Law 266, approved August 24, 1949); and during the fiscal year 1951 the same shall be similarly paid from any corresponding or like appropriation made available for the fiscal year 1951. Such payments shall be made without regard to the provisions of (a) section 3681 of the Revised Statutes (31 U.S.C. 672), (b) section 9 of the act of March 4, 1909, 35 Stat. 1027 (31 U.S.C. 673), and (c) such other laws as the President may hereafter specify.

"The Board shall terminate one year after the date of this order.

HARRY S. TRUMAN

THE WHITE HOUSE,

February 17, 1950."

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CHAPTER I

AN ANSWER IN SUMMARY

One of the bulwarks of a free society is freedom of communications. Its commerce, its education, its politics, its spiritual integrity, and its security depend upon an unimpeded and unsubservient exchange of information and ideas.

One of the hopes for a peaceful world rests upon the ultimate possibility of extending this same freedom of communications beyond all barriers. War begins in the minds of men and in the minds of men must be engendered the will for peace. We must therefore strive to facilitate a meeting of the minds of men everywhere, and through the liberating arts of communication to create the attitudes favorable to peace.

These convictions and concepts have provided the background for the conclusions and recommendations reached in the following study of the economic, organizational, and physical aspects of America's telecommunications system.

Our telecommunications system is a great national resource which makes available to the people of the United States a rapid nationwide and worldwide communications service.

All the facilities which make this service possible--telephone, telegraph, radio, and television--utilize electrical energy in some form to transfer information from one person to another. Electrical

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impulses speeding through these facilities convey intelligence of all sorts throughout the country and to other nations of the world.

When wires and cables are used as the sole media through which they are transmitted, it is not difficult to control these impulses. When the transfer of electrical energy is made by radio through the medium popularly called the "ether," serious problems arise.

Many of these problems stem from the fact that the ether is public property available to all the people of the world, and the further fact that there is a limit to the number of electromagnetic waves which can travel through it without interfering with one another.

If interference is to be avoided, it is obvious that both national and international users of the radio spectrum must reach accord on equitable sharing of this limited medium. Consequently, telecommunications must be considered both from a national and from an international point of view.

The telecommunications system of the United States is engaged basically in the transfer of information from one person to another. Yet information about the system is inadequate. As part of our studies, we have gathered facts that fill some of the important gaps. The recognition that there are other gaps and that they too must be filled underlies several of the recommendations of policy and action which we shall make.

In our quest for solutions to the problems of telecommunications, we surveyed the facilities available today and the difficulties

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encountered in their operation, reviewed the troubles that have caused growing pains in the development of the system, and sought symptoms of future ills.

Both private and public agencies operate in the telecommunications system. We have found inescapable evidence of serious difficulty, not confined to the United States alone, but international in scope, in the management and use of the worldwide but limited resource of the radio frequency spectrum. There is indication of economic danger for some private companies, and of a lack of help on the part of Government agencies in avoiding that danger. There is evidence of confusion of responsibility among Government agencies which from time to time have been established for the regulation of parts of the system. These are principal among the disconcerting facts which our studies have disclosed.

Not all the facts are disconcerting, however. We have also found reason for no small amount of encouragement. There are many--and they are among the largest--areas of the telecommunications system, both public and private, in which standards of efficiency, economy, and performance are superb. There is a spirit of cooperation among the component organizations--public and private. There is in existence an administrative structure which, if properly strengthened, can become an effective central instrument to foster a vigorous telecommunications system.

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Special Problems of Telecommunications

Telecommunications present a special combination of technological, economic, social, and political problems. The telecommunications system as a whole, public and private, depends to an unusual degree upon a technology which is changing and growing with marked rapidity. The task of adjusting organization and practice to take advantage of these technological advances and opportunities is complicated, however, by the intimate connection of telecommunications with both the national security and the international relations of the United States. Political considerations may require commercial carriers to maintain unprofitable circuits to certain overseas points. Economic prospects may counsel against heavy investment in the latest and most expensive high-speed cable equipment, yet the requirements of national defense may justify such an outlay.

The radio sector of our telecommunications system is further complicated by the fact that radio operates in the public domain. The possibility of interference necessitates domestic and international efforts to arrive at agreements for the apportionment of radio frequencies. Here again, efforts to take full advantage of new developments must proceed in the short run within the limits of existing agreements, and may be hampered or helped in the long run by the results of efforts to negotiate new ones.

Special economic pressures have borne heavily on some of the nation's telecommunications companies. Air mail and long-distance

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telephone service have reduced the potential demand for telegraphic services. American companies engaged in overseas operations have been competing with each other for markets and in dealing with foreign monopolies. In this latter case, American companies have met with a special obstacle: The competition among American firms offers foreign monopolies the opportunity to play American competitors off against each other. The Federal Government's own international telecommunications network, which has grown to vast proportions in recent years, has handled traffic which might have been sent over common carriers.

The merging of private companies engaged in international radio and cable communications has at times been advocated as a way of easing their position. In the domestic field, merger of the telegraph companies has already occurred. It has been further advocated that the merged company acquire the record communications business of the telephone company--its teletypewriter exchange and leased line services.

Continued operation of the privately owned companies is essential to the national security, but nowhere do we find provision within the Government to insure that Government policies do not inadvertently affect the economic well-being of these companies.

We have found that the Federal Government has encountered many difficulties in its efforts to keep up with the growth and increasing complications of the nation's telecommunications structure. Some of

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these difficulties are suggested in the chapters on domestic and international telecommunications.

Technological progress in telecommunications is so rapid that it could quickly alter the character of the entire structure. This fact requires special vigilance on the part of the regulatory agencies.

Specific Issues

For analysis, we resolve these general problems into five specific issues. They are:

1. How shall the United States formulate policies and plans for guidance in reconciling the conflicting interests and needs of Government and private users of the spectrum space--that is, for guidance in making the best use of its share of the total spectrum?

2. How shall the United States meet the recurrent problem of managing its total telecommunications resources to meet the changing demands of national security?

3. How shall the United States develop a national policy and position for dealing with other nations in seeking international telecommunications agreements?

4. How shall the United States develop policies and plans to foster the soundness and vigor of its telecommunications industry in the face of new technical developments, changing needs, and economic developments?

5. How shall the United States Government strengthen its organization to cope with the four issues stated above?

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The first four of these questions require brief explanation.

1. Reconciling Uses of the Spectrum. This task--which is known as frequency management--is one of enormous technical complexity. Different portions of the spectrum have radically different propagation characteristics; that is, their range and dependability vary. Some are usable for long-distance and others only for short-haul purposes. Their efficiency also changes from night to day, and from day to day, and is affected by sun spots and by atmospheric conditions.

By better management of the spectrum, much more could be done with frequencies now available. There is opportunity for more effective sharing of frequencies, for more intensive use of individual frequencies, and increased economy in kilocycles assigned to each circuit.

The assignment of space in the spectrum among private users (including state and local but not Federal Government agencies) is a responsibility of the Federal Communications Commission (FCC). The total amount of such space available for assignment, however, is not determined by the FCC. In effect, it is determined by the President, who is responsible for the assignment and management of those frequencies used by Federal Government agencies. The Interdepartment Radio Advisory Committee (IRAC) is the instrumentality through which frequencies are assigned to Federal users. Thus far, no national policy has existed to clarify this dual control of a single resource and thus to aid in governing the apportionment of space between private users and Government users as groups. No criteria have been established

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for use in choosing between the conflicting needs of a Government and a non-Government user.

2. National Security. In the present period of recurrent crisis, it is likely that we shall be faced with a continuing problem of adjusting the use of telecommunications--especially radio frequencies--to what may be violent fluctuations in the requirements for national security. Indeed, we may face a situation in which the President's emergency powers to control, take over, or close down communications facilities will have to be invoked, and arrangements for the delegation and exercise of those powers will be essential. We may also be faced with the necessity of creating wholly new telecommunications facilities.

Telecommunications of course play a major role in the economic and cultural life of the nation. They are the vital nerve system of our modern military establishment. When spectrum space is insufficient to meet both the full needs of national security and the full needs of other affairs, the latter must give way to the former. When the emergency has passed, frequencies and facilities must be restored to civilian use. To create an ad hoc agency to meet each crisis would be a clumsy expedient at best, and indeed, the problems of transfer and retransfer of spectrum space and of facilities for using it are too complex for ad hoc control to be adequate. A continuing mechanism to deal with this situation is needed for the foreseeable future.

3. International Agreements. Just as the United States has no clear policy for apportioning its own share of spectrum space, so it

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has lacked satisfactory means of determining policy as a basis for negotiations with other nations. The United States, in preparing positions for international negotiations, has in effect asked Federal and other claimants to state their needs, and then presented the total as the United States requirement. In those portions of the spectrum where the total of these requirements has been small enough to be accommodated along with the needs of the rest of the world, our delegations to conferences have had a negotiable position. In some cases, however, the total stated requirements have exceeded not merely those which could reasonably be put forward as the proper United States share, but have actually exceeded the total physical content of the bands. Furthermore, there is no permanent mechanism by which the stated requirements of United States users can be adjusted with equity and safety. The imperative need for means of making such adjustments hardly requires elaboration.

4. Maintaining a Sound Industry. The private telecommunications industry of the United States is one of the nation's most valuable assets in peace or in war. The normal life of the country is supported and facilitated by it in numberless ways. In abnormal times, the industry can place at the disposal of the nation its large reserve capacity, built up because of its competitive structure. This capacity helps to take up the immediate surge of military requirements. The industry can release radio frequencies, cable capacity, and other communications facilities, when required for Government purposes, without

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seriously affecting its ability to carry the civilian load.

It is essential that the industry be in sound economic condition. Some of its components, however, have faced serious difficulties. To meet these situations, the companies have from time to time taken individual action, and from time to time Government has been of assistance to them in rate adjustments and other ways.

But there has been no long-range study of the question, no long-range planning. No agency of Government is in a position to take a comprehensive view of this problem. No agency is qualified to advise the President in fields where the interests of private and Government telecommunications users are in conflict. Meanwhile, in the absence of guiding policy, the action of Government agencies could seriously handicap the industry.

Scope of the Study

We have spent nearly a year seeking answers to these four problems and also to the crucial question Number 5--"How shall the U. S. Government strengthen its organization to cope with these four issues?" In this study we found it necessary to collect a large volume of information--some of which was not readily available in public documents. We were fortunate in securing the services of an extremely competent staff and we received most cordial cooperation from all Government and private agencies whom we consulted. Many agencies went to great lengths to supply detailed data on various phases of the problem.

The most pertinent information which we collected is summarized in

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the succeeding chapters of this report, and we have given particular attention to those subjects not adequately covered in existing literature. And yet there are many important phases of the subject which we have covered only too lightly, in some cases because there already exists available public information, but in other cases because we did not have time to carry out the extensive research necessary for an adequate treatment. In fact, as our study progressed, we became more and more aware of the great complexity of the problem and of the fact that no temporary or part-time board could do justice to the entire problem.

Critical to this study was an investigation of the nature and extent of the actual pressure for additional space in the radio frequency spectrum. The picture of the situation presented in Chapter II is one of great complexity. In many bands there is extreme congestion. The competition for frequencies for radio broadcasting and for television is well known to all. Less well known but also critical is the situation in the band suitable for very long range communication--4 to 27.5 megacycles. In this band not only is there great need for many circuits, but, because of propagation characteristics, two stations thousands of miles apart may still interfere with each other if they operate on the same or adjacent frequencies. The problem immediately becomes one for complex international negotiations.

The degree of spectrum crowding varies enormously in different parts of the spectrum and in different parts of the world. And opinions

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vary as to how serious the situation now is. But no one denies that it is getting worse and will continue to do so. Only vigilant intelligent management and vigorous pursuit of new technological possibilities can prevent possible future chaos.

In Chapter III we turn attention to an analysis of the U. S. domest wire and radio telecommunication facilities, tracing their technological development and the economic problems they face. These facilities are very largely privately owned--though the U. S. Government is a most substantial customer. But the great bulk of the facilities available for public message service--telephone and telegraph--are owned by two great regulated but competing monopolies--the American Telephone and Telegraph Company and the Western Union Telegraph Company. These two companies perform an invaluable public service, and it is important for the Government to make sure they are intelligently regulated so that the public and the Government may continue to receive the benefits of the irreplaceable service they supply.

We believe that this service can best be insured by retaining the present system of private ownership.

The field of international telecommunication (Chapter IV) offers far more puzzling problems. Thus, while the United States end of overseas radio telephone service is in the hands of a single company (the Bell System), radio and cable telegraph services are offered by several competing companies. Fluctuating international political and economic conditions, the rapidly growing use by the U. S. Government of

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international communication facilities (many of which are Government owned), competition for space in the crowded long-range radio communication spectrum, and many other factors have led to serious problems whose nature and extent are only too inadequately outlined in this report. But they demand urgent attention by the U. S. Government, and we have recommended policies and mechanisms to help solve these continuing problems.

The nature and functions of the various existing Government agencies concerned with telecommunications have been given detailed examination (Chapter V). We find a complex pattern of such agencies with even more complex interrelations. It is a structure which has functioned smoothly in many ways. But it involves a duality or even multiplicity of control, overlapping interests, and is a structure inadequate to meet the ever more complex problems of this field. We believe the structure can be rendered coherent by the creation of a new executive agency and we set forth in some detail our proposals for the creation of this agency.

Finally in Chapter VI, we set forth existing and proposed telecommunications policies in the hope that they may serve as a starting point for the development of policies to guide present and future agencies, public or private, which deal with telecommunications.

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Conclusions

On the basis of our studies, we have reached the following conclusions.

A. As to the pressures on the radio spectrum:

1. Pressure on the radio frequency spectrum is steadily increasing as a result of the greater use of radio in telecommunications.

2. The means on which we have relied in the past for management of the spectrum are no longer adequate to resolve in the best national interest the problems produced by this increasing pressure. The current difficulty growing out of the search for suitable space for television broadcasting in itself emphasizes this inadequacy.

3. Measured in terms of spectrum space rather than in number of discrete frequency channels, the Federal Government's share of the spectrum, though not so great as is commonly believed, is nevertheless large. While we do not know that it is out of proportion to the Government's responsibilities, it must have the most adequate justification and careful management if the greatest benefit is to be obtained from it.

4. There is need for a continuing determination of the changing requirements of Federal Government users both among themselves and in relation to the requirements of other users.

5. The recent rapid worldwide growth of telecommunications, combined with the needs of the current national emergency, makes the resolution of these problems a matter of great urgency.

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6. The resolution of these problems can be secured only through adequate, energetic management, which demands that the Government organize itself to take a comprehensive view of the telecommunications field.

B. As to United States telecommunications at home:

1. The telephone system of the United States is a financially sound, multi-billion dollar industry consisting of the Bell System and 5,000 independent companies. This coordinated system is providing the nation with what is admittedly the best telephone service in the world. It is steadily improving that service by aggressive technological advancement. In view of the healthy condition of the telephone system, we conclude that no changes in Government procedure for insuring adequate service in the national interest are necessary.

2. The telegraph system of the United States has experienced economic difficulties owed in part to the expansion of other means of rapid communication. The recent return of the principal telegraph company to profitable operation, in part because of improved management and modernization of its plant and in part because of greater general business activity, is encouraging. This current improvement in the position of the industry affords an opportunity to develop information needed for sound, long-range planning to avoid future difficulties. We believe that sound management and vigorous technological development can contribute further to the stability of the domestic telegraph system.

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3. The effects of the administration of the Communications Act of 1934 relative to reductions of telegraph service through the closing of unprofitable offices or through substitution of agencies need further study. Western Union maintains that the restrictive application of present legal provisions places an undue financial burden upon the company which it can ill afford to bear; representatives of labor contend that too great a degradation of service often has followed the substitution of agencies for offices.

4. Rates for the telegraphic services--telegram, TWX, and private leased lines--are given regulatory approval without adequate knowledge of the costs of providing such services. Also, in passing upon long-distance telephone rates, the Federal Communications Commission should inform itself of the probable effect of proposed changes upon the position of the telegraph industry, and upon rates for local telephone service.

5. We have looked carefully into the proposal that our telecommunications industry should be divided clearly into two parts, one dealing exclusively with "record" communications, the other with communications by "voice." Our examination of this question has shown that such a dividing line is very difficult to draw, and we have concluded that the attempt to reorganize our telecommunications system on the basis of such a distinction might result in effects on the system going far beyond the initial intention of any such division. The main bone of contention today is the fact that the telephone company offers

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a form of record communications--TWX and private-line leases--which competes with message-delivery functions of the telegraph company. We note that Congress in 1943 amended the Communications Act to permit acquisition of this form of service by the telegraph carrier. Thus the companies involved are free to negotiate an agreement to make this change, subject to approval by the FCC. We believe that this matter should be determined by the normal processes of negotiation.

6. The operation of leased domestic telecommunications networks by the Federal Government for the transmission of Federal Government messages is not, strictly speaking, competitive with the operations of commercial telecommunications companies. In its teletype networks, the Government is taking advantage of volume rates offered by the telecommunications companies in the same manner as can any other customer with large volume requirements. The Government should continue to take full advantage of the most efficient and economical rates and conditions of service which are available to any large user. While it is important that the Government seek the most economical means of handling its own communications, it also is of great importance that it continue its present policy of using privately owned facilities rather than building up a Government-owned competing network.

C. As to United States telecommunications abroad:

1. The Government should adopt the policy of maintaining the strength of the private competitive international communications system.

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2. There should be a Government agency charged with the responsibility for implementing this policy.

3. Urgent recommendations have been made to Congress that legislation be enacted to permit companies in the international cable and radio field to merge. One of these calls for a single company to handle all United States domestic and international record communicatio thus providing an integrated system. We find no imperative reasons calling for an immediate merger of these companies; we conclude, on the contrary, that recent improvements encourage a continuation of their present independent status. Moreover, in our judgment, a period of partial mobilization is not a good time to undertake a reorganization of these important components of our communications system. Our conclusions in regard to merger are based on conditions as we now find them and can project them. We recognize, however, that the situation can change and that the welfare of our communications system demands constant attention to the condition and stability of these companies. We are mindful of the strong conviction held by informed members of Congress and others that merger is desirable. We have ascertained that interested Government departments are divided in their views on the subject. While we believe that the national interest does not at this time require the repeal of existing prohibitions against merger, we recognize that changi conditions may provide compelling reasons for a merger later on. If so, their anticipation by adequate study and legislation will be essential. The kind of merger which might thus be indicated, as well as the timing

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of it, may be dictated not only by normal economic forces, but by the wisdom of the Government's own policies vis-a-vis the companies and by technological developments. Technological developments may in fact prove to be the conclusive factor in determining the future of these companies.

D. As to Government organization:

1. Fundamental changes in telecommunications require the overhaul of Government machinery for formulating telecommunications policy and for administering certain telecommunications activities in the national interest.

2. The Communications Act of 1934 established a system of dual control of the radio frequency spectrum. This dual control arises largely from the fact that the regulation of private telecommunications is a function of Congress exercised through the FCC, while the operation of Government telecommunications is primarily a function of the Executive. For example, the assignment of frequencies to military services is an exercise of the President's powers as Commander-in-Chief of the Armed Forces.

3. The Federal Communications Commission, though needing further strengthening, should continue as the agency for regulation and control of private users.

4. The President has exercised his power to assign frequencies through the Interdepartment Radio Advisory Committee, made up of

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representatives of the using Government agencies. While this Committee should continue as a forum to arrange the use of the spectrum in such a way as to avoid interference, it is not an adequate means for keeping in order the large portion of the spectrum occupied by Government agencies.

5. The Telecommunications Coordinating Committee has served a useful function and should continue as a mechanism for interdepartmental discussion of telecommunications matters.

6. The whole Government telecommunications structure is an uncoordinated one and will be even less adequate in the future than it has been in the past to meet the ever growing complexities of telecommunications. A new agency is needed to give coherence to the structure.

7. There is need for a better determination of the division in the national interest of frequency space between Government and non-Government users. To achieve that end, close cooperation between the Federal Communications Commission and the proposed new agency will be necessary.

Recommendations

1. There should be established in the Executive Office of the President a three-man Telecommunications Advisory Board to advise and assist the President in the execution of his responsibilities in the telecommunications field. This Board should carry out the planning and executive functions required by the President's powers to assign radio frequencies to Government users, and to exercise control over the nation's

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telecommunications facilities during time of national emergency or war. It should stimulate and correlate the formulation of plans and policies to insure maximum contribution of telecommunications to the national interest, and maximum effectiveness of United States participation in international negotiations. The Board should recommend necessary legislation to the President, and advise him on legislation in the telecommunications field. The Board should stimulate research on problems in the telecommunications field. It should establish and monitor a system of adequate initial justification and periodic rejustification and reassignment of frequencies assigned to Federal Government users, and, in cooperation with the Federal Communications Commission, supervise the division of frequency spectrum space between Government and non-Government users. While we believe that a three-man board is preferable, we recognize the possibility of appointing one man, a Telecommunications Adviser, to exercise the functions of the proposed board.

2. The Federal Communications Commission should be strengthened in funds and in organizational structure so it can better carry out its duties under the Communications Act of 1934, and can participate more fully in Government-wide formulation of policy.

3. Appropriate units within the Department of State should be strengthened for the better performance of the functions of the Department relating to telecommunications.

4. Other Federal departments and agencies which have large

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telecommunications interests also should strengthen their machinery for formulating telecommunications policy, and for relating that policy to the other policies and programs served by telecommunications.

5. The Federal Government should step up its program for conducting and stimulating research in telecommunications, especially in those fields bearing on propagation and frequency utilization. Such studies would make it possible for the Government to take economic or technological changes promptly into account in revising policies for preserving the vigor of our private communications companies.

6. The proposed Telecommunications Advisory Board should give special attention immediately to the stimulation of technological developments which will still further strengthen our overseas communications. It should also formulate policies which would insure that these new technological developments will be used in behalf of the nation as a whole, its industry and commerce, its security, and its cultural exchange.

7. Policy of the United States should be based upon the following fundamental propositions:

a. The radio frequency spectrum is a world resource in the public domain. Our Government must adopt policies and measures to insure that this resource is used in the best interests of the nation, with due regard to the needs and rights of other nations.

b. The United States, almost alone among the nations of the world, relies on privately owned telecommunications companies to

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play the principal part in the country's telecommunications system. It should continue to be the policy of the United States Government to encourage and promote the health of these privately owned companies as a vital national asset.

c. The United States telecommunications system is essential to the national security, to international relations, and to the business, social, educational, and political life of the country. Hence, Government must remain alert to the problems of this system, and be prepared to support measures necessary to insure the continued strength of the telecommunications system as a whole.

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CHAPTER II

PRESSURES ON THE RADIO SPECTRUM

The use of radio frequencies for communications has expanded tremendously since Marconi first bridged the Atlantic with his historic wireless signal on December 12, 1901. Research and development in the past quarter-century have been responsible for most of the additional utilization of the radio spectrum.

In the years immediately following Marconi's achievement, it was thought that only a few frequencies in the lower portion of the radio spectrum were suitable for communications and that they could be employed only for limited purposes.

The Berlin Radio Conference of 1906, for example, considered but two frequencies--500 kilocycles (kc) and 1,000 kc--and discussed them only for ship-shore telegraphy. By 1912, the time of the London Conference, use of the spectrum had broadened somewhat, ranging from 150 kc to 1,000 kc. In the early 1920's, even after broadcasting had begun, frequencies above 1,500 kc were still considered of little value for communications, but later in the decade new emphasis on high-frequency operations and a general spurt in demand for all communications led to a rapid exploitation of additional portions of the radio spectrum.

The extension of use of the spectrum is summarized chronologically in the following table:

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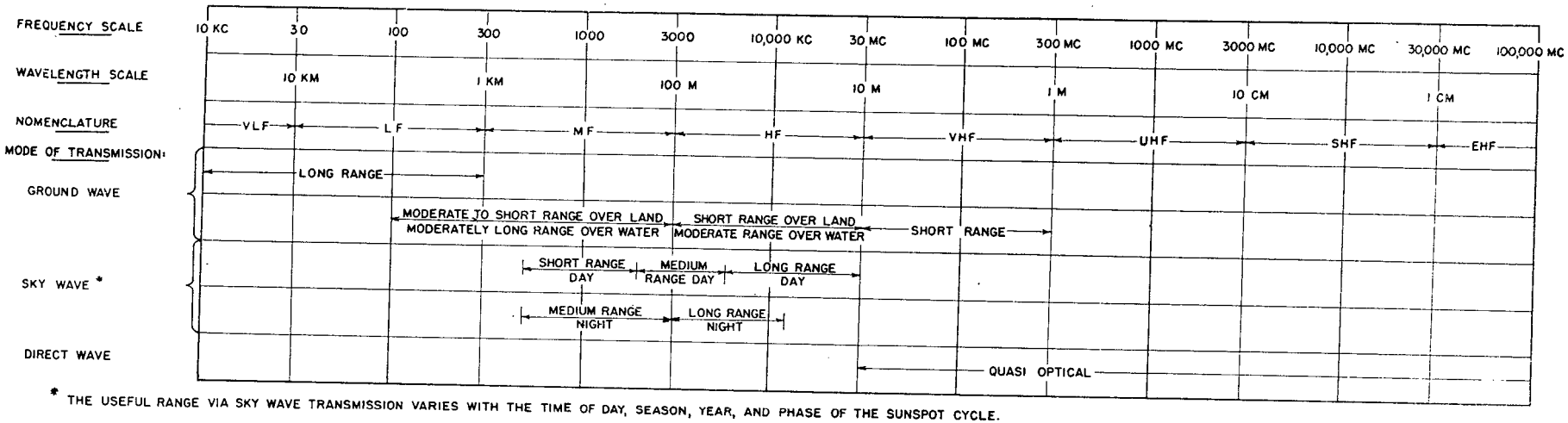
A GLANCE AT THE RADIO FREQUENCY SPECTRUM

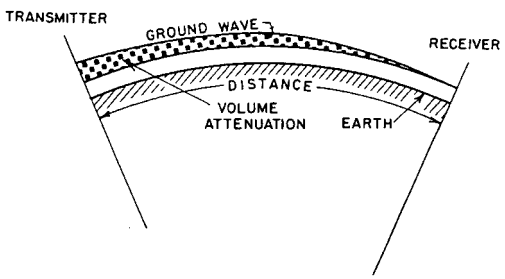
SHOWING SOME OF THE BROADER FREQUENCY CHARACTERISTICS



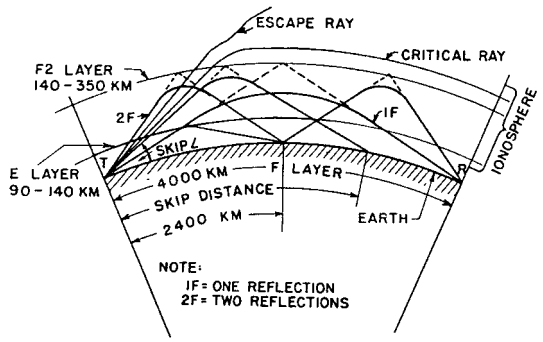
* THE USEFUL RANGE VIA SKY WAVE TRANSMISSION VARIES WITH THE TIME OF DAY, SEASON, YEAR, AND PHASE OF THE SUNSPOT CYCLE.

MODES OF TRANSMISSION

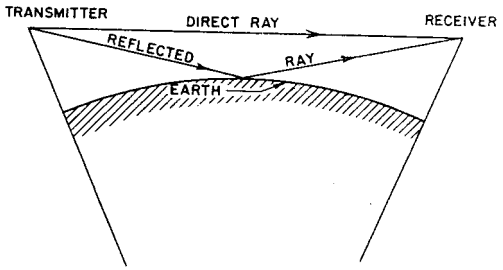
GROUND WAVE



SKY WAVE



DIRECT WAVE



NOMENCLATURE OF FREQUENCIES

FREQUENCY SUBDIVISION	FREQUENCY RANGE
VLF (VERY LOW FREQUENCY)	BELOW 30 KC
LF (LOW FREQUENCY)	30 TO 300 KC
MF (MEDIUM FREQUENCY)	300 TO 3,000 KC
HF (HIGH FREQUENCY)	3,000 TO 30,000 KC (30 MC)

FREQUENCY SUBDIVISION	FREQUENCY RANGE
VHF (VERY HIGH FREQUENCY)	30 TO 300 MC
UHF (ULTRA HIGH FREQUENCY)	300 TO 3,000 MC
SHF (SUPER HIGH FREQUENCY)	3,000 TO 30,000 MC
EHF (EXTREMELY HIGH FREQUENCY)	30,000 TO 300,000 MC

(PRESIDENT'S COMMUNICATIONS POLICY BOARD — FEBRUARY 6, 1951)

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Year	Incident	Usable Radio Spectrum
1901	Atlantic bridged	
1906	Berlin Radio Conference	500 kc and 1000 kc
1912	London Radio Conference	150 kc to 1000 kc
1927	Washington Radio Conference	10 kc to 23,000 kc
1932	Madrid Radio Conference	10 kc to 30,000 kc
1938	Cairo Radio Conference	10 kc to 200,000 kc
1947	Atlantic City Radio Conference	10 kc to above 30,000,000 kc

The development of so valuable a natural resource as the radio frequency spectrum is a matter of paramount importance. Despite technical and operational improvements the demand for frequencies has steadily crowded the supply within the usable spectrum. The use of this resource should have the most careful planning and administration within the United States and in cooperation with other countries. Unfortunately, guidance and administration often have been inadequate.

The Radio Spectrum

A determination of the possibilities for greater use of the radio spectrum is a very complex undertaking. Each use of it, whether an international broadcast carrying a news report thousands of miles, or the signal of a short-range navigation beacon making flecks of light on the receiver aboard a ship almost within shouting distance, requires the establishment of a channel in the spectrum. Contrary to the layman's opinion, the presently usable

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spectrum (10 kc to 30,000,000 kc) does not offer an unlimited number of channels. Consider the spectrum as a slice of the North American continent a hundred miles wide running straight from the East to the West Coast. Each channel may be thought of as a highway through that stretch of land. Some of the highways are narrow, some wide, but each must be somewhat wider than the vehicles using it.

Here a major danger to understanding of the problem arises. The radio spectrum embraces nearly 30 billion cycles. Standard practice refers to radio channels in terms of single frequencies. Hence hasty judgment easily assumes millions of frequencies as efficiently available and wonders why there should be any problem. Another glance at the slice of the continent and the highways will make the matter clear. A center line runs along each highway, just as a center frequency lies in each channel. The hundred-mile slice of the continent would accommodate a vast number of white lines--even though that number would have ultimate limits. To think of the white lines rather than of highways leads to confusion. The radio channel occupies more than the center frequency by which it is identified.

Each usable channel thus consists of a relatively small, but a specific, part of the radio spectrum. Depending upon the traffic it is to carry, it may be only a few cycles or several million cycles wide. In the language of engineering, the total channel width (or bandwidth) required for a transmission of energy is the number of cycles embracing 99 per cent of the total radiated power extended

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to include any discrete frequency on which the power is at least 0.25 per cent of the total radiated power. In double sideband emission (the type used in broadcast transmissions of intelligence), the channel width is twice the departure (tolerance) of the actual operating frequency from the reference or assigned frequency plus twice the bandwidth required to convey the particular intelligence desired. The frequency tolerance is usually specified as a number of cycles which is a percentage of the reference frequency, and thus increases with the number of cycles representing the reference frequency. The specified tolerance usually is the best it is practical for industry to meet in the design of equipment.

If the total U. S. requirements in terms of channels of various widths were known, reckoning the spectrum possibilities would still be exceedingly difficult because of the complex and varied manner in which radio signals travel from the transmitter to the receiver. In radio propagation, energy fed to the transmitting antenna produces electromagnetic waves in the space surrounding the antenna. The energy radiated into space can be used to convey intelligence.

These waves travel away from the antenna with the velocity of light. There are three principal ways in which they may pass from transmitter to receiver: 1. the "sky wave," which travels up to ionized layers in the earth's upper atmosphere (the ionosphere) whence it is reflected back to the earth; 2. the "ground wave," which travels along the earth without influence of the ionosphere;

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and 3. the "direct wave," which travels as its name implies, on the line of sight. Most long-distance radio transmissions consist of the sky wave and most short-distance transmissions consist of the ground wave. Many are a combination of all three.

Frequencies below about 300 kc (VLF and LF) are used for long-distance ground-wave transmissions, particularly in regions such as Alaska where physical conditions make blackouts of sky-wave common. Frequencies from about 100 kc to 3000 kc (LF and MF) generally are used for ground-wave transmissions for moderate distances over water and moderate to short distances over land. During the night, frequencies from approximately 1000 to 3000 kc generally are suitable for sky-wave transmission up to about 200 miles; in daytime, frequencies from about 3 to 8 megacycles (Mc) usually are satisfactory for this distance. Long-distance sky-wave transmission generally is the most effective for frequencies from 3 to 12 Mc (HF) during the night and 6 to 25 Mc during the day. Frequencies from 3 to 30 Mc are used for ground-wave transmissions for relatively short distances over land and moderate distances over water. Those from 30 to 300 Mc (VHF) are usually employed for short-distance ground-wave and direct-wave or optical path transmissions. Frequencies above 300 Mc (UHF, SHF, and EHF) are limited in use to distances not greatly exceeding the line of sight. However, there may be transmission to greater distances by way of the troposphere.

Simple arithmetic, obviously, is not alone enough to determine the possibilities of use of the spectrum.

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Although the parts of the spectrum are not of equal usefulness for all purposes, each is in sufficient demand to give rise to allocation and assignment problems. Use of the high-frequency portion of the radio spectrum (4 Mc to 27.5 Mc) presents the most serious difficulty, because of the multiple applicability of this portion for medium- and long-distance telecommunications, tropical and long-distance broadcasting, and other services, and because of its international aspects. Further, frequencies outside these limits are in general not suitable substitutes. The possibilities of the high-frequency spectrum have to be measured in terms of possible circuits rather than frequencies since, in general, more than one frequency assignment is required for each circuit. The number of possible circuits which can be carved out of the spectrum depends upon the type of circuit desired (radiotelephone, radiotelegraph, etc.); the geographical location of the terminals; the time of day, season, phase of the sun-spot cycle; the amount of power used; the type of antennas used; atmospheric noise; questions of possible interference; number of circuits operated by the agency; efficiency and effectiveness of equipment and operators; availability and correct use of propagational data.

To provide continuous 24-hour-per-day service for the average circuit over a sun-spot cycle, it may be necessary to use five or more frequency assignments for a single circuit in one direction. As the number of circuits operated by an agency increases, the average

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number of frequency assignments required per circuit may decrease slightly because of greater freedom in changing frequency to avoid interference and multiple use of frequencies at different locations and for different path lengths. On the average, about three high frequency assignments are required daily for each one-way circuit. Since communication usually is a two-way matter, most communications circuits require two one-way circuits and, consequently, two complements of frequency assignments. This dual need may not be encountered on light traffic circuits.

Further, on the average long-distance circuit requiring three frequency assignments of, for example, 6, 10, and 14 Mc for nighttime, transition, and daytime operation (over the midpoint of the path involved), the circuit cannot be maintained continuously unless a frequency assignment of each order is available. In practice, because of the greater requirements for frequencies below 8 Mc, the supply of channels between 6 and 8 Mc (taking into account possible multiple use of each frequency) determines the maximum possible number of 24-hour long-distance circuits. Fortunately, the situation is not so bad as it appears at first glance, because of the propagation characteristics of the high frequencies, which have multiple use possibilities with geographical separation, generally as follows:

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Frequency Range	Possible Number of Duplications
4 to 7 Mc	5
7 to 12 Mc	4
12 to 15 Mc	3
15 to 27 Mc	2

The actual number of separate and distinct channels available within any particular portion of the spectrum is not static but is fluid, increasing with improvements in equipment, operating techniques, circuit discipline, availability and proper use of propagational data, need, and willingness to accept a poorer grade of circuit. The actual separation between frequencies required to provide the same grade of service has been continually decreasing because of improvements in the stability and selectivity of equipment. It is not expected, however, that there will be much greater improvement in this respect. The possible frequency separation throughout the high-frequency spectrum is essentially constant on a percentage basis but not on a kilocycle basis. Consequently, there are more possible usable channels between, say, 4 and 5 Mc than there are between 13 and 14 Mc.

In the exploitation of a limited entity such as the radio spectrum, it is essential that as the pressure for radio channels increases there must be established alert telecommunications management to assure equitable allocation of these channels. Further, it is

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essential that this management assure, insofar as is economically practicable, the use of the technical improvements in equipment and operating techniques for increasing the intelligence transmitted per kilocycle of spectrum space.

It is as difficult to evaluate frequency utilization as to determine the possibilities of the radio spectrum. Efficient utilization of radio frequencies can be obtained only if the user and regulatory agencies constantly keep watch over the use of frequencies. Only in this way can the regulatory agencies know which users make full use of their frequency assignments and which have too many frequency assignments. It is estimated that a thorough analysis and control program for the United States and possessions would cost $50 million a year. Such a program would envision the use of U. S. monitoring stations plus additional stations elsewhere throughout the world. As the demand for frequencies increases, the necessity for better frequency management will become greater.

There is no evidence that the United States has made any serious attempt previously to measure the utilization of radio frequency assignments by either industry or the Federal Government. There is evidence that other countries have done some work along this line.

The nations of the world have met periodically to conclude treaties which regulate the use of the radio spectrum, to obtain standardization of methods and procedures, and to minimize interference.

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Nearly all countries have imposed additional regulatory measures in their areas of jurisdiction to implement provisions of international treaties, to prevent domestic interference, and to obtain the most equitable distribution of frequencies.

The history of the international agreements through 1938 is summarized in Section 2 of the Federal Communications Commission (FCC) "Special Report on Frequency Allocation to the Communications Subcommittee of the Senate Committee on Interstate and Foreign Commerce, March 29, 1950."

World War II caused cancellation of the international telecommunications conference planned for Rome in 1942. As a result, the conference in Atlantic City in 1947 followed a 9-year period in which the nations did not get together to seek up-to-date agreements on world use of the radio spectrum.

U. S. Control of Frequency Allocation

The United States Congress has passed three major acts and established two commissions specifically to regulate various phases of communications. These acts were the Radio Act of 1912, the Radio Act of 1927, and the Communications Act of 1934, since amended. The commissions were the Federal Radio Commission and the Federal Communications Commission. Interested Federal Government departments and agencies formed the Interdepartment Radio Advisory Committee (IRAC), recognized by several presidents, and the Telecommunications Coordinating Committee (TCC) as voluntary coordinating groups. The effects

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which these actions have exerted in the assignment and use of radio frequencies are discussed in detail in Chapter V of this report.

In the armed forces during World War II, frequency allocations were coordinated in the Frequency Allocation Committee (FAC) of the Joint (JCB) and Combined Communications Board (CCB) of the Joint and Combined Chiefs of Staff, respectively, and by organizations within each department. Since the war the JCB has been replaced by the Joint Communication-Electronics Committee (JCEC) within the Joint Chiefs of Staff.

Relationship of International and National Organizations

The international and national organizations concerned with telecommunications problems, plus various ad hoc committees and delegations to conferences, make up a formidable array of groups dealing with one or more phases of the problem. Inevitably, there are overlapping of responsibility and gaps in authority. Few persons understand this hodge podge. The complexity of the subject is indicated by the chart in Chapter V, which shows the international and U. S. organizations engaged in some phase of radio spectrum management or use.

Weaknesses in Present Organizations and Practices

Statutory Authority.--The limitations of the Communications Act of 1934, as amended, and of the Commission created largely for its administration have been the subject of much consideration by Congress

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in recent years. The law was written when radio was not so highly developed and before the present demand for spectrum space had become acute. It established a dual system of allocations as between Federal Government and non-Government[1] users but provided no umpire. The FCC is empowered to assign radio frequencies to non-Government users and the President is likewise empowered to assign frequencies to Federal Government users, a power he exercises through IRAC. Each agency enjoys coequal authority over the entire spectrum.

Because of this dual authority over the same entity, it is essential that there be full coordination between IRAC and the FCC. As a member of IRAC, the FCC is afforded, on the one hand, an opportunity to comment upon all assignments to Federal Government stations. On the other hand, IRAC has an opportunity to comment upon proposed FCC assignments when the FCC considers it necessary to refer the proposal to IRAC. Final action by FCC does not require approval by IRAC, but the reverse is not true; FCC as an IRAC member can veto action desired by other Government agencies. In practice, the spirit of accommodation has generally prevailed. But if there is disagreement between the FCC and IRAC, only the President can resolve the issue. Upon at least one occasion during World War II, he was called upon to do so. The fact that this system has worked at all is a credit to the good will and common sense of the members of both agencies.

1/ Includes State and municipal government and all other than Federal Government users.

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National Policy.--Both the FCC and IRAC have been and are greatly handicapped by inadequate national policy for the division and use of the radio spectrum. To cite one instance, lack of a clear policy concerning the use of radio for domestic point-to-point telecommunications during the war led to long, bitter arguments in IRAC. Such meager policy as exists and could be collected is included in Chapter VI of this Report. Much of it has not been previously reduced to writing.

Allocation Practices.--There are several faults in the present frequency-assignment practice. Contrary to the public impression created by procedures for assigning frequencies for standard broadcasting and TV purposes, the FCC in general does not require rigorous justification for the assignment of frequencies for other services. IRAC does not require sufficient justification for the assignment of frequencies, has no authority to question any Government department's statement of need for a frequency, and is not constituted to do so. Assigning blocks of frequencies to be used by a particular agency on a national basis, without providing for their use by others in areas where the original assignee does not use them or is not likely to use them, is wasteful of frequencies and adds to the crowding of the radio spectrum. For example, there are many areas of the U. S., Alaska, and Hawaii where there is little prospect of need or of support for the existing 12 very-high-frequency television channels, much less the greater number of ultra-high-frequency channels

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where use of these frequencies for other purposes would be in the public interest. Another example is the making of too many assignments for broad band transmission, when the broad band is needed only a very small percentage of the time. Waste also results from the practice of assigning many of a user's frequencies to all of that user's stations, although the frequencies are rarely used at more than one or two stations.

Frequency Assignment Records.--It is fundamental that a storage and issuing agency maintain a catalog and adequate records of stock on hand and issued. In its management of the priceless radio spectrum, however, the U. S. has failed to maintain in one place adequate records of frequency assignments or deletions, or to publish a list of such assignments. The latest list available for public use was prepared by the FCC and reproduced by a private firm in 1949; it does not include the frequency assignments of the Federal Government agencies and is not now complete for the non-Government users. In the event a commercial user wishes to apply for frequency assignment for a circuit, he must search through this non-current public list, the International Telecommunications Union (ITU) Frequency List (even more out of date), come to Washington or retain the services of Washington consulting radio engineers to study the FCC records, and then file a complete application. This application incidentally gives notice to competitors that the requested frequencies are reasonably clear and available for use. The applicant has no

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opportunity to determine beforehand if a Federal Government department is using a frequency with which interference will result or if such department will raise an objection. If Federal Government objection is forthcoming, he must repeat the whole process.

Existing Situation

The rapid growth of telecommunications in the nine years between the Cairo (1938) and Atlantic City (1947) conferences led to greater pressure for radio frequencies. More and more countries went outside the Cairo service allocation bands, in derogation, to meet the increased requirements. The war, of course, prevented full coordination between countries to avoid and clear interference. This situation was further complicated by the decision of some of the warring nations, including the United States, to withhold international notification of new uses of radio frequencies and to reject any claims of prior rights for any country registering a frequency after 1939.

Recognizing early in 1943 that the end of the war would present many frequency allocation problems because of withheld notifications, pent-up requirements, continuing large military requirements, and enormously expanding commercial aviation and other new activities, the United States began a consideration of postwar frequency allocations. The U. S. Atlantic City proposal in 1947 was the outgrowth of this preparatory work, of public hearings held in 1944 by the FCC, and of the discussions in Rio de Janeiro and Bermuda in 1945 and in Moscow in 1946.

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The Atlantic City Table of Frequency Allocations was designed to provide essential radio services with adequate spectrum space. Frequency usage within these allocations was to be regulated by an engineered international list of circuit assignments which was designed to make the greatest use practicable of the radio spectrum.

From the point of view of frequency allocation, assignment, and use, the most far-reaching agreements at Atlantic City were: (1) revision of the frequency allocation table to provide, in the main, exclusive bands for the five basic functions--fixed, mobile, broadcasting, amateur, and radiolocation services; (2) changes in the amount of spectrum space allocated to these services; (3) procedure for the preparation of a new international frequency list on the basis of sound engineering principles; and (4) the adoption of the concept of an International Frequency Registration Board (IFRB) to register frequencies on a technical basis.1/

The Provisional Frequency Board (PFB) was created to prepare in draft form a new international frequency list on a basis of these agreements, for submission to the Extraordinary Administrative Radio Conference scheduled for The Hague on September 1, 1950.

Upon approval of such a list for the Atlantic City Table of Frequency Allocations below 27.5 Mc, the IFRB was to commence its functions and a date was to be agreed upon for implementation. Post-

1/ The IFRB and its work are covered in more detail in the "Final Acts" of the Atlantic City Conference.

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poned because of the international situation, the Conference is now scheduled to convene in Geneva on August 16, 1951, if that date is confirmed in April by the Administrative Council of the ITU.

The United States participated, as did the other nations, in the Atlantic City Conference and the work of the Provisional Frequency Board, performed under the agreements reached at that Conference, for the purpose of improving international telecommunications.

Conditions of unrest, cold war, and continuing international crises generated an atmosphere that was hardly favorable to the efforts of the PFB.

The Table of Frequency Allocations between 4 and 27.5 Mc adopted at Atlantic City in 1947 has not yet been implemented. Tentative plans have been prepared for the aeronautical and maritime services, and partially for the fixed services. The frequency list for the Table of Allocations between 150 and 4000 kc, which are for the most part regional in character, is ready within Regions 1 and 3 for final amendment and adoption. Region 2 (which includes the U. S.) has no regionally-integrated plan as of February 1, 1951, even though it is about 85% completed below 2000 kc.

Experience gained from the past three years has highlighted the difficulties of implementation under the procedures envisaged at Atlantic City. Lack of plans and policy plays a major role in the difficulty experienced by all countries concerned to agree upon implementation. It was obvious to the President's Communications Policy

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Board, in view of the forthcoming meeting of the Administrative Council of the ITU in Geneva in April, 1951, and the impossibility for the Board to complete, in the time available, all the tasks assigned to it, that special steps would have to be taken to overcome this lack.

In view of the extreme importance of this matter, the Board considered it imperative that the United States re-examine the situation to determine:

(1) The current scope and magnitude of the United States interest in the Atlantic City Allocation Table below 27.5 Mc.

(2) The most workable methods by which the Table could be implemented in the light of changed world conditions.

(3) The course which the United States should advocate and pursue in the light of findings under (2) heretofore.

Accordingly, in October and November of 1950, the Board discussed the problem with the Under Secretary of State, the Deputy Secretary of Defense, and the Chairman of the Federal Communications Commission. The Board proposed that these three officials constitute themselves into an ad hoc committee, and take responsibility for reviewing the political and technical difficulties contributing to the impasse, and for recommending workable policies for the Government to follow. The Board further recommended that this ad hoc group enlist the help of a small panel of especially qualified persons, who would make an objective appraisal of the factors of national interest involved, independent of the particular interests of any claimant agency.

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The proposal was accepted; the ad hoc group was formed, and the independent panel set up in January, 1951.

Demand for Radio Frequencies

The basic difficulty of the nations of the world in arriving at a satisfactory frequency list and means of implementing the Atlantic City Table is that of inflated demands for radio frequencies. The apparent shortage of frequencies thus engendered has been aggravated as each nation attempts to provide for future as well as present needs. The United States also has been handicapped, as perhaps have many other nations, by the necessity of remaining on a defense emergency basis which requires radio frequencies far in excess of peacetime needs.

The demand for radio frequencies has been growing steadily since the early 1900's. It was not until the beginning of World War II, however, that pressures became acute. During World War II the increased requirements of the Federal Government, in particular the armed forces, for radio frequencies were offset somewhat by the closure of a number of facilities and the release of the frequencies involved to the armed forces. Upon the termination of hostilities, the borrowed frequencies were returned piecemeal to the FCC, commercial circuits were reopened, and many new circuits were established. At the same time, the armed forces found it necessary to continue many of their overseas circuits, each of which required radio frequency assignments. The tremendous expansion of the use of radio by many

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have been expanded rapidly to keep pace with the growth of the activities they support and because of intensified use of communications in those activities. Additional room in the spectrum has had to be found to accommodate these services. At the same time, new services such as television broadcasting have been brought out of the laboratory and have won public acceptance. Many entirely new users--railroads, taxicabs, and trucking companies, for example--have requested frequency channels. When the FCC held a public frequency hearing in 1944, approximately 30 different radio services were represented. Among them were the services concerned with the safety of life and property--the police and fire radio services, the aviation service, the ship service, and the forestry service. The total demands of these groups far exceeded the available spectrum space.

The parts of the radio spectrum where pressure causes the most serious concern are those in which international coordination and agreement are required. Principally, they are the portions having long-range characteristics, 4 to 27.5 Mc frequencies; the portions used by services such as the aeronautical service, where standardization of equipment and procedures is essential; and broadcasting in the Standard Band, which is of regional concern. Other portions of the spectrum are of national concern primarily and usually do not involve other countries, except to provide common systems.

Within the United States, dissatisfaction with efforts to meet

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commanders, and combat or tactical channels between field commanders and their forces. Since the armed forces may be engaged in areas where existing communications to Washington are inadequate or unsuitable, they must provide their own. Usually, existing commercial international circuits cannot be used for reasons of control and security. For example, the foreign terminals of commercial companies, in most instances, are operated and controlled by foreign nationals or governments and all traffic handled may be subject to scrutiny and delay. Few if any of the proponents of greater use of commercial facilities for the transmission of Government messages advocate that military messages be routed through the commercial companies.

Where no interference to the flow of military messages results, the communications facilities of the armed forces are used to transmit traffic for other Federal Government departments and agencies and the Red Cross. It has been suggested that this traffic should be sent via commercial companies and that the cost would be less. The stated policy of the armed forces in this matter is that no increase in military facilities, equipment, or personnel shall result from the handling of other department and agency traffic and that such traffic will be accepted only on the basis of an official request by the department or agency concerned. Military systems must be designed with a reasonable amount of spare capacity able to absorb greatly increased traffic loads on short notice. The armed forces therefore feel that the handling of maximum traffic within authorized

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selected as one medium to this end.

Under the Communications Act, Navy Department radio stations and apparatus are made available for the reception and transmission of press messages offered by newspapers published in the United States or its territories and possessions or published by citizens of the United States in foreign countries, and by United States press associations. The act provides also for the use of Navy facilities for reception and transmission of private commercial messages between ships, between ship and shore, between localities in Alaska, and between Alaska and the continental United States. Both these services are subject to certain rate conditions, and it is provided that they shall be discontinued whenever the FCC notifies the Secretary of the Navy that privately owned and operated stations are capable of carrying them on. The Navy also furnishes a general broadcast service of weather, time, and hydrographic information to all shipping.

In addition to its defense functions, the U. S. Air Force operates weather flying squadrons for the collection of data for weather forecast, collects and broadcasts weather information, and furnishes communications to non-military aircraft in certain areas where civil facilities are not available. These services all require the use of radio frequencies.

Radio frequencies are used by the Department of the Treasury (Coast Guard) in providing marine navigational aids and safety services

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for shipping. The Coast Guard also operates the radiolocation service known as Loran. Transfer of these operations to commercial facilities could not be expected to decrease the total number of frequency assignments required.

The CAA is charged by Congress with the function of providing navigational aids and communications facilities as a public service for both civil and military aircraft. If these functions were turned over in whole or part to private enterprise, the over-all number of frequency assignments or the spectrum space required could hardly be reduced.

The FCC employs radio to connect certain of its remote monitoring stations. Instantaneous communication to all of these stations is essential at times to identify an unknown transmission or to obtain a "fix" on an aircraft or ship in distress. It is considered impractical to lease the facilities of a commercial company for this work or to turn over the function to a commercial company.

Thus we see that there is a large Federal Government requirement for radio frequency assignments, and that much of it is for services which would use the same amount of the radio spectrum even if they were transferred to private operation. Another substantial portion of it is for services which must for security reasons be operated as they are at present. The question may nevertheless be legitimately raised whether the demands have been kept to a minimum in relation to the tasks to be performed. Non-defense radio traffic of some

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Federal Government departments might in some instances be carried by commercial facilities.

In 1939 the major international common carriers were operating 138 circuits, whereas in 1950 the international common carriers as a group were operating 219 circuits (many at high word capacity) to more than 100 foreign cities. Since the war the FCC in general has followed a policy of granting competing companies circuits to the same foreign city.

Since but one U. S. frequency list can be presented to the IFRB, the Federal Government and non-Government frequency requirements should be accommodated within such a list. At present there is no national telecommunications policy under which the relative importance of particular circuits can be determined and the frequency requirements screened. This factor assumes even greater importance when one considers that the pressure on the radio spectrum is continually increasing.

The relative amounts of the spectrum used by the Federal Government and non-Government users are often compared. The question is asked whether the Federal Government has more high frequencies than non-Government users, and whether it has more of the spectrum than it needs. Available comparisons of high-frequency assignments have been made on the basis of the number of discrete frequencies assigned without regard to the band of emission and thus are subject to considerable misinterpretation in many instances. This is evident from

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the fact that one telephone channel with a band of emission of 10 kc occupies 100 times as much spectrum space as one telegraph channel with a band of emission of but 0.1 kc, yet each assignment counts as one frequency. A fairer method of evaluating the amount of spectrum space used by any agency is to take the sum of the bands of emission assigned to that agency. An analysis of the high-frequency spectrum between 4 and 20 Mc as of May, 1950, reveals that although the Federal Government agencies are allocated 1166 frequencies, they have but 4164 kc of the spectrum; whereas the non-Government users, with 833 frequencies, (excluding international broadcasting with 38 frequencies and 380 kc of spectrum space and the amateurs with 700 kc of space), occupy 4324 kc of spectrum space.1/ A comparison of the spectrum space allocated to the Federal Government and the non-Government users for the fixed service by increments of 1 Mc follows, Table I.

1/ The fact that the sum (9567.73 kc) of these assignments is considerably less than the 16,000 kc analyzed does not mean there is unassigned spectrum space. The entire spectrum is not available for assignment by the United States, but is shared with other countries. In addition an equally large part of the spectrum is used by the United States for transmission from foreign locations. Above 30 Mc the shorter interference range characteristics permit full use of the spectrum by the United States, except immediately adjacent to Canada or Mexico.

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TABLE I

FREQUENCIES AND SPECTRUM SPACE ASSIGNED--CONTINENTAL UNITED STATES, TERRITORIES AND POSSESSIONS
(as of May, 1950)

	Federal Government		Non-Government		Shared	
	No. of Frequencies	Total Spectrum	No. of Frequencies	Total Spectrum	No. of Frequencies	Total Spectrum
		Kc		Kc		Kc
4 Mc	167	676.20	74	335.35	4	19.25
5	152	589.42	92	446.15		
6	106	352.65	61	258.05	7	46.00
7	70	236.30	63	325.30		
8	114	389.69	75	272.17	6	24.10
9	69	200.16	31	192.80		
10	52	190.30	76	377.36		
11	64	236.82	41	147.45		
12	84	253.98	33	121.55		
13	54	177.37	57	408.00		
14	30	106.87	27	203.00		
15	32	119.29	59	339.70		
16	69	239.59	40	129.12		
17	64	231.89	39	207.40		
18	26	96.20	40	361.00		
19	13	67.50	25	199.10		
	1166	4164.23	833	4323.50	17	89.35

In the range 4-20 Mc, approximately 380 kc was used for international broadcasting (from the continental U. S. and Hawaii) and 700 kc was allocated to the Amateur Service. These assignments are not included in the preceding table.

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This table shows that, contrary to general belief, the Federal Government has exclusive use of 42.1% of the space between 30 and 300 Mc and but 13.2% of the space between 300 and 3000 Mc. The Federal Government has its largest percentage (44%) of any decade between 3000 and 30,000 Mc. If the analysis is based on a logarithmic frequency scale, a method more nearly reflecting the actual possibilities for derivation of channels in the spectrum, the relative division of the spectrum is as shown by Table III.

Table III

Relative Division of Radio Spectrum in Percentage
Federal Government vs. Non-Government

30 Mc to 30,000 Mc
(Based upon logarithmic scale)

Portion of Spectrum Mc	Federal Government %	Non-Government %	Shared %	Amateur %
30-300	29.7	57.0	8.5	4.8
300-3000	18.8	43.6	28.3	9.3
3000-30 M	36.0	36.7	18.7	8.6
Total	28.2	45.7	18.5	7.6

While Table II shows the Federal Government has about 50% of the total spectrum space between 30 and 30,000 Mc, Table III shows that, based on the probable number of useful channels which can be derived, the Federal Government has allocated for its exclusive use less than a third of the probable number of channels which can be derived from the 29,970 Mc between 30 and 30,000 Mc.

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The preceding discussion and comparison of the relative division of the spectrum is not considered complete nor final. It does, however, show that while the contention that the Federal Government has 50% of the useful radio spectrum is not strictly true, the Government does have a large proportion. This large use of so valuable a national resource demands adequate justification and the most careful management to assure its operation in full accord with national policy and to meet proved need in the best interest of the nation.

A current major problem involving the relative division of the radio spectrum and relative needs of the Federal Government and non-Government users is that of finding adequate space in the spectrum for television. There are now allocated for television broadcasting 12 very high frequency (VHF) 6 Mc channels as shown by Table IV.

Table IV

VHF Channels

Channel No.	Megacycles	Channel No.	Megacycles
2	54- 60	8	180-186
3	60- 66	9	186-192
4	66- 72	10	192-198
5	76- 82	11	198-204
6	82- 88	12	204-210
7	174-180	13	210-216

The spectrum space between 470 and 890 Mc or 410 Mc was reserved by the FCC for ultra high frequency (UHF) television broadcasting channels. To date, experimental licenses only have been issued in the UHF band.

As the number of television stations in operation increased, it became evident from resultant interference between stations and from

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a number of VHF channels for educational purposes serve to increase the pressure for more VHF channels for the rapidly growing television industry. Television interests are continually pressing for more spectrum space in the VHF band or immediately adjacent thereto. Assuming the validity of the need of television for the 42 additional channels adjacent to the present 12 channels, the problem becomes one of finding 252 Mc of continuous spectrum space between channels Nos. 6 and 7 and above Channel No. 13. Thus the question arises--Can the services now allocated these frequencies move, and if so, to where?

An examination of the present allocations in the 86 Mc between 88 and 174 Mc reveals that the Federal Government is allocated 28 Mc; non-Government is allocated 30 Mc; and 24 Mc is shared by Federal Government and non-Government. Of the Federal Government allotment, 16 Mc is within the VHF band which the U. S. was forced to use to work with its allies in World War II and which is used for essential military purposes. Only the remaining 12 Mc offers any possibility at all for TV channels (2). Twenty of non-Government's 30 Mc are allocated to the culturally and technically important FM broadcasting. Even if all of this space were reallocated to television, it would yield only three channels. The 24 Mc shared by Federal Government and non-Government is used for aeronautical navigation and aircraft control, part of the SC-31 system of instrument landing of aircraft. A great investment of time, money, and develop-

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ment resources has been made in this system and it cannot be changed overnight. At best, then, not more than 5 TV channels could conceivably be allocated between 88 and 174 Mc. This would leave 37 channels or 222 Mc to go above 216 Mc, the present upper limit of VHF-TV.

Until January 1, 1952, when the agreement with the British to use the band 220 to 231 Mc for the British Radar Indicator System at U. S. gateways terminates, the nearest frequency above 216 Mc where a TV channel could start would be 240 Mc. Provision for 39 additional channels or 222 Mc would extend the TV band up to 462 Mc, well above the upper limit of the VHF band or 300 Mc, and into the present UHF-TV band. Such an allocation would necessitate moving and finding new space for the aeronautical radio navigation "Glide Path," also part of the SC-31 Instrument Landing System, Meteorological Aids, Amateur, essential military services, and non-Government land mobile services. A number of these allocations and uses, for example, the Glide Path and Meteorological Aids, involve agreements and treaties with other nations and could be changed only with great difficulty and delay. Many of these allocations and uses involve great investments in time, money, and development resources which cannot be wasted.

The investment in time, money, and development resources is proportionately important to the television industry. At the end of 1948 the estimated investment in tangible property of television

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stations and in receivers was $403 million. By the end of 1950, even though no new station construction permits were granted after September, 1948, there were 107 stations serving about 10.6 million receivers. Manufacturers have reached large scale production of receivers and during December produced 704 thousand receivers. At the end of 1950 the estimated investment in tangible property of television stations and in receivers had grown to about $3.09 billion. Television net time sales for 1950 were estimated at about $84 million, compared with $28 million in 1949. This rapid increase in the number of receivers and investment makes much greater the impact of changes in frequency assignment. Even should additional channels become available between the present Nos. 6 and 7 channels, most of the older receivers would require adapters or converters to receive them. Delay in solving this problem multiplies the difficulties and expense of making the necessary changes.

The problem of finding sufficient spectrum space for television has defied solution since the beginning of postwar planning in 1943. It can be solved only after the most careful study and weighing of competing needs of all concerned to arrive at a solution in the best national interest. By no stretch of the imagination could it be resolved by a temporary board. This major problem in itself emphasizes the need for a high-level permanent agency concerned with telecommunications, and with the resolution of conflicting Federal Government and non-Government requirements.

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Summary

In the 50 years since its inception, use of the radio spectrum has grown into an enormous, vital, and complex activity connecting all countries with means of rapid communications. The radio communications systems which have developed are of major importance to the United States and to the world in the dissemination of information and maintenance of security and welfare, and in the conduct of business.

With the development and expansion of radio, the need for regulation, both national and international, has grown until the resulting organizations, treaties, and agreements have become as complex as telecommunications itself. Most of these organizations and agreements were devised to meet an existing need and not in anticipation of future needs. Frequently they were not established formally until long after they started to function. Once formalized, legislation and organizations to deal with telecommunications have not been kept current with this dynamic activity. The condition of "too little and too late" has held more often than not.

Existing organization to control use of the spectrum, one of the most valuable natural resources of the United States, is responsible for the establishment or continuance of dual control of this resource. This dual control has led to friction, misunderstanding, waste, and avoidance of responsibility. The organization is lacking in over-all policy guidance, and so complex that few persons understand

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all its ramifications.

Weaknesses in the present United States telecommunications organizations and lack of high national policy and direction have hindered the United States in the national control of telecommunications and in its international relations on telecommunications. The present telecommunications legislation and organization have failed to produce adequate direction, leadership, administration, and control and have fostered dissension between the Federal Government and industry. Many of these shortcomings could have been mitigated if not avoided.

The United States ratified the Atlantic City 1947 International Convention, including adherence to the Atlantic City Table of Frequency Allocations and associated radio regulations. Over three years later, there has been no acceptable position and plan for the implementation of this Table for more efficient and orderly use of this limited resource.

Experience of the past three years has highlighted the difficulties of implementation under the procedures envisaged at Atlantic City. Lack of plans and policy plays a large part in the inability of all countries concerned to agree upon implementation. It was obvious to the Board, in view of the forthcoming meeting of the Administrative Council of the ITU in Geneva in April, 1951, that special steps would have to be taken to overcome the lack.

Accordingly, in October and November of 1950, the Board dis-

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cussed the problem with the Under Secretary of State, the Deputy Secretary of Defense, and the Chairman of the Federal Communications Commission. The Board proposed that these three officials constitute themselves into an ad hoc committee, and take responsibility for reviewing the political and technical difficulties contributing to the impasse, and for recommending workable policies for the Government to follow. The Board further recommended that this ad hoc group enlist the help of a small panel of especially qualified persons, who would make an objective appraisal of the factors of national interest involved, independent of the particular interests of any claimant agency.

The proposal was accepted; the ad hoc group was formed, and the independent panel set up in January, 1951.

Since the beginning of World War II, the allocation of radio frequencies has been increasingly an engineering and executive matter and not merely a record-keeping problem. However, the U. S. has failed even to maintain adequate records of frequency assignments. Sound frequency management could find ways of greatly reducing the pressure of the demand for radio frequencies, bringing it more into keeping with the supply. Under present management and policy, that pressure has grown to dangerous proportions. In the ten years between 1939 and 1949, the number of discrete frequency assignments between 4 and 20 Mc used by the U. S. was doubled. The growth of U. S. international long-distance broadcasting has greatly increased the

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demand for frequency assignments. In the critical world situation, there is little chance that the pressure will be reduced. The only solution is improved policy for the use of radio and better management of the radio spectrum.

Most of the differences of opinion between the Federal Government and industry users of the radio spectrum spring from lack of information concerning the relative needs of Government and industry for radio and the relative division of the spectrum. Previous estimates of the relative division of the spectrum have been based on non-representative methods of evaluation. Measured in terms of spectrum space rather than number of discrete frequency assignments, the Federal Government's share, though not so great as is commonly believed, is nevertheless large. While we do not know whether this use is out of proportion to the Government's responsibilities, it is apparent that it must have the most adequate justification and careful management if the greatest benefit is to be obtained from this resource.

Pressures for additional, suitable channels in the VHF region for television broadcasting pose a major immediate problem. By the end of 1950 the estimated investment in tangible property alone of 107 television stations and 10.6 million receivers amounted to about $3 billion. Television net time sales for 1950 were estimated at about $84 million. Most of the existing receivers will have to be modified or provided with adapters to receive additional channels regardless of their location in the radio spectrum. The great growth

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of television broadcasting, agitation for the reservation of VHF channels for educational purposes, and the discovery of tropospheric interference have demonstrated that 12 VHF channels are insufficient to meet the stated needs. The space desired for television is now used for essential services of the Federal Government and non-Government users with great investments in time, money, and development resources which should not be jeopardized by moving the peremptory of these services. In addition, the entire VHF band of 270 Mc is insufficient to accommodate the apparent desire for a total of at least 324 Mc.

This Board is of the opinion that a $ 3 billion, rapidly growing industry and a multi-billion dollar Federal Government investment for defense, civil aviation, and other essential non-Government services cannot long be left in this uncertain situation. Because of the rapid increase in the number of new, individually-owned receivers--over 700,000 in December 1950--frequency allocations cannot be changed easily and mistakes reach far into the future. This major problem alone emphasizes the need for a high-level permanent agency concerned with telecommunications and with the resolution of problems involving the interest of both the Federal Government and non-Government users. No temporary Board could hope to resolve them.

The high frequency portion of the spectrum between 4 and 27.5 Mc presents the gravest problem because of its multiple use for medium and long-distance telecommunications, tropical and long-distance broadcasting and other services, and because of its international

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aspects. Better and more far-sighted management and regulation might have averted some of these difficulties. The full possibilities of the radio spectrum have not yet been realized, but are being approached. Exploitation of the spectrum is not static but is fluid, increasing with the cooperation and good will of users, improvements in equipment, operating techniques, circuit discipline, need, and willingness to accept a poorer grade of service where necessary. It is not likely that the improvements derived from these measures will keep pace with the demands unless energetic steps are taken to establish an agency competent to assure the best circuit discipline, equitable allocation of frequency channels, and full use of technical developments.

Conclusions

1. Pressure on the radio frequency spectrum is steadily increasing as a result of the greater use of radio in telecommunications.

2. The means on which we have relied in the past for management of the spectrum are no longer adequate to resolve in the best national interest the problems produced by this increasing pressure. The current difficulty growing out of the search for suitable space for television broadcasting in itself emphasizes this inadequacy.

3. Measured in terms of spectrum space rather than in number of discrete frequency channels, the Federal Government's share of the spectrum, though not so great as is commonly believed, is nevertheless large. While we do not know that it is out of proportion

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to the Government's responsibilities, it must have the most adequate justification and careful management if the greatest benefit is to be obtained from it.

4. There is need for a continuing determination of the changing requirements of Federal Government users both among themselves and in relation to the requirements of other users.

5. The recent rapid worldwide growth of telecommunications, combined with the needs of the current national emergency, makes the resolution of these problems a matter of great urgency.

6. The resolution of these problems can be secured only through adequate, energetic management, which demands that the Government organize itself to take a comprehensive view of the telecommunications field.

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provide the backbone of military telecommunications in time of emergency. The dependence of the armed forces upon the domestic telecommunications facilities of the United States is indicated by the following statement made to the Board by the Department of Defense:

> "The nerve system of National Defense is the sum total of all communication systems that are available, operationally and potentially, for the prosecution of any emergency or war effort. The operational existence of nation-wide systems of rapid voice and record communications in peacetime is indispensable from the standpoint of meeting the wartime requirements of both the military services and the civil economy. As the intensity and complexity of warfare continues to increase, correspondingly greater demands will be placed on the communication systems of the nation from the standpoint of both circuit capacity and flexibility of operation. It is, therefore, considered in the vital interest of National Defense that there be maintained within the United States to meet that need as many nation-wide commercial communication systems as are economically feasible."

Civil Defense.-- Since the outbreak of the Korean action in June, 1950, the attention of the people and Government--Federal, State, and city--has been drawn to the need to plan and organize for civil defense.

For the over-all national interest there must be sound, modern, efficient nationwide systems for the rapid handling of telecommunications. From the standpoint of national security and civil defense, and in view of the possibility of sabotage, strikes, and catastrophe, duplicate systems should be maintained. Circuits between key points should not be concentrated in one cable, on one pole line, nor on

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one radio beam route. Nor should all terminal equipment serving key points be housed in one building. The dispersion and duplication of facilities should be considered in all telecommunications planning for the future. In planning the defense of our cities against bombing, we need to be sure that communication can be maintained both within and between cities, and that emergency means are available for communication with the populace by radio.

The Two Basic Systems.--Although the telephone and telegraph systems do not offer precisely the same kind of service, each can and does serve at least as a partial substitute or replacement for the other for emergency telecommunication. Much of their outside plant facilities can be used interchangeably.

To provide the nation with an adequate system for both peace and war, these two basic networks for telecommunications should be developed and maintained. Practical considerations will limit the extent to which alternate routings will be feasible; but within these limits, each network should maintain separate inside and outside plant facilities with alternate circuit routes and terminals.

In the discussion which follows, the soundness of the nation's telephone system is apparent. On the contrary, the telegraph industry has passed through a succession of crises which probably are not over. Current improvements in the position of the industry afford an opportunity to develop information needed for sound, long-range planning to avoid future difficulties. We believe that sound management

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and vigorous technological development can contribute further to the stability of the domestic telegraph system.

The Telephone System

The nation's telephone system consists of the Bell System with approximately 34 million telephones, together with some 5,000 independent telephone companies operating an additional 8 million telephones.

Units of the Bell System are the American Telephone and Telegraph Company, its general departments and its long lines department, 20 associated Bell operating companies, Western Electric Company, and the Bell Telephone Laboratories. The independent companies are served by a healthy manufacturing industry which has pioneered many important technical advances such as the use of dial telephones.

Description of the Bell System

The Bell System's primary undertaking is the furnishing of telephone service. Through interconnecting arrangements with the independent companies, it provides domestic local and long-distance telephone service to the 42 million U. S. telephones, and international telephone service with nearly all of the balance of the estimated 72 million world telephones.

The Bell System also leases to its clients telephone and telegraph circuits for various domestic services, maintains a teletypewriter

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exchange service (TWX), a telephone service to land mobile units and to aircraft, and telephone service to overseas points and to ships at sea, the latter divided into two categories, coastal harbor and high seas.

The Bell System in 1949 had total assets of nearly $11 billion and a gross annual revenue of nearly $3 billion. It owns or controls about 80% of the telephones and receives about 90% of the revenues of the domestic telephone systems. 1/

General reliance upon telephone service is so widespread in the nation that to itemize uses of it would be to labor the obvious. Its public acceptance is evidenced by the fact that there is now a telephone for every 4 persons in the country. For the present purpose, this over-all contribution of the telephone industry to the national interest is taken for granted, and other individual contributions are discussed specifically.

The Bell System and the National Security

The national security requires that there be available, to expand or supplement the military communications system, a nationwide efficient, integrated, and diversified domestic telephone system operated by persons loyal to the United States. Defense planning should also include multiple automatic communications systems on a national grid

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1/ Attachment III-A gives selected Bell System statistics which reflect the size, growth, and importance of the Bell System and some comparative data with the totals for all telephone carriers for 1949.

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to insure continuous operation if key points are destroyed. Further, we must plan for essential expansion, and stock critical materials.

Efficient, fully functioning civil operations which support the military operations are also necessary to a successful war effort. To function properly, civil activities such as commerce, manufacturing, transportation, exercise of Government, civil defense, fire protection, and public information must have adequate rapid communication.

In time of national emergency, the communications networks must be expanded to include many new manufacturing plants and military posts. Communications must be provided for fire protection and guard systems for these plants and posts. Convenient telephone pay stations must be furnished for workmen and military personnel. Frequently, trunklines as well as local facilities must be expanded.

In World War II the Bell System provided 400,000 miles of intercity leased circuits and 2,600 teletypewriter stations, built new facilities for over 3,000 military establishments, and provided 600,000 telephones for them. Aircraft warning service was provided for 58 Information and Filter Centers, handling Army Flash Calls at a peak rate of 30 million annually.

During World War II public telephones were installed at 201 camps (housing over 5,000 men each), at 376 attended locations involving about 3,000 attendants and nearly 19,000 telephones. Telephone facilities were also provided for 88 hospitals with 1,000 or more beds, with 102 attended locations, 584 attendants, and over

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4,600 telephones. The demands of World War II increased the telephone calls per month from 2.8 million in 1940 to 3.3 million in 1945, an increase of 18%. To meet these requirements, the Bell System expanded from 17 million telephones, 89 million miles of wire, and $4.7 billion invested in plant in 1940 to 22 million telephones, 99 million miles of wire, and $5.7 billion invested in plant in 1945.

The Bell System provides trained telecommunications personnel. In World War I, 14 telegraph battalions were formed with men from the Bell System. In World War II, communications specialists cadres were designated to provide a nucleus of experienced telephone men within each of 380 Signal Corps units. For these units 4,250 officers and enlisted men came from the Bell System. Over 400 additional Bell System specialists volunteered under this plan for designated commissioned staff positions in the Signal Corps. In all, nearly 70,000 men and women from the Bell System entered the military services during the war. Four affiliated units were ordered to active duty in 1950 after the start of the fighting in Korea. In addition, many trained civilian telephone operators replaced military operators.

During World War II the Bell System operated 26 plant schools, training 7,235 men for the armed forces.

The system's laboratories helped materially in the development of new tools of war. Telephone research conducted in peacetime proved to be valuable in many military problems, enabling the Bell laboratories to make major contributions to such projects as gun directors,

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rockets, torpedoes, guided aerial missiles, detection of submarines and magnetic mines, airplane crew trainers, propagation of microwaves, and microwave relay equipment. In all, over 1,200 military research projects were carried through to completion.

The extensive resources of the Bell System also mean that large quantities of critical items of materials and equipment can be stored for war emergency use.

The extensive manufacturing facilities of the Western Electric Company, a Bell System subsidiary, made it possible to produce large quantities of urgently-needed equipment for communications and military purposes.

The Bell System and the National Economy

The Bell System in 1949 received for its domestic communications services nearly $3 billion. It paid out about $2 billion in wages and salaries to some 600,000 employees, and about $346 million in taxes, and collected for the Federal Government about $444 million in excise taxes. Operating disbursements of about $500 million, in addition to wages and taxes, were made to other companies and individuals. Dividends of about $216 million were paid to nearly a million stockholders. Capital expenditures of over $1 billion were made for expansion. The system's major contribution to the national economy, difficult to measure in dollars but nonetheless real, is the increase in business attributable to the convenience of rapid communication.

The Bell System and the connecting companies network provides

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widespread facilities for distribution of international wire and radio telephone messages. These facilities connect the nearly 42 million telephones in the U. S. with nearly 30 million telephones in 86 other countries of the world. In 1949 about 620,000 overseas and high-seas telephone calls were completed, producing about $7 million in revenue.

Trends in the Bell System

Technological Trends.--The domestic telephone communications systems have made many mechanical and technical advances which have improved the quality and speed of service. The "hearability" of the telephone has been improved about four-fold in the past 20 years through the use of newly-developed equipment and techniques. Greater use of automatic equipment has reduced the average time of completing toll and long distance calls from 1.8 minutes in 1948 to 1.5 minutes in 1949, with 95 out of every 100 being completed while the calling party was holding the line.

Dial telephones have been increased to 73% of the total. New type toll switching systems enable customers in large areas to dial their own calls directly to other cities beyond their local calling areas.

The provision of the teletypewriter exchange has made it possible for any one teletypewriter to be connected to any other of the 25,000 teletypewriters in the system.

Coaxial cable and microwave relay have appreciably increased the

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available channel capacity and improved in great measure the quality of electrical transmissions.

Manual switching or relaying has been greatly reduced through the use of improved automatic switching systems. Toll dialing equipment is now in operation to permit operators to dial toll calls straight through on 25,000 toll circuits to over 600 cities or towns.

Economic Trends.--Since 1939 average hourly earnings in the telephone industry have increased 70% and costs of materials have increased more than proportionally. For instance, in 1949, electrolytic copper was 2.2 times its 1939 cost, zinc 3.3 times the 1939 cost, and lead 3.38 times the 1939 cost. These rising costs have been offset in part by operating economies and by local rate increases.

From the early days of the telephone, revenues from local service have generally followed business conditions, lagging behind somewhat and fluctuating to a lesser extent. Through the years there has been an increase in the number of local calls that can be made without increasing the subscriber's monthly bill.

World War II started another cycle of rising costs which the company has sought to offset by requesting increased local rates. With earnings below the average of the previous 25 years, the Bell Telephone Companies, faced with rising costs and wages and the need to expand plant facilities, in 1946 secured local rate increases in 8 states and requested rate increases in 16 others. By 1949 increases in local rates had become effective in, or had been requested in,

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practically every state. Though increases in local telephone rates have varied for different classes of service in different places, the increases requested (including those already granted) averaged about 20% of the Bell System revenues.

The U. S. Treasury Department 1947 study entitled "Excise Taxes on Communications" summarized the subject of rates as follows:

> "Rates charged on local telephone service vary among localities and are subject to differences in State regulatory practices. Following increases made after World War I, there were no important changes in basic rates until 1946. There was a slight decline between 1935 and 1941, but no change in prices to consumers during the war except for the increase in excise tax. Although basic rates remained substantially unchanged for a long period, the rate of return permitted to be earned has shown a long-term decline. Rates probably were not reduced during the period between the wars because the increase in the demand for local telephone service apparently leads to higher unit costs which the companies have only been able to offset by technological developments and increased employee work loads. Because of higher costs, rates are now being increased."

Since 1919 interstate long distance rates have been periodically reduced, under the jurisdiction of both the Interstate Commerce Commission and the FCC. Over the period, 14 reductions have been made. Most recent action was taken on January 19, 1951, when the FCC directed that A. T. & T. and its 20 affiliates in the United States file a statement before March 23 on the basis of which decision would be taken on a possible interim reduction of long-distance rates. Hearings to determine whether existing rates are unjust, unreasonable and burdensome were scheduled to begin April 16.

The Commission's order was taken as occasion by the National

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Association of Railroad and Utilities Commissioners (NARUC)--representative of the state commissions whose responsibility is for intrastate rates as distinguished from the interstate toll rates with which FCC is concerned--to petition to intervene and seek enlargement of the issues. The NARUC move was strongly endorsed by Senator Ernest W. McFarland of Arizona, Chairman of the Communications Subcommittee of the Senate Interstate and Foreign Commerce Committee. In a letter to the Commissioners, January 30, 1951, Senator McFarland said in part:

> "The problem of disparity in telephone rates has disturbed me for a long time although I appreciate that it is commendable on the part of the Federal regulatory agency to be vigilant in attempting to avoid an inordinately high return to the American company on its plant investment. The trouble is that the general public does not realize that every move that is made to reduce long distance toll rates results directly or indirectly in an eventual increase in local exchange rates and in intrastate toll telephone rates....
>
> "Some of the examples...of differences between an interstate toll rate and an intrastate rate for an identical or nearly identical mileage are almost fantastic. For instance, the three minute station-to-station rate between Florence and Yuma, Arizona, is $1.05 while the rate for the same service between Yuma and Winterhaven, California, is 80¢ although the telephone route mileage is identical, namely 197 miles....
>
> "We all know that the nationwide telephone plant is a complex and closely integrated structure and that over the years no separation formula has been wholly fair or wholly satisfactory either to the American company and the associated companies or to the 48 state commissions. But one thing is clear to all of us--there would be no long distance toll business without the local plant and the local telephone instrument in each home and business....
>
> "The fact remains that while the Commission (FCC) has ordered long distance rates lowered, local exchange and intrastate rates

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> have steadily increased. Moreover, while wages and other general expenses of doing business have increased tremendously, those who use the long distance actually get cheaper service. In my judgment, this anomaly cannot be explained away by merely insisting that greater volume of long distance business has brought this about since it is clear without any question that the basic volume increase is due largely to the tremendous expansion of local facilities."

The Western Union Telegraph Company also filed a petition to intervene, on the ground that a substantial reduction of long-distance rates might adversely affect its financial stability. The General Services Administration of the Federal Government also petitioned to intervene, citing that the Government is among the largest single customers of the Bell System.

Total taxes on the Bell System's telephone service in 1949 aggregated nearly $800 million--an increase of about $100 million over 1948.

Since the early days of the telephone, the gross revenues of the telephone systems and in particular the Bell System have increased rapidly except for a temporary regression following 1930. By about 1940 the Bell System had again reached the revenue level of 1930, and the impetus of World War II increased its earnings even more rapidly until in 1949 its gross revenues were nearly $3 billion.

The capital investment, operating expenses, and taxes showed the same general rise from 1925 to 1950, increasing more rapidly since World War II. As a result the per cent return on capital of the Bell System (including Western Electric) showed a steady decline from a high of 8.7% in 1927 and 1928 to 4.3% in 1933, then fluctuated

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between a high of 7% in 1940 and a low of 4.5% in 1947, reaching 4.9% in 1949. The average return for the 25-year period was 6.26%.

Through 1931 the A. T. & T. never failed to earn its dividend. In the next 17 years, there were 9 years when the dividend was not earned but was paid partly out of the surplus accumulated over the years. The Bell System at the end of 1949 had a surplus applicable to A. T. & T. stock of over $340 million.

With minor exceptions there has been for some years a monopoly of telephone service in each area. Rates and services, instead of being controlled by competition, are now regulated by State commissions and the Federal Communications Commission. Although there are more than 5,000 telephone companies in the U. S., the Bell System is the dominant unit in the domestic telephone communications field. Actual ownership of the Bell System is now in the hands of nearly 1 million stockholders.

General Trends.--The growth of the Bell System reflects the importance of the telephone to U. S. industry and social life.

The requirements of the public for rapid, flexible record communications led to the expansion of the Bell System's private line service, begun before 1890, and its teletypewriter exchange service (TWX), started in 1931. Together these total nearly 48,000 stations, with revenues of $46 million in 1949.

Mobile radio telephone service for ships and small craft has existed for a number of years. State and city police have used private

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mobile radio telephones since the early 1930's. The second world war increased the demand for communications in all circumstances. In response to this requirement, the Bell System in 1946 inaugurated the new domestic public land mobile radio telephone service, providing for connection via radio and wire with any other telephone in the nation. By the end of 1949 it was available in 144 areas, and on certain railroad trains.

Influences Affecting the Bell System

Public demand is a powerful instrument in shaping the policy and operations of the Bell System. Demands for better quality and faster and cheaper service, and the company's pride of performance, have led to many technical and operational improvements. Subscriber objection to delays in completion of toll calls and the ever-increasing volume of calls stimulated the establishment of the toll dialing system. Demands for long distance telephone service beyond the capacity of existing plant facilities led to the development of the carrier system, the coaxial cable, and the microwave radio relay.

Through arrangements between Western Union and the telephone company, a telephone subscriber may dictate a telegram to the Western Union operator and have the cost charged to the monthly telephone bill. The telephone company collects the charge, deducts its commission for the work performed, and pays Western Union. Conversely, Western Union frequently makes delivery of telegrams by telephone. In addition to the normal telephone service furnished to Western Union, the

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telephone company also leases considerable circuit mileage to Western Union for its use. At the same time, the Bell System competes with Western Union for record communication business through its teletypewriter exchange service, private line teletypewriter, and some telegraph service.

The Bell System is closely related to other domestic telecommunications systems such as are used by broadcasting, airlines, and other companies, because it leases to them the circuits which make these systems possible.

The Telegraph System

Rapid record delivered telegram service in the United States is provided principally by the Western Union Telegraph Company. The service involves the carrier's taking possession of a message, charging for it on a word-count basis, and conveying it by rapid means to the addressee. The business came into being something over a century ago, displacing the Pony Express familiar in American legend. During the past twenty years, the telegraph business has undergone a number of economic vicissitudes. In an effort to overcome these, the Congress in 1943 permitted merger of the Postal Telegraph Company with the Western Union Telegraph Company. As the company neared the start of its second century, increased business and industrial activity in the United States and increased alertness and aggressiveness on the part of Western Union's management combined in April 1950 to change the

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earning status of the company for the better. Western Union in 1950 showed an encouraging net income after several years of deficit operation.

The troubles of the telegraph industry gave concern to Congress as many as fifteen or sixteen years ago. The 1943 merger action stemmed from those troubles. Recommendation has been made from time to time that a thoroughgoing long-range study of the problems of telegraph communication should be made by appropriate Government authority. The most recent such recommendation was that of the Federal Communications Commission in 1946, but the necessary funds were not made available by Congress. Present performance and immediate prospects, however encouraging, do not eliminate the need for such a study.

Description of Western Union Telegraph Company

Since its incorporation in 1851, Western Union has gradually developed into an integrated nationwide telegraph system through purchase, lease, or stock ownership of more than 500 telegraph properties. The merger of the Postal Telegraph Company with Western Union in 1943 virtually completed this process. The system operates as a regulated monopoly under the provisions of the Communications Act, which places regulation of interstate and foreign communications by telephone and telegraph, both wire and radio, in the hands of the Federal Communications Commission. Purely intrastate wire communication does not fall within Commission jurisdiction.

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The provisions of the Act require that common carriers subject thereto furnish service at reasonable charges upon reasonable request. Without Commission approval, carriers may not construct or acquire interstate lines or curtail or discontinue service. All charges, practices, classifications, and regulations must be just, reasonable and non-discriminatory. Common carriers file with the Commission tariff schedules for regulatory purposes.

Western Union as it operates today under this public sanction webs the nation with more than a million miles of open wire and almost 380,000 miles of wire in undergound and overhead cables. This outside plant, directly or through tributary lines of telephone companies, serves almost 30,000 public telegraph agencies and offices and 22,000 private customer offices scattered over the nation. In addition, 42 million telephones in the United States are available to the subscribers for the filing or receipt of telegrams.

Over 41,000 employees received more than $125 million in 1949 for operating and maintaining this system. More than 174 million domestic telegram messages were handled in 1949, producing revenues of $141 million at the average toll of about 82 cents per message. Net investment in this communication plant runs over $172 million.

The largest customer of Western Union is the United States Government, which as a single user, provides more than 3% of the total domestic operating revenues of the company.

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Western Union offers a number of telegraph services, including straight telegram, serial, day letter, night letter, telegraphic money order, telemeter service, leased wire, custom-built telegraph systems, commercial news service, and illustrated telegram service. In addition, it handles correct time service, messenger errand service, messenger distribution service, collection and remittance service, and American Express money orders and travelers' checks.

While, historically, Western Union has been and still is a wire system, it has recently begun to utilize radio in several applications. One of these is the use of microwaves (radio beam) to replace wire for trunkline channels. Another is the "telecar service" which involves pickup and delivery of telegrams by cruising automobiles connected by radio with the central office. Still another is the marine reporting service, involving the reporting of vessels to the central office by radio from pilot vessels.

By far the bulk of the traffic today is recorded on automatic typewriters called "teleprinters" or on typing reperforators. The old-fashioned manual Morse system is disappearing, while the facsimile method may emerge as a fully automatic device requiring little operating labor. As the name implies, this method aims to reproduce at the receiving end the material as offered for transmission--written, printed, typed, or drawn matter.

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With the United States today a leader in world affairs, the need for efficient international communications is obvious. International telegraph communications originate at or are destined to places all over the United States. Hence a pickup and delivery facility is necessary. This facility is provided for the general public by the Western Union's nationwide system of wires and offices. The system serves not only Western Union's overseas cable service but those of other overseas cable and radiotelegraph companies. However, in gateway cities most of the commercial overseas companies handle a large percentage of their own pickups and deliveries.

Western Union and National Security

With a few exceptions, the armed forces of the United States do not construct or own domestic wire telegraph networks. Their domestic telegraph requirements are met by normal telegram service provided by Western Union and by lease of facilities from the telegraph and telephone companies.

Potential demand for telegraph services in any future war may be gauged by the demands made upon the telegraph industry in World War II. Federal Government domestic messages rose from 2.5 million in 1937 to more than 14.5 million at the war period peak in 1943, or almost six times. In addition, the armed forces began to lease telegraph lines from Western Union in significant volume in 1938 and these facilities reached a war peak of 1,800 miles in 1944. The growth of such service has been accelerated in the postwar period and had reached 78,000 miles in September 1950.

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The telegraph industry also provides an immediate source of "know-how" and facilities to meet special communications requirements of the military. In World War II, Western Union was called upon to handle more than 7,000 special telegraph projects for war purposes. These included development of special equipment to meet military requirements, adaptation of existing equipment, and many research assignments.

In peacetime the telegraph industry provides a ready reservoir of trained communications personnel. More than 10,000 employees of Western Union and Postal entered military service during World War II. Assuming that the bulk of these performed military duty for which they were already trained, the military was thus relieved of much training effort. The industry not only had to train additional personnel to handle increasing war business, but also had to train replacements for those who entered the armed forces.

Well over $5 million was expended by the telegraph companies to set up and operate training organizations. Taking advantage of the school facilities, the military fitted hundreds of members of the armed forces into these groups, in order to reduce its own mammoth training job.

Apart from huge increases in the carriage of messages, special circuit facilities and equipment were supplied to the Department of State, the Federal Bureau of Investigation, the Maritime Commission,

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the Office of Strategic Services, the Office of War Information, Army, Navy, Army Anti-submarine Control, British Admiralty, British Air Commission, other governmental agencies, and many large basic war industries. Special telegram services were created, including the casualty message procedure, the Expeditionary Force Message, the Homeward Bound Message, and the reduced rate telegraph money order.

Telegraphic communication "know-how," research, and development contributed to the solution of many military communications problems. Special automatic equipment and circuits were involved, such as radio multiplex, telekrypton, telefax, varioplex on ocean cables, multiple film scene selector, reperforator switching, means for generation of additional channels from existing wire line plant, etc. While some of these activities produced results applicable in peacetime, others tended to defer the normal long-range program of modernization.

Western Union and the National Economy

Significant measures of Western Union's participation in the domestic economy are the following rounded figures for 1949:

Total net investment in communication plant	$172,000,000
Operating revenues	$171,000,000

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Total telegraph offices	29,400
Telegraph revenue messages handled.	174,000,000
Number of employees (October 31, 1949)	41,600
Total employee compensation	$125,900,000
Total interest charges (domestic and overseas).	$ 3,150,000
Federal and State taxes - paid by company.	$ 5,775,000
Federal excise taxes - paid by customers.	$ 36,500,000

Trends in Western Union

Technological Trends

Transmission of domestic telegraph messages for many years was accomplished almost wholly by the manual method, employing the Morse "dot-dash" code.

In 1915 Western Union began a series of technological improvements with the introduction of the "automatic multiplex telegraph system" on its trunkline network. In this system the circuit is "multiplexed" into two or more channels, each of which can carry a message in two directions simultaneously. The system is "automatic" in that the sending operator, by operating a keyboard, punches a tape which is automatically fed into the system and the transmission is

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automatically received on an electric typewriter at the receiving end of the channel. The new system improved accuracy and speed of service, raised the productivity of operators, and obviated large capital expenditures which would otherwise have been necessary to carry increasing volumes of traffic with equal or improved quality of service.

In 1926 a modified version of the automatic system, known as the "simplex printing telegraph system," was applied to circuits connecting main offices to branch offices and to smaller independent offices in other communities. By 1928 most of the telegraph companies' branch offices had been so equipped. At this point, to round out the automatic system, the telegraph companies began making installations of this type in the offices of larger customers.

Because, with little instruction, an ordinary typist could send and receive telegrams on them, these electric telegraph "typewriters" were well received by the larger users of the telegraph service. The installation of simplex printers made it unnecessary for a customer who wanted a rapid service to employ a Morse operator. The telegraph companies were also interested in avoiding the delay and expense of messenger pickup and delivery. Today more than 20,000 such printers are in customers' service and many thousands more are in use in telegraph offices operated directly or indirectly by Western Union itself.

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Even with the automatic system, a telegram moving across the country had to be typed manually from two to six or even seven times en route. To eliminate such labor-consuming, delaying, and error-producing manual re-transmissions, the company initiated a limited program of reperforator switching at its larger relay offices. By 1943 several of its larger offices had been converted to this type of operation, but, because of war conditions, the program was more or less suspended. Following the merger of Postal with Western Union in the fall of 1943, an extensive program to modernize and mechanize the combined operation and plant and to improve telegraph service was planned.

Insofar as reperforator relay switching is concerned, the program, originally scheduled to be completed in seven years, was speeded up in January 1946. The dire necessity for reducing costs and improving handling methods accelerated the reperforator switching plan to the extent that the objectives sought at the time of merger are today practically realized. In this system each area relay center has direct circuit connections with every other area relay center, thus avoiding relays through intermediate centers.

In the early 1930's Western Union undertook to investigate the possibilities of facsimile to transmit and record reproductions of printed, typed, and hand-written copy. The system was tried on both intercity trunk circuits and on short lines between the customers' and branch offices and main offices. By 1934 it was determined that,

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in its then state of development, facsimile had a speed in words per minute far below that of other systems in use at the time. Nevertheless, developmental work continued and some installations were made until the project had to be suspended during the war.

Emerging after the war was the desk-fax, a small and relatively inexpensive machine capable of sending and receiving messages. The operation requires no skill. It is fully automatic once the message blank is placed in the machine and the starting button depressed. As part of Western Union's postwar program, more than 2,000 desk-fax units have been installed in customers' offices. The company's management believes that the desk-fax promises to solve, in part at least, the perplexing problem of quick and economical pickup and delivery of telegrams.

To assist in the solution of the pickup and delivery problem at branch and "agency" offices, installation of transmitting and recording facsimile equipment designed to handle a substantial volume of telegrams is part of Western Union's current program of plant improvement.

One of the heavy expense burdens borne by the communications industry is the construction and maintenance of its trunk circuit plant. Over the years, Western Union has continued the erection of stronger and better pole lines, replacing the less desirable and less efficient iron wire with copper, and substituting underground cable for aerial lines in congested areas.

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In 1934 Western Union commenced the use of carrier current telegraphy in its network of trunk facilities. Carrier operation permits the derivation of a multiplicity of circuits from a smaller number of wires. Even when the cost of the terminal equipment necessary to derive the additional circuits is deducted, the savings over the construction of new wire lines are high.

By 1944 carrier current telegraph had developed to the extent that installations between New York and Washington provided 36 high-speed two-way telegraph circuits on two physical wires. By this time, it was clear to Western Union that carrier operation was a vast improvement over the "ground return" single wire trunk circuit operation then in general use.

Western Union's wire plant in 1930 comprised 219,000 miles of pole line and over 1.5 million miles of open wire. The merger of Postal with Western Union in 1943 added 31,000 miles of Postal line and 334,000 miles of wire, but, because of its physical condition, most of this equipment was dismantled after World War II.

By 1950 Western Union's wire plant had contracted to 205,000 miles of pole line (of which 98,000 miles are railroad lines shared by Western Union) and to a little over 1 million miles of wire.

In addition to this plant, the company installed and operates more than 800 miles of multi-channel radio beam, and leases from the telephone companies 1.25 million miles of carrier channels.

The demands of World War II accelerated research and development

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in the use of radio, particularly on frequencies above 30 million cycles. Much was learned about the behavior and use of frequencies from 30 million to 10 billion cycles. From this research, it has become possible to adapt radio beams to the transmission of record communications.

Radio beam (microwave) relay involves the construction of a series of towered radio stations along the desired route, spaced about 30 miles apart. The beam system obviates the otherwise necessary continuous rights of way, pole lines, cross arms, and wires.

As a result of the mechanization program, Western Union states that its modernized telegraph plant is capable of handling more than double the present telegraph volume. Percentage utilization of plant available for message business as of October 1950 was as follows:

Daily peak period (one-half hour)	32%
Over 24-hour weekday	11%
Over Saturday-Sunday weekend	4%

The company declares that it recognizes the vital importance of maintaining separate trunking systems as between oral and record communications. Asked what its intentions were as between leasing of trunk-line facilities from the Bell System and the continued construction of its radio beam system, Western Union told the President's Communications Policy Board on November 6, 1950:

> "Contrary to the impression that may have been created by Western Union's increasing use of facilities leased from telephone companies in recent years, Western Union has at the present time and intends to retain in the future a comprehensive network of physical facilities entirely independent

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of telephone facilities....

"Western Union has substantially completed large-scale rebuilding of its circuit facilities on an FM carrier basis. This has involved the transposition and loading of physical wires on which FM carrier was imposed, the addition of FM carrier on radio beam voice bands and as required, on leased voice bands. Its radio beam system linking New York, Philadelphia, Washington, and Pittsburgh, is in operation, and in connection with the expansion of this system the Company has planned routes across the nation and has acquired tower sites as far west and south as Minneapolis, Kansas City, Dallas, and Atlanta.

"These plans reflect Western Union's recognition of the advisability, in the interest of national security, that a nationwide network of telegraph trunking circuits be for reasons of physical security separate from the circuits carrying voice communications. Given favorable economic conditions and the high level of demand for circuits that makes radio beam systems economically justifiable, we envisage over a period of time a radio beam system providing trunk facilities between major cities, replacing leased facilities and some parts of Western Union's existing wire plant.

"The speed and extent of the expansion of the radio beam system are necessarily dependent, however, upon the establishment of National Policy. Western Union's ability to obtain necessary capital funds for the expansion will be influenced in major degree by the establishment of National Policy strengthening its financial position; and the expansion can be justified as a matter of economics only if National Policy is formulated to the end that telegraph traffic which has been diverted from Western Union be returned to it."

As of December 31, 1949, Western Union's outside plant facilities were:

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Miles of Line

Facility	Owned	Jointly Owned	Leased	Percent Leased
Pole Line	88,169	13,272	6,359	5.90
Wire	1,030,000	11,040	25,750	24.10
Aerial Cable	72,758	19,308	257	.27
Underground Cable	260,012	15,057	1,992	7.20

Carrier System Miles

Channel	On Owned Wires	On Owned Radio Beam	Leased Voice Frequency 1/	Percent Leased 1/
300 cycles	72,908	6,908	36,531	31.4
150 cycles	212,641	75,216	1,206,240	80.7
Other	7,898	-	-	-

1/ Almost wholly from A. T. & T. and associated companies

The relative costs per telegraph channel mile, assuming the actual assignments made to the various types of service, were stated by Western Union in October 1950 as:

1. For Western Union lines $19.70
2. For lines leased from telephone company 5.30
3. For microwave 6.30

In summary, basic technological developments in Western Union have been directed not only toward economy in investment, reduction in operating expense, and improvements in existing services, but also toward new services. Some of these are telemeter service and private automatic telegram systems, and currently, a private telegraph network

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involving automatic switching centers located in Western Union offices and operated by Western Union personnel.

Service Trends

Western Union's basic service is the transmission of telegraph messages; this is supplemented, as has been explained, by a number of allied services including the leasing of circuits. Discussion of service trends hence involves message business, which can be measured by the number of telegrams transmitted and by the revenues they produce, and non-transmission business, the most convenient measure of which is revenues.

Message Business.--About 80% of Western Union's income is produced by telegrams, the most important of which is the full-rate so-called "day message," which brings in almost 75% of the company's total public message service revenues. Business messages--those concerned with commercial transactions as distinguished from personal and social matters--account for about 75% of the total message volume.

The general trend of Western Union's message volume between 1927 and 1949 was downward. The reduced rate serial service, after a fast build-up in 1934, had steadied down to about 7.5 million messages in 1949. Money order messages, on the other hand, show a rather healthy long-range growth.

The reduced rate "timed wire service" classification, which had reached a peak of 8.5 million messages in 1949, was ordered discontinued by the Federal Communications Commission because it was found

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to be unjustly discriminatory.

The reduced rate greeting message--a "social" rather than "business" service--had reached a record volume of 22 million in 1941. This service and all other non-essential activities of Western Union were ordered discontinued by the Board of War Communications in 1942 in order to clear the lines for essential war traffic. They were not restored after the war.

The number of Government transmission messages averaged around 7.5 million per annum between 1926 and 1941, rose to a peak of over 14.5 million per annum during the war years, then fell off to an average of about 3 million, standing at less than 2.5 million in 1949. The trend is similar for non-Government messages but not so pronounced. These messages totaled 189 million in 1926 and dropped erratically thereafter. They numbered 151 million in 1949.

With these changes in the character and quantity of transmission messages, the total of all messages dropped by 30 million or 14% between 1927 and 1949; because of rate increases, however, revenues rose by $11 million or 8% over the same period. 1/

Western Union's message volume is sensitive in two ways to the marked increase in the number of telephones in the United States. The total of telephones of the Bell System, which serves over 80% of the country's telephone subscribers, stood at about 12 million in

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1/ Attachments III-B and III-C

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1925, 17.5 million in 1940, 22.5 million in 1945, and over 33 million in 1949. The telephone has probably taken over social and personal business from the telegraph. The increase in the number of telephones has increased the number of direct avenues to telegraph service, since Western Union receives messages by telephone for transmission, through cooperative billing arrangements with telephone companies.

Growth of air-mail service is another factor taken into account in analyses of reasons for the decline in telegraph message business. The question of dependability of delivery--a major consideration in business transactions such as supply 75% of Western Union's message volume--here has to be balanced against savings in cost.

Non-Transmission Business.--Non-transmission service revenues increased from about $8 million in 1927 to almost $20 million in 1949, a rise of 150%. Leased services and money order charges show almost a steady climb during the same period. Measured service (telemeter), for which the customer who is on a fixed connection with another customer pays a rate based on the monthly accumulative number of words transmitted, has grown from $36,000 in 1936, when the service was established, to almost $2.5 million in 1949. 1/ Altogether, non-transmission revenues, which represented about 5.5% of all operating revenues in 1927, had risen to 11% of the total in 1949.

A substantial portion of the increase in non-transmission business

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1/ Attachment III-D

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came from the increase in leased circuits. These in 1927 had produced revenues of slightly more than $2 million; by 1949 the figure had risen to $7.5 million. An illustration of the growth of leased facilities in the latter part of the period is given by data from Western Union on facilities leased to Government agencies:

Year	Revenues	Miles of Circuits	Number of Western Union-owned Printers
1937	4,800	100	4
1944	790,500	57,300	250
1949	1,421,200	106,000	470
1950	1,726,300*	135,000	600

*Estimated on basis of first eight months actual.

Some organizations operating leased facilities estimate that they are saving from 20% to 40% of what their telegraph expenses would otherwise be; it is likely that the increased use of leased circuits has contributed to the decline in message business. An isolated case cited by Western Union is a drop of 50% in monthly public message revenue at its main office in Schenectady, New York, which is explained as "caused mainly by the conversion of the file of our largest customer there (General Electric) to a leased wire system set up by Western Union for that company."

Need for thorough study of the situation is indicated by the fact that though the leasing of circuits is growing, is regarded as saving money for lessees, and is probably reducing Western Union's message business, the question whether leasing gives Western Union any profit cannot be firmly answered. In response to an inquiry from the Board

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as to the profitability of leased wire service, Western Union reported:

1. The factors involved in a study of the over-all economics of private wire systems are exceedingly complex, so that several months would be required for completion of a study in process, and a direct answer to the question could not be given.

2. The profit margin, if any, as indicated by the study thus far, is small. The rental of out-station equipment and switching center equipment is almost certainly done at a loss.

In its response, Western Union took occasion to comment that:

> "In the operation of private wire service Western Union has been faced with the Hobson's choice of meeting the rates of the Bell System, in which private telegraph and TWX systems are an insignificant part of the total revenues and upon which a profit is relatively unimportant to the well-being of the telephone system, or go out of the business and see an ever increasing proportion of the volume record business diverted to the Bell System. Until there is an over-all integration of rates for communications service in accord with a national policy of fostering sound economic conditions in the industry it seems that the kind of chaotic situation that now exists in this field will continue."

Influence of TWX.--Revenues of the teletypewriter exchange service (TWX) to which Western Union referred have shown a significant increase. In this service, the carrier provides the necessary terminal teletypewriter equipment at the subscriber's location and the desired circuit for operation by the subscriber in the same manner as in public telephone service. Time rather than words serves as the base for the tolls.

In 1931, the first year TWX service was offered to the public,

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revenues amounted to only $7,000. They climbed steadily to a peak of $23 million in 1943, fell to $13 million in 1946 and again climbed to almost $18 million in 1949. Private line teletypewriter service, without the exchange feature, brought the telephone companies $25.5 million in revenues in 1949, as against $9.5 million in 1935.

But here again there is need of knowledge. In October 1949 the Chairman of the Communications Subcommittee of the Senate Committee on Interstate and Foreign Commerce requested the Federal Communications Commission to furnish information on the TWX service of the Bell System. This subcommittee wanted data particularly on the TWX rate structure, on whether the present rates would be compensatory if that service were an independently operated organization, and also on the extent to which TWX is servicing all business or only the lucrative part thereof.

The Federal Communications Commission, in responding to this request, regretted "that it is not in a position at this time [March 1950] to furnish your committee with reliable data which would provide the basis for some determination as to the extent to which current rates for TWX service rendered by the Bell System Companies are compensatory to those companies," pointing out that Bell System representatives estimated that a current study would cost between $400,000 and $500,000 and require on their part from four to six months, and that no study had been made since one in 1935, which is not considered reliable for application to the situation today.

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The Commission also made the following points:

1. On March 1, 1944, overtime rates for TWX service were reduced from about one-third of the initial period rates to about one-quarter, resulting in estimated annual savings of $2.4 million to users.

2. On February 1, 1946, the initial period rates for connections in excess of 350 miles were reduced by amounts ranging from 5 cents to 65 cents, depending on the distance, with the overtime rate and report charges being reduced proportionately. These reductions resulted in estimated annual savings to users of $1 million.

Production.--The value and trend of operator productivity at Western Union central offices in terms of equated messages per hour worked are shown in Attachment III-E. From an average figure of about 61 messages per hour in 1941, production fell off during the war years to a low of about 55 in 1944. With the postwar introduction of reperforator switching, production has climbed steadily to a high of 113.2 equated messages per hour worked in June 1950.

The average number of revenue messages per man-hour in 1929 was 1.54. The current series shows an almost steady climb from 1.71 to 2.13 for this measure and indicates in effect improved efficiency in the amount of labor time applied to the handling of each message unit.

The figures are:

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Year	Average Number Revenue Message Transmission Units 1/ (thousands)	Aggregate Hours Paid For 2/ (thousands)	Average Number Revenue Message Transmission Units Per Hour Paid For
1944	233,192	136,297	1.71
1945	245,162	132.476	1.85
1946	221,248	120,518	1.84
1947	224,629	107,917	2.08
1948	202,317	100,911	2.00
1949	186,031	87,205	2.13
1950	(7 months) 3/	45,064	3/

1/ Western Union Annual Report to FCC, 1949
2/ Western Union Commercial Department Wage and Hour Reports
3/ Not available December 1950

Speed of service performance and the trends for periods for which data were readily available are given in Attachment III-F. These data represent the quality of service at the 25 largest traffic offices in the United States.

The relay drag figure represents the interval between the time a message is received at a relay office and the time it is sent to another office. The figure for reperforator-switching offices averages about 8 minutes less than for manual offices, standing at 8.8 minutes in June 1948, and at 7 minutes in August 1950.

The trend of the manual figure is likewise downward since September 1948. The combined figure dropped from a high in 1943 of 14.8 minutes to 9.6 minutes in August 1950.

The average origin-to-destination speed of service is shown by the lower graph indicating an improvement from the rates in September 1948 to January 1950. From then, the trend is upward again, standing

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in August 1950 at 40 minutes for tie-line deliveries, 44 minutes for telephone deliveries, and 48 minutes for messenger delivery.

As the foregoing figures suggest, perhaps the oldest and most perplexing operational problem in the telegram service is the terminal handling problem. Today a telegram may be economically speeded across the country in a few minutes, but to get it to the transmitting office and to deliver it from the receiving office economically and speedily is another question.

While the terminal handling problem is not yet solved--and indeed may not ever be fully solved--data on Western Union terminal and originating handlings show the following trends in percentage distribution of its load for the methods indicated:

	Messenger		Counter		Telephone		Tie-Line	
Year	Terminating	Originating	Terminating	Originating	Terminating	Originating	Terminating	Originating
1928	80	50	1	26	13	18	6	6
1934	74	50	3	17	9	19	14	14
1940	66	40	2	16	15	26	17	18
1946	56	26	3	25	20	26	21	23
1950*	53	25	3	13	17	31	27	31

*February study.

Discounting any changes in the ratio of business to social telegrams, it is clear that the trend is toward terminal handling by wire--principally by teleprinter, telephone, Morse, or facsimile as against the costly messenger handling. Because telephone calls cost money to

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Western Union and often result in handling confirmation of telephoned telegrams, and, because teleprinters cost more than newly developed facsimile equipment, Western Union has embarked on a postwar program to install in large numbers of patrons' offices facsimile equipments such as the desk-fax earlier mentioned.

Economic Trends

During the past 20 years, powerful economic forces, realignments, and developments have had impact upon the rapid record communications industry in the United States. Among the more important are rising price levels, rising labor costs, increased taxation, new direct and indirect competition, technological advances, and Government regulation.

All these factors, with the possible exception of Government regulation, have had telling effects, in one way or another, upon practically all business enterprises. But the high ratio of fixed plant investment to revenues peculiar to public utility operation, together with the active interest of State and Federal Government in that operation, has restricted to some extent the ability of the telegraph industry to adjust to changing conditions in the same way, to the same extent, and with the same rapidity, as an unregulated private enterprise.

These factors were a challenge to management and a hazard to corporate survival. They ultimately led to the inability of the Postal Telegraph Company to operate at a profit so that in 1943 it was

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demand for telegraph service and that Western Union should be able to earn a profit in the near-term future.

In spite of that outlook, there is much to be gained by Government authorities--those responsible for regulation and those interested in the industry for its national security value--in studying the financial history and prospects of Western Union. One fact that stands out immediately is the absence of adequate data on which to base fair conclusions. Review of the company's difficulties should help to indicate where these gaps need to be filled, as well as to provide valuable lessons for the future when new economic problems are encountered.

An analysis of rapid record communications in relation to all rapid domestic communications was made for the Board by Dr. Bonnar Brown of the Stanford Research Institute. He found that total intercity communication revenues (including telephone, telegraph, and air mail) fluctuated very closely with the country's gross national product, but that record intercity revenues (of both telegraph and telephone companies) have lagged behind. He prepared the table on page 113 to illustrate these trends.

Commenting on the trends disclosed by his analysis, Dr. Brown declared:

"Both of the series--column 4 and column 5--show a rise in percentage in the late 20's, but the rise for record communications is less, and, consequently, its proportion of the total communications revenues had already started to fall. Whether the early 30's saw the culmination of a growth period, or whether the data simply reflect

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GROSS NATIONAL PRODUCT AND DOMESTIC COMMUNICATION REVENUES

	1 Gross Nat'l Product (Billions)	2 Total Communi. Revenues (Millions)	3 Record Communi. Revenues (Millions)	4 Percent Col. 2 of Col. 1	5 Percent Col. 3 of Col. 1	6 Percent Col. 3 of Col. 2
1926	99.5	413	166	.41	.17	40.2
1927	97.6	437	165	.45	.17	37.9
1928	99.8	482	174	.48	.17	35.0
1929	103.8	538	187	.52	.18	34.8
1930	90.9	518	173	.57	.19	33.5
1931	75.9	474	150	.62	.20	31.8
1932	58.3	378	118	.65	.20	31.3
1933	55.8	350	114	.63	.20	32.7
1934	64.9	361	121	.56	.19	33.4
1935	72.2	392	125	.54	.17	32.8
1936	82.5	440	137	.53	.17	31.2
1937	90.2	460	140	.51	.16	30.5
1938	84.7	441	128	.52	.15	29.0
1939	91.3	467	131	.51	.14	27.0
1940	101.4	497	135	.49	.13	27.2
1941	126.4	586	153	.46	.12	26.1
1942	161.6	740	178	.46	.11	24.0
1943	194.3	915	204	.47	.10	21.3
1944	213.7	1010	210	.47	.10	20.8
1945	215.2	1127	217	.52	.10	19.3
1946	211.1	1118	204	.53	.10	18.3
1947	233.3	1161	230	.50	.10	19.8
1948	259.1	1286	219	.50	.08	17.1
1949	255.6	1347	211	.53	.08	15.6

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seems to be a general public feeling questioning the efficiency of telegraph operations. Some improvement in volume could possibly result from better service and from exploration of untapped sources of business.

"The present international situation is one which appears to assure a high and growing physical volume of business for the nation as a whole for some years to come. This means communications activity at a high level, and there is even some indication from the history of World War II that the relative decline in record communications revenues is checked in a period of international tension. Nevertheless, our economy in recent years has been operating close to capacity, so that physical volume either in business as a whole or in record communication cannot be expected to increase very rapidly. Prices are rising, and it is doubtful that they will be kept fully in check, so that revenues can also rise from rate increases, but it is to be remembered that rate changes are sluggish and follow price-level changes only with considerable lag."

Influences on Revenues.--Trends in the use of rapid communications services at five-year intervals over a quarter century are shown in the following carrier revenue figures:

Year	Air Mail 1/	Toll Telephone 2/	Telegraph Operations of Telephone Companies 3/	Landline Operations of Western Union (and Postal) 4/	Total
		(In thousands)			
1926	$ 996	$ 245,704	$ 15,881	$ 150,112	$ 412,693
1929	4,762	345,935	23,918	163,358	537,973
1934	5,316	235,093	17,987	102,557	360,953
1939	17,656	318,573	20,867	109,899	466,995
1944	79,734	720,014	36,641	173,207	1,009,596
1949	71,627 5/	1,064,521 6/	39,135	171,393	1,346,676

1/ Air mail - Includes domestic air-mail letter, card, and parcel post postage revenue. Until 1949 the portion of domestic air-mail revenue attributable to parcel post was not available. Estimates for 1949 indicate it to have been about $11 million or 15.4% of total 1949 air-mail revenues used in this series.
2/ Toll telephone - Includes public message tolls, private toll line revenue and miscellaneous toll telephone revenue. Data are partially estimated.
3/ Telegraph operations of telephone companies - Includes TWX, private line telegraph, and message telegram services. Data are partially estimated.
4/ Western Union and Postal Telegraph - Includes domestic transmission and non-transmission revenues.
5/ Preliminary.
6/ Preliminary, and based on incomplete coverage.

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trends affecting the telegraph industry are again emphasized. Figures for representative years between 1927 and 1949 were:

Year	Interstate Toll Messages		Western Union Transmission Messages	
	Revenues 1/	Volume 2/	Revenues	Volume
	(in thousands)			
1927	$ 62,029	35,646	$140,345	215,816
1929	94,421	49,313	154,435	234,050
1934	75,232	37,459	94,653	155,215
1939	102,896	59,218	98,091	189,055
1944	346,884	175,793	158,032	232,712
1949	439,371	225,806	151,740	185,673

1/ Gross revenues (before uncollectibles) from telephone message tolls in which the Long Lines Department of the A.T.& T. Co. has participated. Does not include toll message revenue from calls handled without Long Lines participation or from private line telephone.

2/ Number of telephone messages in which the Long Lines Department of A.T.& T. has participated. Does not include toll messages handled without Long Lines participation or from private line telephone.

Attachment III-G, derived from Attachments III-H and III-I, shows the average revenue per interstate toll telephone message and per telegraph message.

Rates.--The full-rate telegram, which is the major source of Western Union's transmission revenues and which is the principal medium for the business or commercial messages constituting about 75% of the company's message volume, is carried at rates which, in a typical example, compare thus with other means of rapid communications:

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Charges between Washington and Chicago
(Federal excise tax excluded)

Ten-word full-rate telegram.	$ .75
Three-minute TWX telegraph call.	.95
Three-minute nighttime and Sunday station-to-station telephone call. . .	1.00
Three-minute daytime station-to-station telephone call	1.40
Three-minute nighttime person-to-person telephone call.	1.55
Three-minute daytime person-to-person telephone call.	1.95

Western Union's present rates incorporate increases which were granted by the Federal Communications Commission in 1946 and 1947 because the company was then operating at a deficit estimated at $12 million for 1946. The Commission's action included:

a) An initial flat over-all increase of 10% in domestic interstate message rates; Western Union estimated that this increase, coupled to other adjustments, would produce $18.5 million additional annual revenues.

b) Elimination of certain low "exceptional" or "special" rates, which would produce an estimated additional $3.7 million annual revenue.

c) A flat over-all increase of 20% in 1947, replacing the 1946 increase of 10% in the domestic interstate message rate. It was estimated that this increase would produce

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an additional $8.5 million annually.

d) Elimination of a 20% preferential rate on certain Government messages, which would produce an estimated additional $692,000 per annum.

What influence these rate adjustments may have had on the volume of transmission business cannot be precisely measured; some effects are suggested in Attachments III-B, III-C, III-D, and III-K. It appeared likely that expansion of leased circuits was accelerated. Thus the total number of Government messages, for example, dropped progressively from almost 5.5 million in 1946 to less than 2.5 million in 1949, and the mileage of lines leased from Western Union by the armed forces rose from the war peak of 1,800 miles in 1944 to 78,000 miles in the fall of 1950. The leased circuit revenues of the company afford another indication; these rose from $3.6 million in 1946 to more than $7.5 million in 1949. Private line teletypewriter revenues of the Bell System, which rose from $18.5 million in 1946 to $25.5 million in 1949, and its TWX revenues, which went from $12.9 million in 1946 to almost $18 million in 1949, may also have benefited by diversion of telegram messages.

Excise Taxes.--Early in the second World War, excise taxes were increased to 25% on interstate telegrams and on telephone toll conversations costing over 24 cents. Long-distance telephone communication has continued to increase, the tax apparently being taken as a matter of course. Western Union, averaging estimates, found that

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"it is indicated that an increase in revenues of about $10 million might be expected from the elimination of the tax," although "there is no formula by which a precise determination can be made as to the effect of the elimination of this tax upon the volume of domestic telegraph traffic."

Air Mail.--Air mail has experienced a long steady increase in revenues. This growth may have affected Western Union night letter revenues. Attachment III-B shows that night letter (over night message) revenues stood at almost $39 million in 1926, dropped to a little over $19 million in 1933, climbed to over $35.5 million during the war peak in 1945, and since have fallen to $26.5 million in 1949. Total air-mail subsidy or deficit payments to airlines for 1950 have been estimated at $125 million.

Influences on Expenses.--By far the largest share of the telegraph industry's gross income dollar has gone to payments to and for employees. The trend has been upward. The wage portion of the income dollar fluctuated between the narrow limits of 54 cents and 60 cents from 1926 through 1944. From 1944 to 1946 it rose from 60 cents to over 72 cents of the income dollar. For 1947, however, it fell back to 64 cents and for 1948 and 1949 leveled off to about 68 cents.

During the same period 1926 to 1949, total Western Union and Postal landline employees declined from 76,000 in 1926 to 57,000 in 1938, rose again to 65,000 in 1941, and receded to 41,500 in 1949.

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Western Union reports that the average weekly earnings of landline local field employees, excluding messengers, rose from $37.99 in 1945 to $62.78 in 1949. Related data from the Department of Commerce show the following:

	Telephone		Telegraph	
	May 1949	April 1950	May 1949	April 1950
Average weekly hours per worker	38.6	38.7	45.2	44.6
Average weekly earnings	$51.84	$53.44	$63.69	$64.13
Average hourly earnings	$ 1.343	$ 1.381	$ 1.409	$ 1.438

Note: The normal weekday average hourly earnings for both services are essentially the same, if the overtime rate is eliminated from these data.

The National War Labor Board on December 29, 1945, granted Western Union employees wage increases amounting to $31 million in retroactive pay and $25 million in recurring annual wages. In its decision, the Labor Board pointed out that the telegraph industry was a low-paying industry with an inequitable wage structure, that no general wage increases had been made by Western Union since those ordered by the NWLB in 1943, and that over one-third of the adult employees were receiving less than 55 cents per hour. One reason for the fact that no increases were made between 1943 and this NWLB award was that the National Labor Relations Board for about a year had been holding hearings on representation of Western Union employees.

The sharp increase in wage rates no doubt was the main stimulus for the introduction of labor-saving devices in the telegraph service.

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One example is automatic reperforator switching, which contributed largely to making possible the reduction in the number of employees in the postwar period from 57,500 in 1946 to 41,500 in 1949.

Reduction of Service.--Closing and reduction of telegraph offices and agencies of Western Union have been a knotty problem to both Western Union and the Federal Communications Commission since the merger legislation of 1943.

When the Communications Act was amended to permit merger, Section 214 was also amended to read as follows:

> "No carrier shall discontinue, reduce, or impair service to a community, or part of a community, unless and until there shall first have been obtained from the Commission a certificate that neither the present nor future public convenience and necessity will be adversely affected thereby; except that the Commission may, upon appropriate request being made, authorize temporary or emergency discontinuance, reduction, or impairment of service, or partial discontinuance, reduction, or impairment of service, without regard to the provisions of this section."

Additionally, Section 214(a), which authorizes the Commission, after hearing, to require a carrier to extend its lines and to provide itself with adequate facilities for performing its services as a common carrier, was amended to give the Commission specific authority to require a carrier "to establish a public office" and to provide itself with adequate facilities "for the expeditious and efficient performance of its service as a common carrier."

Studies made by Western Union indicate that company-operated offices and tributary agency offices at which the message revenues

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average less than $1,500 a month are operated at a deficit. As of January 1950, there were 1,300 such offices. From the test study, Western Union estimated that these offices incur an annual operating deficit estimated at over $3.25 million.

The minuteness of the revenues obtained by a large proportion of the telegraph offices Western Union operates can be seen from Attachment III-L. In addition to the 13,000 offices represented therein, Western Union operates an additional 12,000 agency or commission offices not included in these data.

Attachment III-L reveals that for the classes shown, .85% of Western Union's offices (118 communities in number with revenues over $10,000 per month) produce over 71% of its public message revenues. It also shows that 5.25% of the company's offices (727 communities in number with revenues between $1,000 and $9,999 per month) produce 20.79% of its public message revenues. The remaining 93.9% of the offices (12,997 in number) produce only 7.57% of the public message revenue, and 2,045 joint railroad offices (Class 4) reported no public message revenue for January 1950.

The President of Western Union in his Report of Annual Meeting of Stockholders, April 12, 1950, stated: "...While recognizing the necessity for reasonable governmental regulation of public service companies, the fact remains that, under present governmental and public service policies, the company is required to maintain hundreds of unprofitable offices."

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On its own motion the Federal Communications Commission adopted an order on December 30, 1946, providing for an investigation of and public hearing on the over-all plans of Western Union, with respect to the discontinuance, reduction, and impairment of service.

As a result of this investigation, the Federal Communications Commission established a figure of 46 sent and received messages a day as a general guide in determining whether the Commission will authorize conversion of a company-operated office to a teleprinter agency office.

At the hearings in this investigation, Western Union representatives gave testimony and submitted numerous exhibits with respect to company policy, standards, and plans relating to discontinuance, reduction, and impairment of service.

The company's basic policy, expressed at a previous hearing, was reiterated as follows:

> "...It was our (Western Union) policy to serve, as far as we could, within our means, as many people in the United States as possible; that we must operate as efficiently as we can, first, in the public interest, so that the telegraph users are not asked to bear unnecessary cost; secondly, in the interests of the employees; and thirdly, in the interests of the stockholders."

Western Union representatives testified that three principal factors made it necessary to reappraise the existing (1947) telegraph coverages:

> "(1) The need for normal postwar contraction of facilities following expansion made necessary by increased use of telegraph during the war;

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"(2) The desirability of changes in the facilities for accepting and delivering telegraph traffic growing out of technological improvements;

"(3) The need of economy and greater efficiency of operation arising from deficit operations."

The company also told the FCC that "it is not possible to follow a mathematical formula in selecting offices for consolidation. The requirements of the public for telegraph service, volume of traffic, revenue, operating expense, distance from the nearest office, all vary so widely that each consolidation must be considered on its own merits."

Conversion from company-operated offices to agency operation is not "usually considered by the Company unless the load and revenue fit both of two standards." These are: (1) that the average revenue (collections made from all incoming and outgoing messages) at the particular office does not exceed approximately $750 per month; and (2) that the ratio of local operating expense to revenue is 50% or more.

The standards used for determining at which offices hours should be reduced are contained in FCC Rules and Regulations for informal requests for reduction authority. For other situations, formal application is submitted to the Commission with a detailed showing of need so that each case may be judged on its own merits.

With respect to closures and reduction of service, the Federal Communications Commission concluded that no general policy could be formulated to govern its consideration of such action.

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In addition to the closing of a large number of duplicate offices resulting from the merger of Postal with Western Union, curtailments since 1947 have been appreciable. During 1947, 1948, 1949, and the first six months of 1950, Western Union reports, the FCC authorized a total of 2,324 branch office consolidations, conversions, and reductions in office hours, from which annual savings are estimated to be over $3.1 million.

Interest Charges.--Western Union in recent years has been reducing and adjusting its debt structure in order to save on interest payments. In 1942 the company paid out more than $3.9 million in interest (chiefly on funded debt). By 1949 these charges had been reduced to a little over $3.2 million, and in 1949 they were $3.1 million.

Further actions along this line were taken in 1950 by liquidation of the company's outstanding $7.8 million of 4.5% funding and real estate bonds, prepayment of installments on remaining obligations to the Reconstruction Finance Corporation, and calling for redemption of $15.3 million of 5% bonds due December 1, 1951. The latter call was made possible by a $12 million loan from a group of New York banks at 3.5% interest.

The Current Status of Western Union

The encouragement of competition in the telegraph field was embodied in the Communications Act of 1934 as a matter of policy. In the next year, however, the Federal Communications Commission evidenced

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its doubt of the wisdom of that policy by recommending enactment of legislation empowering it to authorize and approve consolidations of telegraph companies. This recommendation was not acted upon. But as the condition of the telegraph companies worsened, the idea of consolidation was revived in 1939. The Senate in June of that year authorized an investigation of the telegraph industry by a subcommittee of the Interstate Commerce Committee. No legislation resulted. In 1943, however, Congress amended the Communications Act to permit merger of domestic telegraph companies and to permit Western Union to buy the telephone system's TWX and private line telegraph services. Merger of the Postal Telegraph Company with Western Union followed. The idea of regulated monopoly rather than competition as a means of strength came to the fore.

Concern for the most effective use of the opportunities offered by merger then became the keynote. Reporting its decision of September 27, 1943, authorizing the Postal-Western Union consolidation, the Federal Communications Commission gave expression to it thus:

> "We have found that merger may be expected to place the domestic telegraph industry on a sounder financial basis than heretofore, and to furnish opportunities for the elimination of obstacles to improved telegraph service at reasonable cost to the public; but we cannot pass over the obvious failure of the management of the proposed merged company to address itself to any specific plans for meeting the demands of users for a record communications service having speed and price standards to which the public is entitled and which will effectively meet the competition of the telephone and the airmail. Attainment of these service objectives, and a generally sound condition, will require radical modifications in Western Union's managerial and fiscal policies and practices, and in its

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facilities and operating practices.

"The Commission is seriously concerned with the failure of the management to direct its plans and aims to such service objectives. In the interests of providing a completely adequate telegraph service in keeping with the technical accomplishments and public requirements of the present and of the future, vigilant regulatory action will be necessary. The Commission will expect that within 1 year from the effective date of the merger, the merged company will have developed completely and submitted to the Commission, a comprehensive plan for converting, within the shortest possible time, its existing facilities into a modern, efficient, and Nationwide communications system capable of effectively competing with other communications services. A continued disposition to ignore such service objectives will call for such action on the part of the Commission as may be needful and appropriate to assure to the public the rapid, efficient, and Nationwide record communication service with adequate facilities at reasonable charges which it is the stated duty of the Commission, under the Communications Act, to make available.

"The future changes in facilities and services available to the public require special attention. In order to avoid any future misunderstanding upon this matter, which is vitally connected with the maintenance of proper service in the domestic telegraph industry, we deem it important to state before concluding, that we will not sanction any ill-considered elimination of facilities or services whether or not they are a result of merger. We will expect that abandonment of facilities, closure of offices, reductions, impairments, or discontinuances of service will be carried out only pursuant to considered rational plans in which factors of public need and convenience will be controlling."

In response to the Commission's request the merged company submitted on October 7, 1944, a "Plan for the Improvement of Telegraph Service." In general terms the plan mentioned the terminal handling problem, transmission of messages between telegraph offices, leased telegraph systems, training program, carrier and reperforator switching program, telefax (facsimile), telemeter, public information, rates,

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research, and railroad contracts. After the war, implementation of the plan was begun and was pressed to virtual completion by the end of 1950, some three years in advance of the original target date. During the postwar years, however, financial problems continued to plague the company and the Commission.

On petition of Western Union in March 1946, the Commission granted a flat over-all increase of 10% in domestic interstate rates but denied the requested elimination of the 20% differential on Government messages. Summing up the case in its annual report, the Commission stated:

> "It found that Western Union was currently operating at a deficit and anticipated a loss of about $12,000,000 in 1946 if its rates were not raised. The Commission concluded that Western Union would need substantially more revenue than it requested 'if it is to continue in operation as a solvent enterprise and provide satisfactory service on a comprehensive Nation-wide basis.' It pointed out, in particular, that Western Union was faced with increasing competition from telephone and teletypewriter exchange services and airmail services, besides being affected by increased wage costs and reductions in international telegraph rates. The Commission is not satisfied that the modernization program is the answer to Western Union's problems. However, in view of prevailing economic conditions and Western Union's dire need for additional revenue, the Commission granted the rate increase for 1 year pending developments."

In granting the increase, the Commission pointed out that such a temporary expedient did not meet the basic difficulty, emphasized the need of a comprehensive investigation into all phases of the company's operations, and sharply criticized the lack of comprehensive and dependable data in the company's petition for the increase. In June the Commission issued an order calling for the investigation, but noted that

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such an inquiry was beyond the limitations of Commission funds and personnel and would necessitate a request to Congress for additional funds.

Before that request could be made, two further actions were taken from which betterment of Western Union's financial situation was expected. Elimination of "exceptional" or "special" city-to-city and city-to-state rates as discriminatory was ordered in October. Since these rates were lower than Western Union's standard rates, it was estimated that their elimination would produce additional revenue from interstate service of $3.7 million. In December the Commission's earlier view that the March rate increase of 10% was an expedient only was substantiated as Western Union petitioned for a further advance in interstate message rates. After public hearings, the Commission on December 27 replaced the March increase with a flat 20% increase with no time limitation. The effect of this substitution was to increase current rates by 9.1%, as against the 15% desired by Western Union. This rate revision action was estimated to produce $8.5 million additional annual interstate revenues. In its report on this case, the Commission concluded, in part, as follows:

> "Western Union faces a real emergency and the sound course for it to follow in the immediate future is not clear. There is no question, however, about the urgency of Western Union's need for additional revenues. We are firmly in agreement with the testimony of Western Union's president that rate increases are not the ultimate answer to the company's situation. At the present time, however, it appears that some rate increase may offer immediate revenue relief to the company. The availability of a Reconstruction

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Finance Corporation loan was characterized by Western Union's treasurer as 'an anchor to windward, which may be of some help in the immediate situation.' Further general rate increases by Western Union will, of course, worsen its position in relation to the competitive means of communication provided by the telephone companies and the airmail, and may fall short of meeting the company's revenue needs."

Seeking an appropriation of $375,000 to conduct the investigation proposed in its June 1946 order, the Commission in testimony before the House Interstate Commerce Committee on February 25, 1947, expressed doubt "whether the modernization program proposed by Western Union, or any program which can be devised can save Western Union and, if so, whether it can be put in operation in time;" stressed the need for determination of national policy; and explained that, broadly speaking,

"...five alternative policy solutions are apparent. If a comprehensive record communications system is not a necessary part of our national economy, then nature may be permitted to take its course with respect to the disposition of Western Union's facilities. If such a system <u>is</u> necessary, but need not be independent, then consideration may be given to the possibilities that the telegraph system may be consolidated with either the telephone industry or the post office. If it is determined that an <u>independent</u>, record communications system is necessary, then the whole issue resolves itself into the means by which this is to be accomplished and the issue of subsidy is involved.

"A fifth possibility would permit Western Union to concentrate its business only between cities with large volumes of traffic--to skim the cream of traffic--abandoning all other communities, but this would be far from the 'nationwide... communication service with adequate facilities' enjoined by the Communications Act."

The requested appropriation was not granted. During the period

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since the hearings, the 80th (1947-1948) and the 81st (1949-1950) Congresses made studies of the communications problems of the country, including the domestic telegraph situation, but neither enacted legislation pertinent here. The modernization program of Western Union was expedited, and the company's management took a more aggressive leadership. Rounding out the modernization effort a program was announced by the company in 1949 including:

(1) Installation and operation of new high-speed message centers in Detroit, Los Angeles, and New Orleans.

(2) Installation of hundreds of desk-fax (facsimile) machines in customers' offices in eight major cities.

(3) Installation and expansion of private telegraph networks for large industrial users.

(4) Continued operation (made possible through legislation exempting them from the wage and hour provisions of the Fair Labor Standards Act) of 12,500 telegraph agencies.

(5) Consolidation of major operating departments of the company for greater operating efficiency and economy, and the establishment of a separate sales and advertising division.

(6) Further reduction of the company's debt.

The company went into broader matters in a special report issued in October 1949, proposing the adoption of a coordinated national communications policy and advocating substantial changes in the telecommunications industry. The report recommended:

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(1) Repeal of the 25% Federal excise tax.

(2) Purchase by Western Union of the teletypewriter exchange service (TWX) and telegraph services of the telephone company.

(3) Legislative permission for purchase by Western Union of the cable and radio facilities of American companies operating in the international field.

(4) Provision by Western Union of an integrated system of domestic communications geared to military requirements and available in normal times to the public and the Government.

(5) Long-term Government financing, as may be necessary, to achieve the above objectives.

Negotiations were carried on in 1943-1945 between Western Union and the A.T.& T. looking toward the acquisition of TWX and allied services by Western Union under the permissive legislation of 1943, but without result. Resumed late in 1949, they had not been concluded at the time of this report. On July 1, 1948, Western Union, the A.T.& T., and certain companies of the Bell System had entered a contractual agreement in which Western Union would sell and transfer to the Bell System its public telephone business and property for $2.4 million cash and the public message telegram business of the Pacific Telephone and Telegraph Company and a subsidiary. This agreement was subject to approval of the FCC, and of state or other regulatory agencies.

Accordingly, a joint application was filed with the FCC on

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February 1, 1949, for certificates under Sections 214 and 221(a) of the Communications Act of 1934 as amended. In late 1949 and early 1950, an FCC examiner held hearings, during which two state commissioners sat as representatives of the National Association of Railroad and Utilities Commissioners. These hearings resulted in an order for the issuance of a certificate, which in effect approved the application.

However, on September 8, 1950, the Chief of the Common Carrier Bureau of the FCC excepted to the initial decision on the grounds that the acquisition of the telephone facilities of Western Union by the Bell System companies under the proposed conditions would deprive Western Union subscribers of "personalized service and of the advantages of an auxiliary or standby service," and would require them "to pay higher charges for their message toll telephone service." As for the discontinuance of public message telegram service by the Pacific companies, the Bureau excepted to the decision on the grounds that the service proposed to be provided by Western Union would generally be less stable in character than the service rendered by Pacific, that speed of service on a large percentage of traffic would be adversely affected, and that "the proposed transaction will result in the elimination of all competition between Western Union and the Pacific Companies in the offering of message telegram service." The Bureau submitted that an order should be entered denying the joint application.

Also on September 8, 1950, on behalf of the Attorney General of

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the United States, exceptions were submitted to the Examiner's findings, conclusions, and initial decision.

The applicants have filed a reply brief to the exceptions, but the FCC decision had not been rendered at the time of this report.

April 1950 saw a reversal of the decline in Western Union's operating revenues. The modernization program, rigid economies, improved operating methods, and greater sales efforts are regarded by the management as the company actions which contributed to the change, and rate adjustments, the Korean situation, and increased general business activity as the salient non-company factors. Commenting on the upturn, the Federal Communications Commission in a report dated August 31, 1950, to Senator McFarland of the Committee on Interstate and Foreign Commerce said in part:

> "The Western Union Telegraph Company has reported a net income of $2,687,000 before Federal income taxes for the first six months of 1950. Assuming that revenues and expenses will continue at the March through June level (Western Union reported net losses in January and February), Western Union may realize a net income of $7,000,000 for 1950 as compared with an assumed loss of $5,000,000 in the above-mentioned report. The principal reason for the difference in assumptions is the substantial savings that the company has been able to effect, principally through force reductions as a result of the company's mechanization and economy programs. Landline expenses in the first six months of 1950 were $7,578,000 less than the same period of 1949 of which $6,312,000 represented savings in labor expenses.
>
> "Assuming that Western Union will be able to maintain its earnings in 1951 at the level assumed for 1950, and after adjusting for the sale of buildings subsequent to the date of our earlier letter and further assuming that the once suggested cut in Federal excise taxes on telegrams will not materialize, Western Union may be expected to have cash

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balances on December 31, 1950 and 1951 of $34.4 million and $22.6 million respectively. If the application now pending before the Commission for authority to sell the former Postal Telegraph Company's toll telephone system to the Bell System companies should be approved by the Commission, the cash balance for 1951 would be increased by $2.4 million.

"Western Union's improved financial situation bolsters the Commission's conclusions...that the Commission 'would prefer to give Western Union a further opportunity to extricate itself from its financial difficulties, rather than to propose the enactment of drastic legislation at this time which might result in, or lead to, Government ownership or operation of Western Union, or which might result in one huge monopoly of practically the entire communications industry of the United States.'"

Summary

The over-all national demand for telegraph facilities and services, as well as for telephone and air mail services, has been growing almost steadily since 1926. During that period, however, the relative demand for telegram service has lessened. This shift in the character of the demand for telegraph service has seriously threatened the continued existence of the Western Union system as a private enterprise. Remedial measures applied by the company and by regulatory authority in recent years, following a longer period of Government concern over the prospects of the industry, resulted in a return to profitable operation in April 1950. The long-range prospect is indeterminate.

Domestic Telecommunication Systems of the Federal Government

Federal Government agencies during the year 1949 operated nationwide leased wire teletype networks, the size of which is indicated by

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the following estimated figures:

Miles of leased teletype wire, including weather services.	325,931
Miles of leased teletype wire, excluding weather services.	167,824
Cost of leased wire, including weather services.	$ 8,053,877
Cost of leased wire, excluding weather services.	$ 3,501,796
Originated words transmitted, including weather services. . .	16,347,342,986
Originated words transmitted, excluding weather services. . .	5,835,071,689

A more detailed presentation of these estimated figures appears in Attachment III-M.

No attempt has been made in this study to include any statistics concerning extensive telephonic communications of the Federal Government agencies, the bulk of attention being devoted to statistics relating to wire record communications, largely teletype. Such commercial message statistics as were available, however, are included.

Domestic radio communications such as aeronautical mobile, military land-mobile, radar, etc., are considered to have no particular significance in this study and therefore have been excluded. No figures embracing costs of operation (other than the costs of leasing facilities and equipment) are shown. The development of such figures was considered to be too great a study to make in the time available. This was because many agencies do not keep adequate cost records.

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from the grand total of leased line words because they embrace special forms of transmission involving special teletype symbols and telephonic wordage.

General Services Administration.--The General Services Administration (GSA) operates a leased wire teletype network totaling 14,392 miles, supplemented by TWX service for Government agencies, for the year 1949.

This service, available to all Government agencies, operates from 8:00 A.M. to 11:00 P.M., E.S.T., Mondays through Fridays, and offers direct message service between 54 major U. S. cities, in addition to the possibility of refile via other media to other U. S. cities, or to foreign countries.

Pickup and delivery are done by telephone (with mail confirmation), messenger, or by local teletype line when and if the message volume warrants. The Administration estimates that, by acting as a clearing house for Government domestic rapid communications, it reduces domestic telegraph costs to the Government 35% to 40%. The cost of this service, exclusive of overhead, is prorated to the users on the basis of the cost of the facilities.

Veterans' Administration.--The Veterans' Administration maintains a leased wire network of 8,658 miles, supplementing the leased facilities of other Government agencies, to connect its offices in every State for the conduct of its business. West of the Mississippi River, it uses a great amount of TWX service.

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Other Federal Government Agencies.--Certain other agencies (listed by footnote in Attachment III-M), while free to use facilities maintained by GSA, also lease teletype wire lines or otherwise contribute to the total figures, as indicated in the Attachment.

The degree of radio transmission involved in the figures presented for "Other Federal Government Agencies" is negligible, being for the most part the result of secondary operation, as in the case of the FCC and Department of Justice, which use radio frequencies for emergency purposes when wire lines fail, or to the few points that normally are not served by wire.

Trends in Federal Government Use of Communications

The policy of using military systems for the transmission of record communications of the Federal Government agencies is one of long standing. The volume of Government messages, both military and non-military, gradually increased, and the military systems were expanded. Domestic radio circuits within the continental limits were introduced around the year 1921. These, however, were not comprehensive enough to furnish service to all points in the United States, and the Federal agencies, including the military, relied in great measure upon the domestic commercial companies for service.

There was a gradual transition, starting in 1930, in which wire circuits leased from commercial companies replaced radio circuits for the transmission of Government domestic messages. This transition was the natural outcome of the knowledge that radio frequencies could be

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employed to better advantage in overseas communications. At present the use of radio frequencies for domestic communication has been reduced to almost nothing.

Commercial landline rates for Government messages were fixed in 1886, under the authority of the Post Roads Act, at 40% of the existing commercial rates. From that time on, the commercial operating companies made continued efforts to have Government rates equalized. Finally, by a gradual process which started in 1935, Government message rates and public rates were equalized in 1947.

As Government rates rose and volume increased, Federal agencies turned more and more to the use of leased wire lines. The saving from leased line operation roughly approximates the increased cost that would have resulted from the equalized rates, given the same volume.

The use of leased wire lines by Federal Government agencies became so extensive that the Public Buildings Administration (later transferred to the General Services Administration) was authorized in 1946 to coordinate leased line operations and to provide means of raising the efficiency of such operations.

At the present time the GSA has made some progress toward the more efficient use of lines leased by the Federal Government.

A strong influence which has accelerated the leasing of teletype wires by Federal Government agencies is their cost advantage over message service, given sufficient volume of messages between specific

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points. The two main sources of leased teletype wires are the A.T.& T. and the Western Union Telegraph Company.

Legislation.--Public Law #413, 79th Congress, approved June 14, 1946, gave the Public Buildings Administration authority (with certain restrictions) to operate public utility services, including telecommunications, serving one or more Government agencies.

Public Law #152, 81st Congress, approved June 30, 1949, transferred this authority to the General Services Administration.

In addition, this later law gives broad powers to the GSA in the operation and management of public utility services for the convenience and economy of the Government. GSA claims power under this law to eliminate or consolidate leases of communication circuits operated by various Federal Government agencies.

Interrelationships.--Interrelationships between Federal Government systems are not particularly complicated and continue to incline toward a "community" system of operation wherein messages originated by one agency may, by arrangement, be transmitted over the facilities controlled by one of the others.

Relationships between Government systems and domestic commercial systems are more complicated. All of the Federal Government networks depend upon the commercial companies for wires and maintenance, and, in some cases, for equipment.

Generally, all of the Federal agencies that have communications operations rely upon the commercial domestic organizations to round

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Western Union reports the average cost, including all rate categories, to be about 5 cents per word. At this average cost per word, the percentage of saving, adjusted from the GSA estimate, would be 32.1 per cent.

Summarized estimates for the year 1949, using the Western Union average cost figure of 5 cents per word and the savings percentage adjusted from the GSA estimate, follow:

Federal Government Leased Wire Operations, Excluding Weather Data

Rental of facilities.	$ 3,501,796
Total words transmitted	5,835,071,689
Cost at 5 cents per word.	$ 291,753,584
Saving by use of leased lines indicated by 32.1% saving adjusted from GSA estimate.	$ 93,652,900
Resultant estimated cost of Federal Government operation of leased facilities	$ 198,100,684

We have not attempted to determine whether it is necessary for the Federal Government to transmit almost 6 billion words yearly for its domestic business.

Other Domestic Telecommunications Systems

There are a great number of rapid telecommunications systems within the United States other than those which have been described above. These systems include networks interconnecting broadcast and television stations; airline and railroad telecommunications systems;

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miles of telephone wire, and 215,000 miles of pole line. This telecommunication network, which extends throughout the nation following the railroad lines, is used for train dispatching, matters relating to passengers and freight, and various other forms of company business. Employees chargeable to the railroad communication service totaled 39,121 and their yearly compensation was $145,248,935.

Domestic Wire Networks of the Press Associations

The Associated Press, United Press, International News Service, and Transradio News Service operate large national teletype networks for the distribution of news. The collective cost of these leased circuits for the year 1949 was $450,000.

Domestic Systems of Large Corporations

A number of the large corporations in the United States, especially those which have nationwide interests and branch offices, maintain their own domestic leased wire teletype systems. Corporations such as United States Steel, General Motors, Ford Motor Company, and General Electric, and many smaller ones, have volumes of domestic telecommunications that enable them to lease and operate wire systems on a national basis and to effect appreciable savings in costs by comparison with telephone toll rates and domestic telegraph message rates. It is estimated that from 20% to 40% can be saved by private line teletype operation, depending upon volume, under current Western Union message rates.

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On the Great Lakes and Rivers

On the Great Lakes, the Mississippi River, and connecting inland waterways, communication is carried on between ships and between ship and shore by radiotelephone. Certain shore stations have a "public coastal service" which will permit calls from ships to be completed through landline connections. Operational messages are also relayed or forwarded as requested by the company or captain. Charges for this service are regulated by law, and established long distance rates apply on shore connections. Revenues as reported by the Class A and B telephone carriers in 1948 for such services were $575,000 on a basis of 400,000 calls.

Land Mobile Telecommunication Services

These services provide communication between mobile stations and base stations which tie in with public landline telephone facilities. The telephone companies in many locations operate the base stations. In general, trucking firms and automotive emergency road services make extensive use of such systems. A.T.& T. revenues from this service totaled $1.6 million in 1948 on 1.4 million calls handled.

Taxicabs are making extensive use on a nationwide basis of very high frequency radiotelephone for dispatching. In 1949 radio was used in nearly 3,000 separate taxicab communication systems covering about 54,000 mobile units.

In Hawaii

The 6 islands of the Territory of Hawaii are provided with telephone

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Several petitions for increases in rates have been filed, and the company has filed a motion for temporary relief to help it continue to give satisfactory service, and to permit small additions to plant equipment pending the approval of a new rate schedule.

Present plant investment approximates $9 million, with other current assets of about $1 million. Total operating revenues in 1949 were $2.5 million with net earnings of $254,000 after tax deductions but before interest charges of $196,000. Thirty-five thousand telephones were in service and the company had 80,000 miles of wire, 90% of which was in cable. Compensation to 675 employees was $965,000 in 1948.

In Alaska

Alaska, with an estimated population in 1947 of 92,000, is provided with telecommunication facilities by the Alaska Communications System (ACS), a branch of the U. S. Army Signal Corps. Since its authorization by act of Congress in 1900, the system has operated the only longline communication channels within the Territory and between the Territory and the United States. The ACS now has 32 telecommunication stations serving the Federal and Territorial Government agencies, and the general public, by wire and radio. The latter includes service to and from ships at sea, press services to newspapers, broadcast programs to radio stations, and general commercial messages. Regular telephone service is provided in the larger cities by 14 exchanges with a total of approximately 12,000 telephones in service. In 1948

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the telegraph service provided by ACS to 58 Government agencies had an estimated commercial value of $480,000 and military telegraph messages of $3 million. Telephone service to the agencies approximated $54,000 and that to the military $173,000.

Supplementing the ACS, mainly to serve isolated communities, is a 60-station radiotelephone system maintained by the Alaska Communications Commission, an agency of the Territorial Government. The Alaska Native Service also operates a total of 102 radiotelephone stations, the majority of which are located in Arctic and sub-Arctic regions. The stations are used to conduct the routine business of the service, as well as for emergency purposes.

The Civil Aeronautics Administration maintains an extensive network of 42 radio stations, operated by 625 employees, used primarily for aircraft navigation and for weather information. Routine weather reports from outlying stations are also relayed to a common point for forwarding. The CAA is also the largest Government agency user of Alaska Communications System facilities, receiving services valued at $80,000 in 1948 and $76,000 in 1949.

Recent Trends

The outstanding trend apparent in the development of the domestic systems described in this section is that of relatively rapid and substantial growth. For example, the broadcasting industry served 12 million homes with 618 radio stations in 1930. In 1949 it served 42 million homes with 3,067 radio stations. The aviation industry in

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1930 maintained 170 ground radio stations and 293 aircraft stations. In 1949, 1,572 radio transmitters were licensed to commercial aircraft operating with 1,409 ground radio stations.

The growth of television has increased the estimated tangible investment in stations and sets from a 1948 total of $403 million to more than $3 billion at the end of 1950. In 1947 there were only 12 stations serving 210,000 receivers. In January of 1951 (even though no new television station construction permits were issued after September 1948), a total of 107 stations were serving an estimated 10.6 million receivers. From Omaha east there are 47 interconnected cities having 80 television stations serving 9 million receivers. Of the total stations, New York has 7, with Chicago and Washington 4 each. Sixteen other non-interconnected cities have 27 stations serving 1.6 million receivers. These figures indicate that about 40% of the homes in TV areas now have receivers. During the month of December 1950 alone 704,000 were placed in use. Los Angeles' 7 stations placed that city first in estimated television investment.

The accelerated growth of television has hastened the construction of coaxial cables, bringing the nation's total to 7,600 miles in 1949. This over-all program has been modified somewhat because of planned installation of microwave radio relay systems between various cities.

Conclusions

1. The telephone system of the United States is a financially

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sound, multi-billion dollar industry consisting of the Bell System and 5,000 independent companies. This coordinated system is providing the nation with what is admittedly the best telephone service in the world. It is steadily improving that service by aggressive technological advancement. In view of the healthy condition of the telephone system, we conclude that no changes in Government procedure for insuring adequate service in the national interest are necessary.

2. The telegraph system of the United States has experienced economic difficulties owed in part to the expansion of other means of rapid communication. The recent return of the principal telegraph company to profitable operation, in part because of improved management and modernization of its plant and in part because of greater general business activity, is encouraging. This current improvement in the position of the industry affords an opportunity to develop information needed for sound, long-range planning to avoid future difficulties. We believe that sound management and vigorous technological development can contribute further to the stability of the domestic telegraph system.

3. The effects of the administration of the Communications Act of 1934 relative to reductions of telegraph service through the closing of unprofitable offices or through substitution of agencies need further study. Western Union maintains that the restrictive application of present legal provisions places an undue financial burden upon the company which it can ill afford to bear; representatives of labor contend that too great a degradation of service often has followed the

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substitution of agencies for offices.

4. Rates for the telegraphic services--telegram, TWX, and private leased lines--are given regulatory approval without adequate knowledge of the costs of providing such services. Also, in passing upon long-distance telephone rates, the Federal Communications Commission should inform itself of the probable effect of proposed changes upon the position of the telegraph industry, and upon rates for local telephone service.

5. We have looked carefully into the proposal that our telecommunications industry should be divided clearly into two parts, one dealing exclusively with "record" communications, the other with communications by "voice." Our examination of this question has shown that such a dividing line is very difficult to draw, and we have concluded that the attempt to reorganize our telecommunications system on the basis of such a distinction might result in effects on the system going far beyond the initial intention of any such division. The main bone of contention today is the fact that the telephone company offers a form of record communications--TWX and private-line leases--which competes with message-delivery functions of the telegraph company. We note that Congress in 1943 amended the Communications Act to permit acquisition of this form of service by the telegraph carrier. Thus the companies involved are free to negotiate an agreement to make this change, subject to approval by the FCC. We believe that this matter should be determined by the normal processes of negotiation.

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6. The operation of leased domestic telecommunications networks by the Federal Government for the transmission of Federal Government messages is not, strictly speaking, competitive with the operations of commercial telecommunications companies. In its teletype networks, the Government is taking advantage of volume rates offered by the telecommunications companies in the same manner as can any other customer with large volume requirements. The Government should continue to take full advantage of the most efficient and economical rates and conditions of service which are available to any large user. While it is important that the Government seek the most economical means of handling its own communications, it also is of great importance that it continue its present policy of using privately owned facilities rather than building up a Government-owned competing network.

* * * * *

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BELL SYSTEM SELECTED STATISTICS
AND SOME COMPARATIVE DATA FOR ALL TELEPHONE CARRIERS

Attachment III-A

Dec. 31 1925	Dec. 31 1930	Dec. 31 1935	Dec. 31 1940	Dec. 31 1945	Dec. 31 1949	All Carriers Dec. 31, 1949	% Bell System	
11,909,578	15,187,296	13,573,025	17,483,981	22,445,519	33,388,258	40,709,398*	82	*5/
6,147	6,639	6,896	7,052	7,374	8,224	19,342*	43	*5/
394,529	428,212	407,454	399,838	420,009	483,777			
27,769,000	45,116,000	47,639,000	54,339,000	60,759,000	81,865,000			
12,835,000	23,777,000	26,425,000	30,307,000	33,966,000	44,813,000			
4,339,000	5,231,000	4,562,000	4,660,000	5,034,000	6,411,000			
44,943,000	74,124,000	78,626,000	89,306,000	99,759,000	133,089,000	147,300,000	90.3	
					58,768			
					750			
					23,823			
					25,077			
					48,900			
50,141,000	64,034,000	60,290,000	79,303,000	90,548,000	132,023,000	160,000,000	82.5	
$2,566,809	$4,041,237	$4,187,790	$4,747,674	$5,702,057	$9,432,750	$10,510,000*	87.7	*6/
$ 737,560	$1,077,300	$ 919,116	$1,174,322	$1,930,889	$2,893,273	$ 3,180,000*	90.8	*6/
335,858	391,746	268,754	323,701	474,527	593,869	--		
362,179	567,694	657,465	630,902	683,897	829,498	--		
$ 58,113	$ 84,732	$ 94,507	$ 184,770	$ 399,917	$ 346,144			

open wire and cable pairs. When carrier is used the maximum capacity of an open wire pair and the maximum capacity of two cable pairs is 12 telephone channels.
rovide 600 telephone channels.
oad band channel miles.
stern Electric Company and Bell Telephone Laboratories.
tem (41,790,000 telephones as of June 30, 1950)
o.

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Western Union and Postal Telegraph (Landline)
Number of Transmission Messages by Class of Message
1926 - 1949

P.C.P.B. #5

(Thousands)

Attachment ~~III~~ III-15

Year	Full Rate	Day Letter	Night Letter and Night Message	Serials	Total Public Messages	Government	Press	Money Orders	Timed Wire	Greetings	Cable and Radio 2/	Other Transmission Messages 3/	Grand Total
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
1926	132,472	17,724	38,784	-	188,980	6,522	17,952	4,077	-	-			217,531
1927	131,153	18,344	37,388	-	186,885	6,681	18,148	4,102	-	-			215,818
1928	135,318	19,900	37,748	-	192,966	7,655	19,678	4,272	-	-			224,571
1929	138,641	22,260	38,851	-	199,752	8,159	21,287	4,852	-	-			234,05[illegible]
1930	123,535	21,897	33,659	-	179,091	8,806	19,417	4,657	-	-			211,97[illegible]
1931	106,797	20,414	27,518	550	155,279	8,993	15,054	4,044	3	-			183,37[illegible]
1932	80,342	16,612	19,921	2,556	119,431	8,728	11,678	3,148	90	-			143,07[illegible]
1933	78,007	18,463	19,208	4,903	120,581	8,916	10,999	2,864	193	-			143,55[illegible]
1934	81,269	19,563	19,875	7,908	128,615	9,763	12,065	3,079	1,693	-			154,21[illegible]
1935	87,578	20,811	20,124	7,774	136,287	7,656	14,749	3,414	2,607	2,117	4,356	5,064	17[illegible]
1936	93,605	22,249	20,019	9,369	145,242	8,078	14,842	3,757	3,474	8,714	4,693	4,766	19[illegible]
1937	92,279	19,590	23,043	9,267	144,179	8,495	14,279	4,207	3,389	15,013	6,403	4,746	20[illegible]
1938	85,190	18,574	19,641	8,550	131,955	8,622	11,788	4,003	2,900	16,360	5,678	4,333	18[illegible]
1939	87,811	18,641	19,661	9,086	135,199	7,648	11,400	3,892	3,109	17,534	6,178	4,095	18[illegible]
1940	93,812	15,631	20,220	8,580	138,243	5,882	11,143	4,072	4,093	18,766	5,804	3,642	19[illegible]
1941	105,690	13,917	22,736	8,608	150,951	5,751	11,288	5,269	6,003	22,329	6,174	3,163	21[illegible]
1942	113,242	11,657	25,126	6,723	156,748	13,040	8,361	8,609	8,603	18,300	5,783	3,704	22[illegible]
1943	118,286	16,883	30,544	5,909	171,622	15,453	7,401	13,359	928 1/	9,654	9,033	4,242	231,6[illegible]
1944	116,926	15,791	33,086	6,531	172,334	12,743	8,484	15,898	-	9,623	9,614	4,016	232,71[illegible]
1945	123,537	15,949	35,578	7,156	182,220	10,593	9,903	15,748	-	11,627	10,698	3,840	24[illegible]
1946	124,945	13,362	32,401	5,924	176,632	5,474	10,104	11,192	-	3,832	9,656	3,814	220,70[illegible]
1947	134,733	12,309	31,405	8,050	186,497	3,107	11,596	8,512	-	-	9,852	4,523	224,00[illegible]
1948	117,748	10,087	29,181	7,967	164,983	2,799	12,254	8,577	-	-	8,897	4,368	201,87[illegible]
1949	108,014	9,281	26,511	7,670	151,476	2,422	11,638	8,308	-	-	7,998	3,831	185,67[illegible]

1/ Timed wire service discontinued in February 1943 by order of the Commission and a new service, Longrams and Serial Longrams, was introduced. The number of Longram messages was included with day letters, serial longrams with serials. Longrams and serial longrams were discontinued in 1946.

2/ Cable and radio messages represents the domestic haul of international traffic handled by Western Union and Postal Telegraph. Data not available 1926-1934

3/ Other transmission messages include Commercial News department, contract (principally railroad) messages and facsimile. Data not available 1926 - 1934

Sources: For the period 1926 to 1934, inclusive, the data are based on responses from The Western Union Telegraph Company (landline system) and the Postal Telegraph Company to Telegraph Division Order No. 12. Data for subsequent years are based on annual reports to the Commission. For the years 1930 - 1936 Postal Telegraph data were reported for the month of January only; annual data were estimated on the basis of the relationship of January transmission revenues to the transmission revenues for the year.

Source: Rt 59[6]

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Attachment ~~2~~ III

Western Union and Postal Telegraph (Landline):
Composition of Transmission Revenues
1927 - 1949
(Thousands of dollars)

Year	Message: Full Rate (1)	Day Letters (2)	Night Letters (3)	Money Order Messages (4)	Government (5)	Press (6)	Serials (7)	Timed Wire (8)	Greeting (9)	Total (10)	Other (11)	Total (12)
1927	$ 83,471	$18,262	$25,000	$ 3,333	$ 806	$3,490	$ -	$ -	$ -	$134,362	$ 5,983	$140,345
1928	85,478	19,848	24,924	3,388	874	3,780	-	-	-	138,292	7,241	145,533
1929	89,437	22,400	26,019	3,765	981	4,005	-	-	-	146,607	7,828	154,435
1930	79,027	21,980	22,476	3,708	1,061	3,789	-	-	-	132,041	7,305	139,346
1931	65,880	20,262	17,570	3,183	1,085	3,164	315	4	-	111,463	6,895	118,358
1932	48,526	16,548	12,750	2,443	1,021	2,484	1,295	156	-	85,223	5,034	90,257
1933	45,781	17,922	12,062	2,169	1,262	2,248	2,370	248	-	84,062	4,963	89,025
1934	46,908	18,885	12,237	2,354	1,607	2,551	3,678	1,693	-	89,913	4,740	94,653
1935	48,291	18,866	12,029	2,485	1,441	2,548	3,912	2,608	596	92,776	4,792	97,568
1936	51,720	20,033	11,907	2,627	1,470	2,694	4,611	3,324	2,563	100,949	4,849	105,798
1937	50,747	19,069	11,010	2,755	1,536	2,630	4,539	3,261	4,501	100,048	6,220	106,268
1938	46,673	16,559	9,139	2,552	1,607	2,245	4,158	2,856	4,708	90,497	5,146	95,643
1939	48,230	16,561	9,066	2,551	1,601	2,208	4,421	3,009	5,004	92,651	5,440	98,091
1940	53,043	14,060	9,205	2,681	2,097	2,251	4,115	3,871	5,347	96,670	5,328	101,998
1941	62,156	12,708	10,459	3,532	3,314	2,256	4,053	5,648	6,451	110,577	4,992	115,569
1942	69,650	11,379	12,221	6,025	8,087	1,771	3,331	8,131	5,630	126,225	4,179	130,404
1943	82,742	16,617	15,138	9,150	10,819	1,423	3,118	813	3,332	143,152	9,876	153,028
1944	85,073	15,746	16,493	11,322	10,298	1,619	3,669	-	3,356	147,576	10,456	158,032
1945	91,422	15,863	17,641	11,059	8,912	1,889	3,938	-	3,861	154,585	11,960	166,545
1946	95,694	14,420	18,188	8,631	4,627	2,421	3,424	-	1,273	148,678	11,564	160,242
1947	115,824	15,100	20,852	7,849	3,202	2,907	5,469	-	-	171,203	12,631	183,834
1948	102,165	12,833	18,839	7,818	3,362	3,171	5,504	-	-	153,692	11,904	165,596
1949	93,713	11,562	16,957	7,651	2,914	3,007	5,296	-	-	141,100	10,640	151,740

Source: Responses of carriers to FCC Order No. 12 and annual reports to FCC.

Source: Rt 59[5]

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Attachment 2 to III-D

Western Union and Postal Telegraph (Landline):
Composition of Nontransmission Revenues
1927 - 1949

(Thousands of dollars)

Year	Leased Circuit (1)	Measured Service (2)	Other Leased Plant (3)	Code Registration (4)	Errand Service (5)	Money Order Charges (6)	Time Service (7)	Other (8)	Total (9)
1927	$2,143	$ -	$ 864	$ -	$1,466	$1,892	$1,359	$ 206	$ 7,930
1928	2,072	-	892	-	1,723	1,956	1,349	225	8,217
1929	2,338	-	814	-	2,058	2,196	1,319	198	8,923
1930	2,324	-	954	-	2,031	2,079	1,285	204	8,877
1931	2,228	-	973	-	1,961	1,779	1,116	282	8,339
1932	2,269	-	963	-	1,934	1,356	854	269	7,645
1933	2,301	-	976	-	2,140	1,235	646	290	7,588
1934	2,194	-	1,018	-	2,598	1,325	528	241	7,904
1935	2,227	-	1,035	-	3,219	1,408	539	266	8,694
1936	2,342	36	1,053	-	4,112	1,520	556	355	9,974
1937	2,426	188	1,082	-	4,550	1,643	595	476	10,960
1938	2,500	456	1,142	-	4,336	1,517	609	610	11,170
1939	2,631	794	1,140	-	4,418	1,510	603	712	11,808
1940	2,615	1,125	1,144	-	4,653	1,558	604	890	12,589
1941	3,524	1,465	1,199	-	5,016	1,953	614	1,179	14,950
1942	4,292	1,843	1,241	-	3,081	3,103	621	1,204	15,385
1943	3,689	2,088	1,415	6	61	5,100	612	954	13,925
1944	3,655	2,275	1,502	5	51	6,306	626	755	15,175
1945	3,572	2,395	1,493	28	55	6,537	653	770	15,503
1946	3,681	2,251	1,599	45	298	5,920	741	759	15,294
1947	4,319	2,154	1,617	59	699	5,394	928	650	15,820
1948	5,696	2,316	1,621	60	1,033	5,406	941	760	17,833
1949	7,528	2,405	1,593	64	1,234	5,122	938	769	19,653

Source: Responses of carriers to FCC Order No. 12 and annual reports to FCC.

Source: Rt 59[3]

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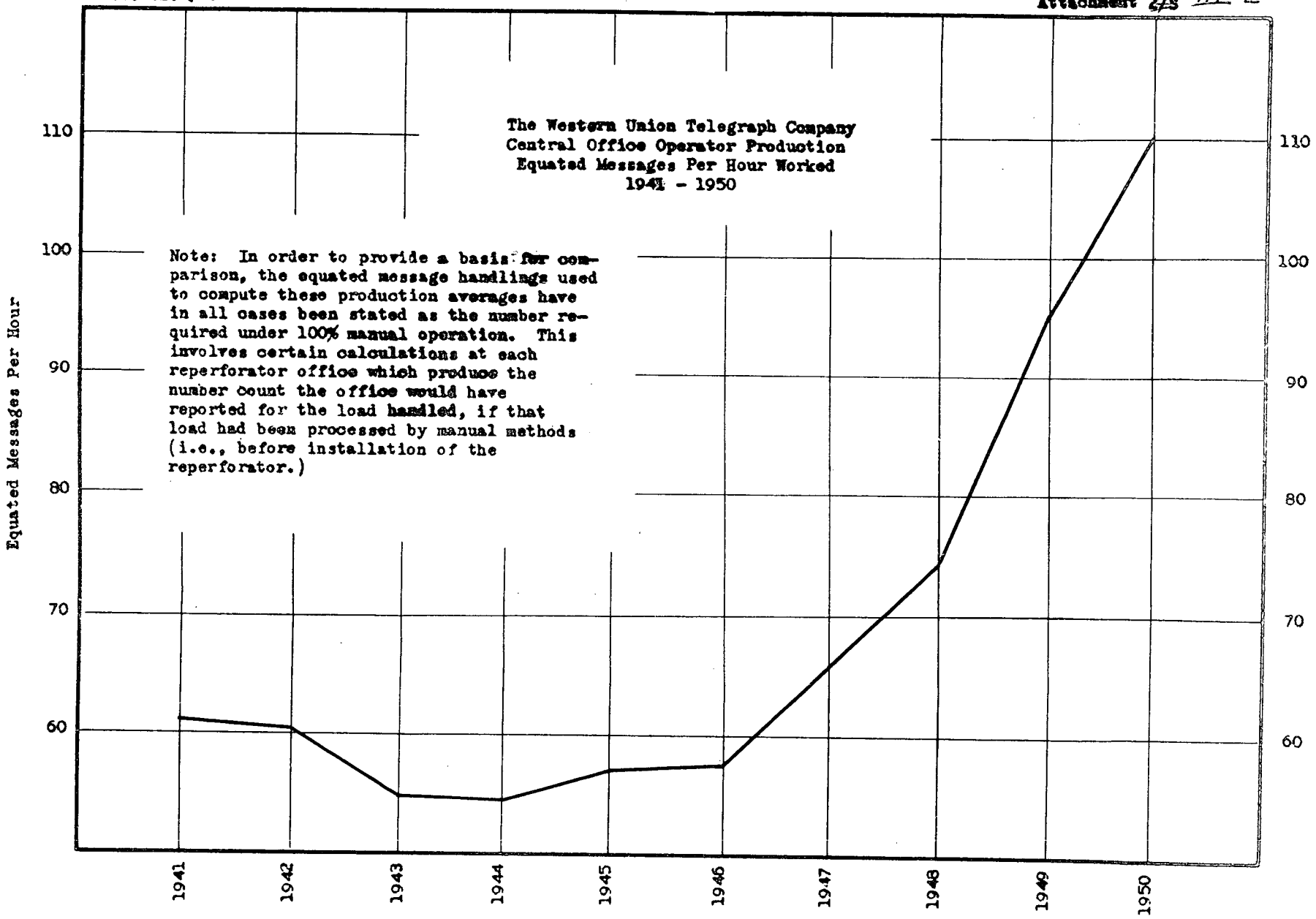
P.C.P.B. # 5

Attachment 2/5 III-E



Source: Rt51

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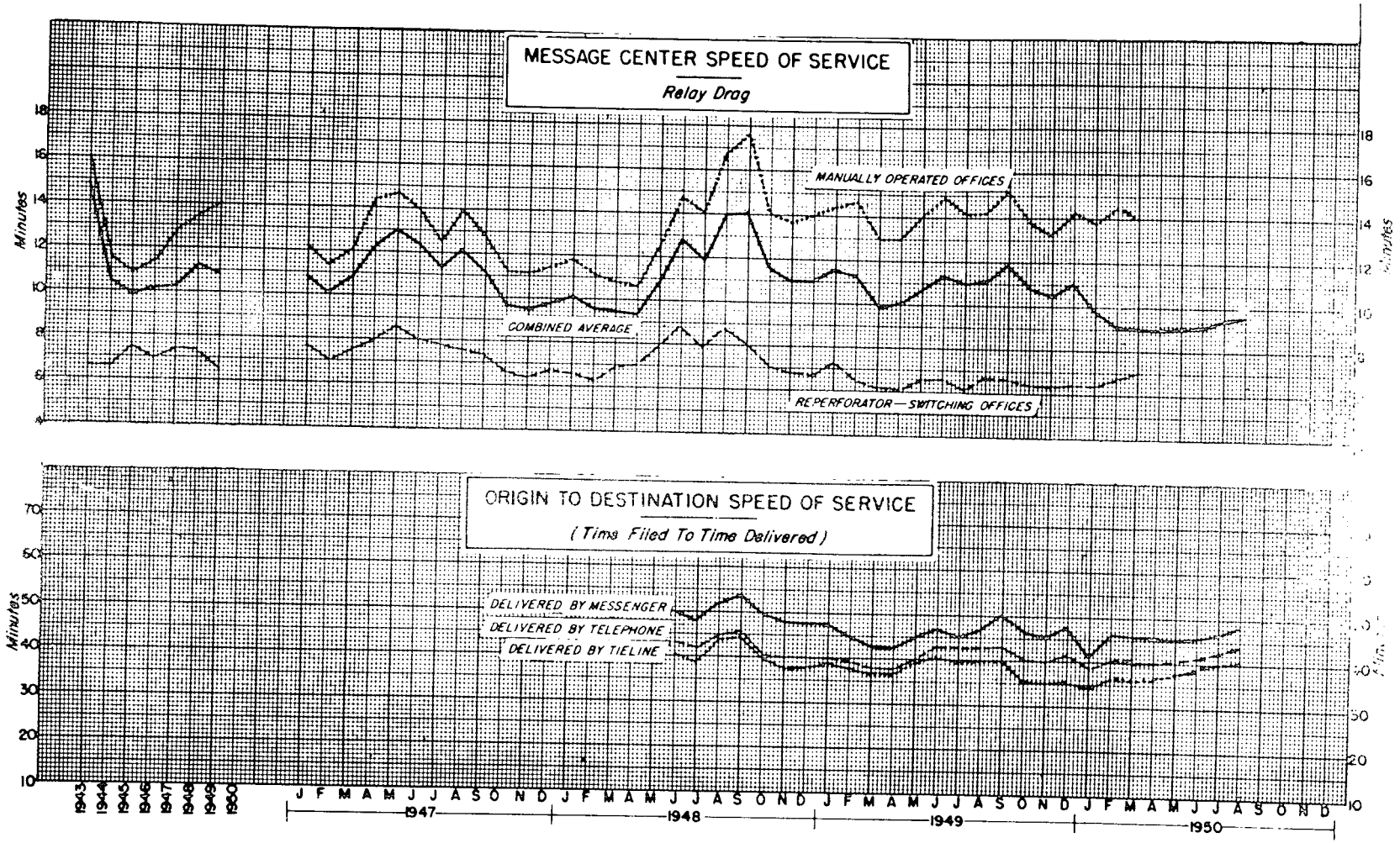
P.C.P.B. # 5

Attachment ~~2/6~~ III -F

SPEED OF TELEGRAPH SERVICE

Source: W.U. Response to FCC



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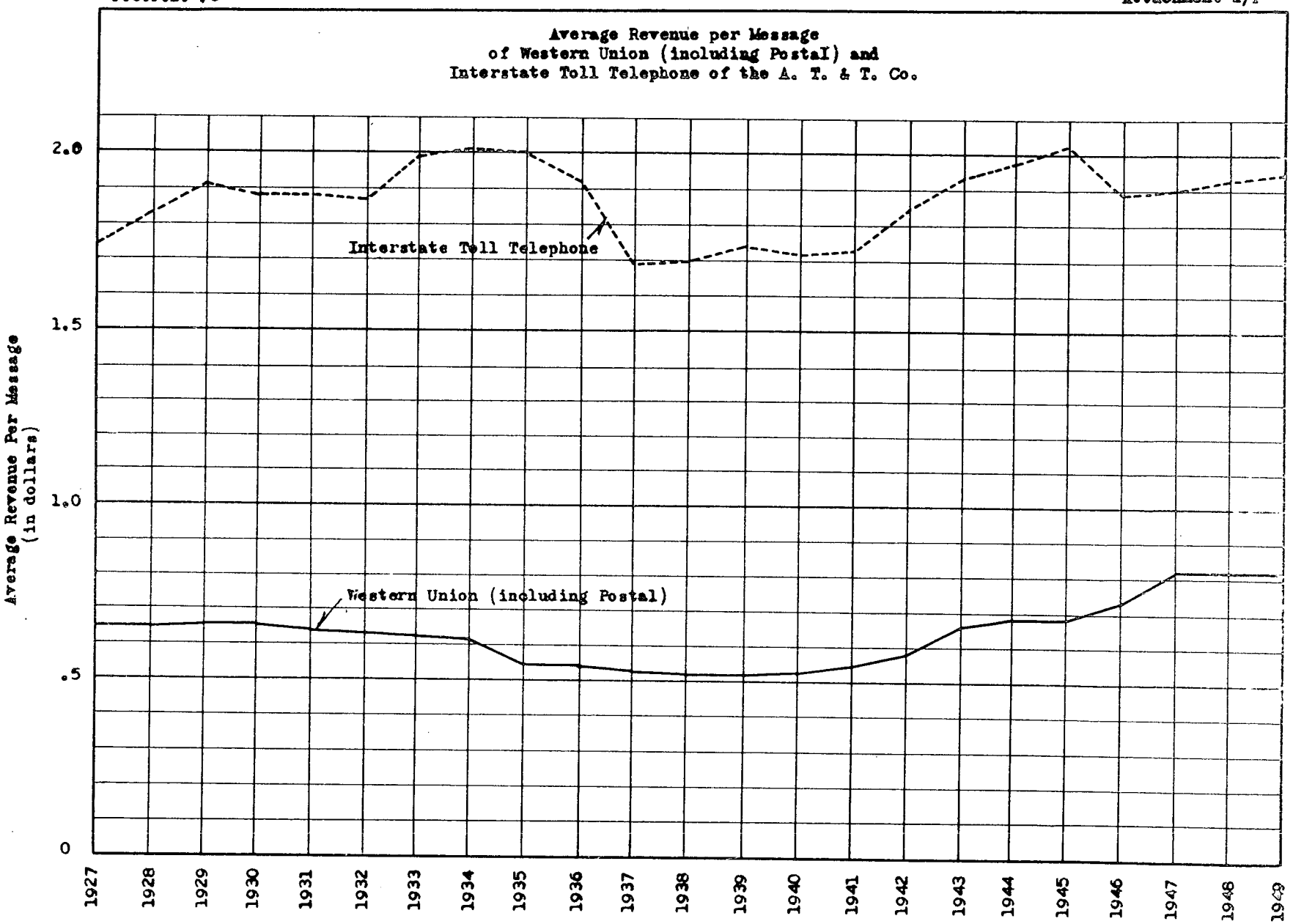
Attachment 2/F III-G



Source: FCC Reports (Rt59[5]) (Rg81)

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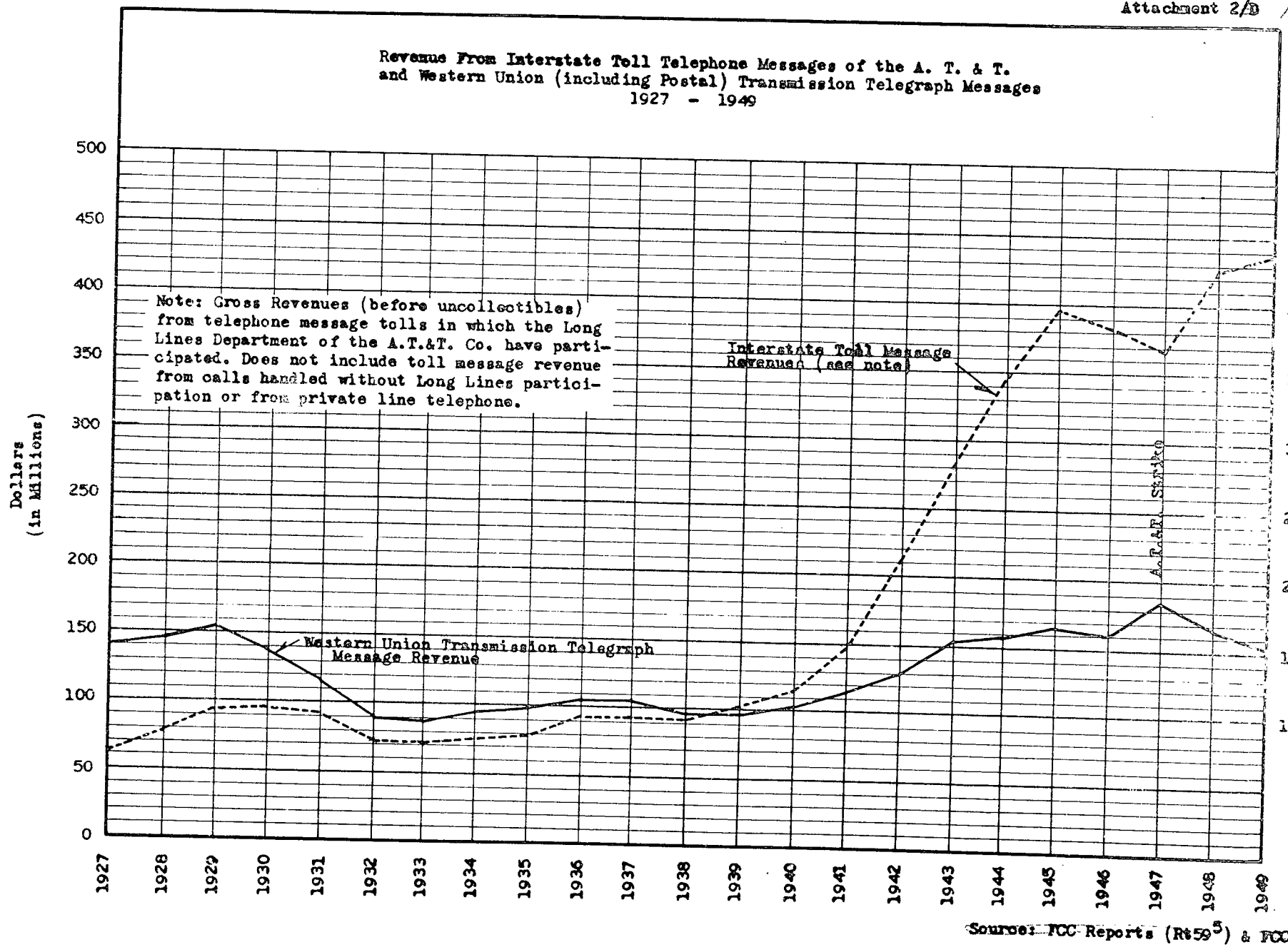
Attachment 2/D III-H



Source: FCC Reports (Rt59[5]) & FCC

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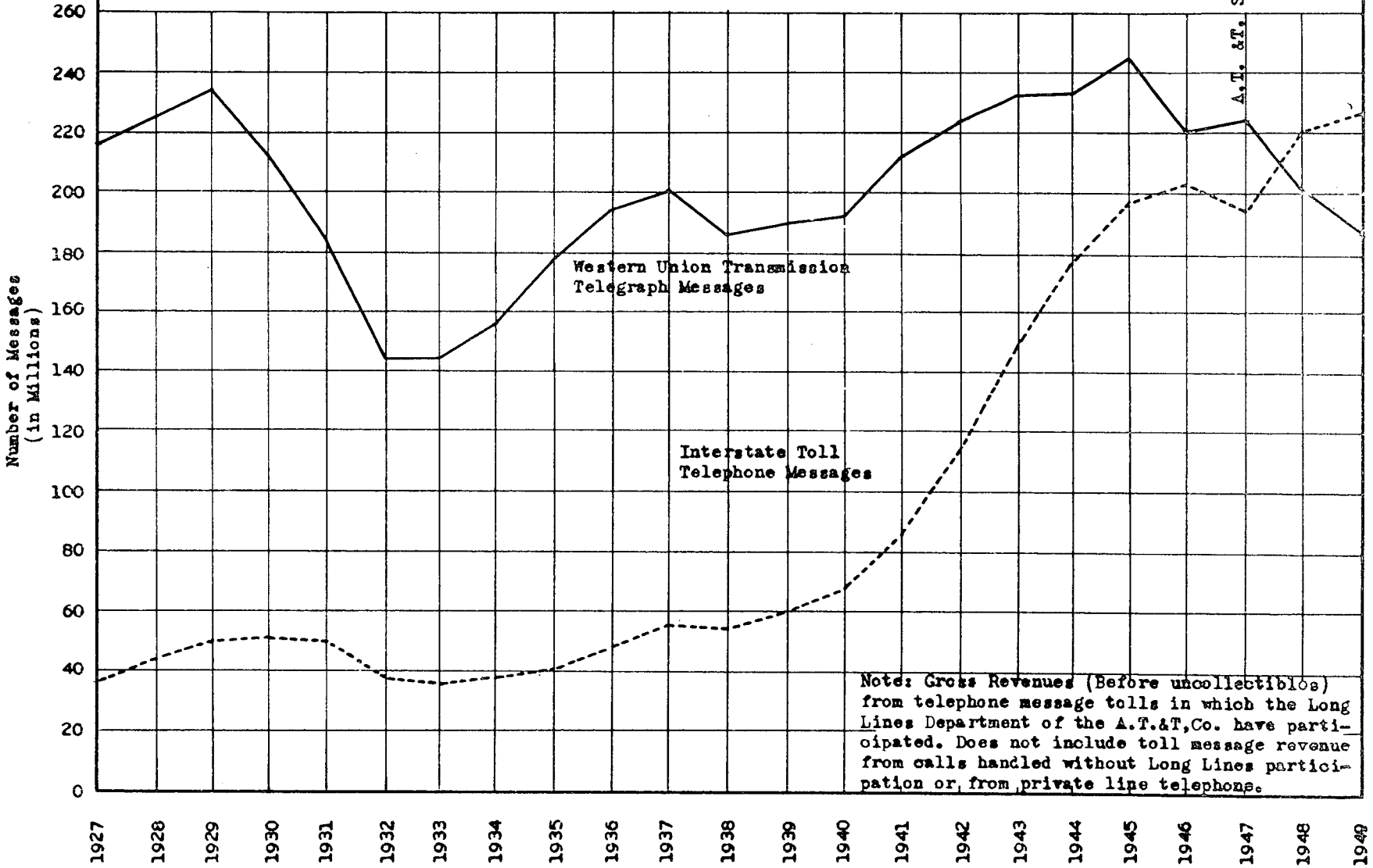
P.C.P.E. #5

Attachment 2/E

Interstate Toll Telephone Messages of the A. T. & T.
and Western Union (including Postal) Transmission Telegraph Messages
1927 - 1949



Note: Gross Revenues (Before uncollectibles) from telephone message tolls in which the Long Lines Department of the A.T.&T,Co. have participated. Does not include toll message revenue from calls handled without Long Lines participation or from private line telephone.

Source: FCC (Rg81)

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P.C.P.B. #5

Attachment 2/M

Revenues 1/ from Telegraph Operations of Large Telephone Companies
1926 - 1949

Year	Total 2/	Private line Morse	Private line tele-typewriter	Private line tele-photograph	TWX	Other 3/
	(Thousands of dollars)					
1926	$16,580	$ -	$ -	$ -	$ 0	$ -
1927	18,016	-	-	-	0	-
1928	21,057	-	-	-	0	-
1929	25,197	-	-	-	0	-
1930	27,034	-	-	-	0	-
1931	25,252	-	-	-	7	-
1932	21,798	-	-	-	514	-
1933	21,018	-	-	-	995	-
1934	21,407	-	-	-	2,276	-
1935	20,684	6,836	9,575	460	3,813	-
1936	24,166	7,201	10,733	467	5,645	120
1937	26,178	6,961	11,592	475	6,792	358
1938	23,963	5,493	10,755	494	6,824	397
1939	23,804	4,641	10,455	480	7,789	439
1940	23,344	3,630	10,326	471	8,440	477
1941	25,320	2,872	11,282	473	10,183	510
1942	35,942	2,206	16,466	474	16,255	541
1943	41,407	1,344	15,724	412	23,485	442
1944	41,693	1,401	18,826	366	20,642	458
1945	40,818	1,539	21,573	366	16,827	513
1946	34,065	1,508	18,537	550	12,963	507
1947	35,876	1,285	19,601	776	13,757	457
1948	41,830	1,081	22,766	1,182	16,323	478
1949	46,219	879	25,562	1,369	17,965	444

Year	Total 2/	Private line Morse	Private line tele-typewriter	Private line tele-photograph	TWX	Other 3/
	(Percent of total)					
1926	100.0	-	-	-	.0	-
1927	100.0	-	-	-	.0	-
1928	100.0	-	-	-	.0	-
1929	100.0	-	-	-	.0	-
1930	100.0	-	-	-	.0	-
1931	100.0	-	-	-	4/	-
1932	100.0	-	-	-	2.4	-
1933	100.0	-	-	-	4.7	-
1934	100.0	-	-	-	10.6	-
1935	100.0	33.0	46.3	2.3	18.4	
1936	100.0	29.8	44.4	1.9	23.4	.5
1937	100.0	26.6	44.2	1.8	25.9	1.5
1938	100.0	22.9	44.9	2.1	28.5	1.6
1939	100.0	19.5	43.9	2.0	32.7	1.9
1940	100.0	15.6	44.2	2.0	36.2	2.0
1941	100.0	11.3	44.6	1.9	40.2	2.0
1942	100.0	6.1	45.8	1.4	45.2	1.5
1943	100.0	3.2	38.0	1.0	56.7	1.1
1944	100.0	3.4	45.1	.9	49.5	1.1
1945	100.0	3.8	52.9	.9	41.2	1.2
1946	100.0	4.4	54.4	1.6	38.1	1.5
1947	100.0	3.6	54.6	2.2	38.3	1.3
1948	100.0	2.6	54.4	2.8	39.0	1.2
1949	100.0	1.9	55.3	3.0	38.9	0.9

1/ Revenues differ from those shown for toll telegraph operations of telephone companies in ~~Table~~ primarily due to inclusion of revenue for local telegraph service and revenue of other companies in addition to those of the Bell System, Cincinnati Suburban Bell Telephone Company and Southern New England Telephone Company.

2/ Coverage of total revenue figures:
- 1926-1930 - Private line revenues of Bell System, Cincinnati Suburban Bell Telephone Company and Southern New England Telephone Company.
- 1931-1934 - Private line and TWX revenue of Bell System, Cincinnati Suburban Bell Telephone Company, and Southern New England Telephone Company.
- 1935-1949 - Bell and other Class A and B carriers reporting to FCC.

3/ Includes message telegram service and miscellaneous private and non-private line revenue.

4/ Less than 0.1 per cent.

Source: Responses of Bell System Telephone Companies to Telegraph Division Order No. 12 and annual reports of Class A and B Telephone Carriers to the Federal Communications Commission.

Source: Rg 85

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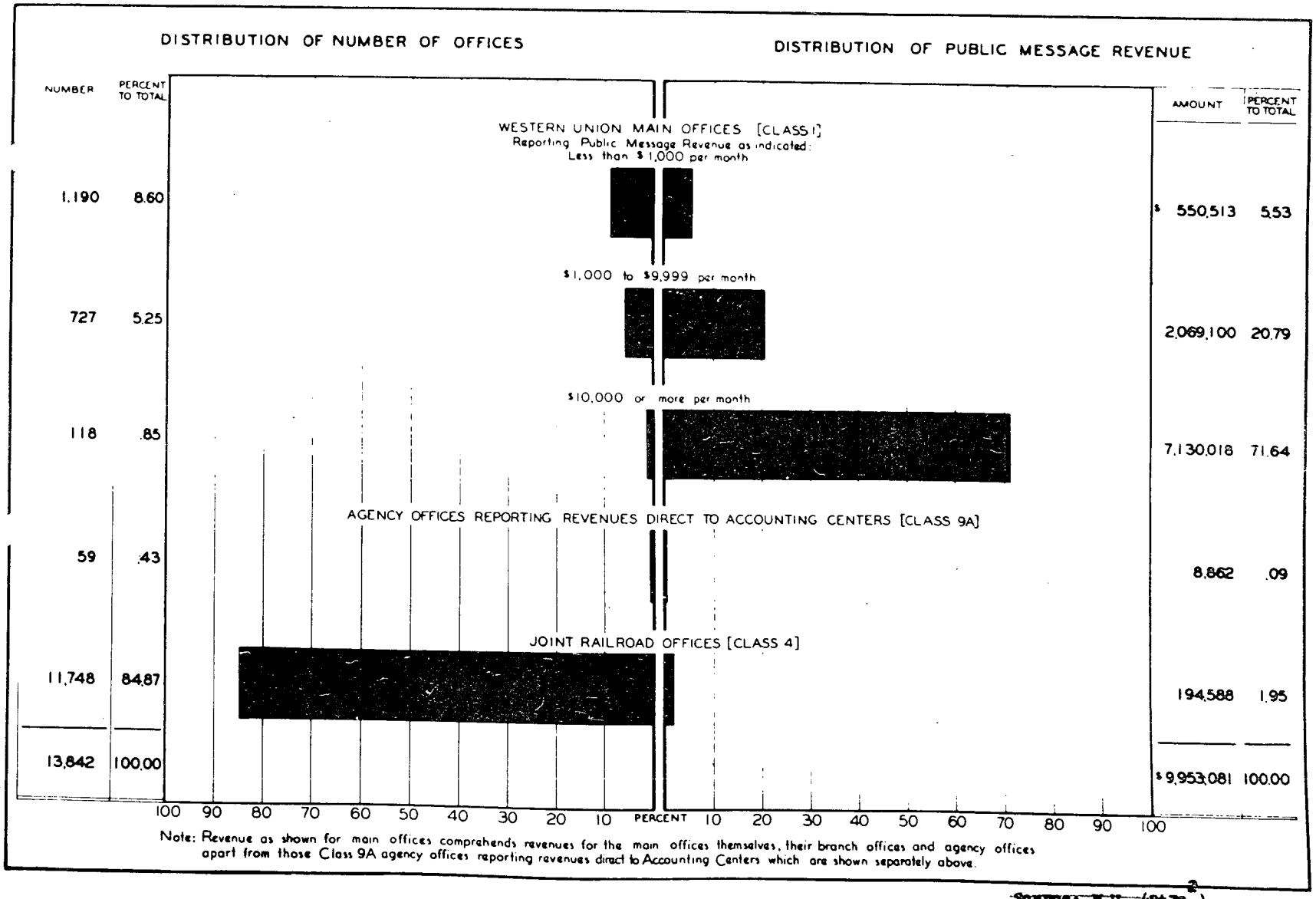
P.C.P.B. # 5

THE WESTERN UNION TELEGRAPH COMPANY

Attachment ~~2/2~~ III-L

LAND LINE SYSTEM

DISTRIBUTION OF OFFICES AND PUBLIC MESSAGE REVENUE ACCORDING TO CLASS OF OFFICE AND AMOUNT OF PUBLIC MESSAGE REVENUE REPORTED IN JANUARY 1950



Note: Revenue as shown for main offices comprehends revenues for the main offices themselves, their branch offices and agency offices apart from those Class 9A agency offices reporting revenues direct to Accounting Centers which are shown separately above.

~~Source: W.U. (Rt 79)~~

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ATTACHMENT ~~277~~ III-M
(REVISED ~~10/30/50~~)
(REVISED 1/3/51)

STATISTICS — 1949

DOMESTIC CONTINENTAL UNITED STATES FEDERAL GOVERNMENT AGENCY OPERATION OF LEASED WIRE TELETYPE LINES — ESTIMATED AVERAGE FIGURES

FEDERAL GOVERNMENT AGENCY	MILES OF LEASED LINES I	COST OF LEASED LINES AND EQUIPMENT II	ESTIMATED ORIGINATED WORDS TRANSMITTED III (1)	NUMBER WORDS HANDLED FOR OTHER GOVERNMENT AGENCIES IV	ANNUAL COST T W X SERVICE V	NUMBER WORDS TRANSMITTED VIA WESTERN UNION VI	ANNUAL COST OF WORDS TRANSMITTED VIA WESTERN UNION VII
DEPT. OF AGRICULTURE	17,630	$ 244,036	45,705,272	NONE	$ 2,400	5,412,367	$ 171,03
DEPT. OF THE AIR FORCE (WEATHER)	80,497	2,905,958	(2)	(2)	NONE	NONE	NONE
DEPT. OF THE AIR FORCE (OTHER THAN WEATHER)	33,000	588,000	460,000,000	6,000,000	70,028	(3)	127,943
DEPT. OF THE ARMY	23,423	429,958	330,816,624 (4)	43,500,000	162,326	(3)	524,080
DEPT. OF COMMERCE (CIVIL AERONAUTICS ADMIN.) - WEATHER	77,610	1,646,123	10,587,960,000 (5)	(2)	NONE	NONE	NONE
DEPT. OF COMMERCE (CIVIL AERON. ADMIN.) - OTHER THAN WEATHER	31,770	695,772	4,317,800,000	25,000	600	47,400	2,400
DEPT. OF COMMERCE (WEATHER BUREAU)	6,279	116,280	100,000,000	NONE	55,280	4,450,866	190,75
GENERAL SERVICES ADMINISTRATION	14,392	246,088	4,882,034	23,762,639 (6)	29,228	7,063,564	163,311
DEPT. OF THE NAVY	12,609	446,157	373,697,016	254,760 (8)	66,840	(3)	116,699
VETERAN'S ADMINISTRATION	8,658	225,000	38,729,040	270,000	125,536	9,215,080	160,912
OTHER FEDERAL GOVERNMENT AGENCIES (9)	20,063	510,505	87,753,000	1,876,304	311,795	7,861,382	256,633
TOTALS	325,931	$ 8,053,877	16,347,342,986	75,688,703	$ 824,033	34,050,659	$ 1,713,760
TOTALS LESS WEATHER FIGURES	167,824	$ 3,501,796	5,759,382,986	75,688,703	$ 824,033	34,050,659	$ 1,713,760
GRAND TOTAL LEASED LINE WORDS (7)			5,835,071,689				

NOTES: (1) FIGURES SHOWN DO NOT INCLUDE RELAYED WORDS.

(2) NO ESTIMATE MADE BECAUSE OF THE SPECIALIZED NATURE OF THE SERVICES AND FORMS OF TRANSMISSION.

(3) FIGURES NOT AVAILABLE.

(4) THESE FIGURES REFLECT SOME TRANSMISSION BY RADIO, EXACT PERCENTAGE NOT AVAILABLE.

(5) THIS FIGURE NOT REFLECTED IN TOTALS BECAUSE OF SPECIALIZED NATURE OF SERVICES AND FORMS OF TRANSMISSION.

(6) INDICATES NUMBER OF WORDS TRANSMITTED ON A PRORATE BASIS, UNDER AUTHORITY OF PUBLIC LAW 413 (SEC. 7) 79TH CONGRESS, APPROVED JUNE 14, 1946.

(7) DOES NOT INCLUDE WEATHER TRANSMISSIONS, BUT OTHERWISE INCLUDES WORDS TOTALED IN COLUMNS III AND IV.

(8) SHOWN FOR WASHINGTON AREA ONLY — OTHER FIGURES NOT AVAILABLE.

(9) OTHER FEDERAL GOVERNMENT AGENCIES, WHICH ARE REFLECTED IN THESE FIGURES:

FEDERAL COMMUNICATIONS COMMISSION
DEPARTMENT OF THE INTERIOR
DEPARTMENT OF STATE
DEPARTMENT OF THE TREASURY
MEDIATION AND CONCILIATION SERVICES
EXPORT - IMPORT BANK
FEDERAL POWER COMMISSION
NATIONAL MEDIATION BOARD
HOUSING EXPEDITER
UNITED STATES GOVERNMENT PRINTING OFFICE
UNITED STATES TARIFF COMMISSION
INTERSTATE COMMERCE COMMISSION
RECONSTRUCTION FINANCE CORPORATION
FEDERAL RESERVE SYSTEM
DEPARTMENT OF JUSTICE
ATOMIC ENERGY COMMISSION
CIVIL AERONAUTICS BOARD

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CHAPTER IV

UNITED STATES TELECOMMUNICATIONS ABROAD

Electrical communications that rival the domestic systems in speed connect the United States with points all over the world. Commercial networks span the globe with messages, conversations, and pictures that give direction to the nation's foreign trade. International radio facilities built up by the Federal Government handle a heavy volume of communications for the conduct of defense and diplomacy. Long-range broadcasting under the supervision of the Department of State is one of the country's essential international activities under current world conditions. Commercial and government interests participate in operation of international telecommunications for protection of life at sea and in the air.

All but the cable systems are directly concerned with the demand for radio frequencies discussed in Chapter II of this report. Another problem affecting international telecommunications of the United States arises from economic and other difficulties of the companies engaged in cable and radiotelegraph service.

The cable companies have been burdened with a heavy investment in plant. Intense competition with each other and from radio has held down profits. Development of radio in the international field has added circuits faster than traffic has grown. The American companies often have found themselves at a disadvantage in negotiations with the monopolies of government-controlled companies of other countries.

The result has been an intermittent demand for legislation that

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would permit the merger of some or all of the American companies selling cable and radiotelegraph services.

Many agencies of the Government from time to time have supported the merger idea, but for the most part Congressional policy has been opposed to such action. The Communications Act of 1934 calls for a competitive structure among the international record communication companies. Officials with a primary responsibility for national security are eager that as many international circuits as possible are kept in operation.

To supplement other information available on the economics of the merger question, the President's Communications Policy Board retained the engineering firm of Ford, Bacon & Davis to make a special survey of the record communications industry. These consultants found that, while savings from merger in the international field might make possible reductions in rates, of a group of big customers of the cable and radiotelegraph companies most were opposed to consolidations on the ground that poorer service might result. The engineers concluded, moreover, that the companies now have good chances of operating at a profit.

The staff of the Board, in its over-all study of United States overseas telecommunications, has amassed a great deal of statistical information about the international telecommunications networks, both government and non-government. Although this information has been tabulated and a substantial amount of it analyzed, the analysis of

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the government networks has not been completed.

Much of the information relating to overseas telecommunications of the Federal Government has to do with operations of the armed forces. When the President on December 16, 1950, proclaimed a state of national emergency, the Board decided that security requirements would prevent inclusion of material of this nature in a public report. The material therefore was classified and remains in the files of the Board.

Development of Commercial Systems

Cables

American companies entered the international communications field in 1881 when a cable was laid between Canso, Nova Scotia, and Penzance, England, and leased to the Western Union Telegraph Company for operation.

British companies already had been operating across the Atlantic for some time and later pioneered also in service to Latin American countries and across the Pacific. In the Atlantic service, a British monopoly prevented companies of other countries from landing their lines at Newfoundland and it became necessary for companies wishing relays there to lease lines from the British interests.

Operation of the transoceanic cables originally involved relaying messages manually at stations located at several points along the cable route. In 1898 cable relays were developed to

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permit automatic operation. Because of the characteristics of cable transmission, however, direct service was not possible over long routes that involved several relays. In 1921 regenerators were developed to allow operation of cable circuits direct from the United States to Europe, thus speeding up the service and decreasing the cost of operation.

Another improvement came in 1923 when, in order to increase its traffic-carrying capacity, the Commercial Cable Company, an American organization, laid a line with a copper conductor double the size of previous conductors. The following year the Bell System announced development of a high permeability alloy and Western Union laid a cable in which the conductor was wrapped with tape made of the new "permalloy." This cable has a capacity in excess of 300 words a minute, while the Commercial company's 1923 line has a capacity of 200 words a minute and the capacity of the earlier cables is much lower.

Descriptions of the American cable systems in operation today are included in the discussion of the "Economic Outlook for U. S. Cable and Radiotelegraph Companies."

Radiotelegraph

Transoceanic communication by radio was established on a firm basis prior to World War I, after most earlier attempts had met with only sporadic success because of lack of efficient

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transmitting and receiving equipment. One reason for this situation was that each equipment manufacturer did not have available patented devices controlled by others. As a result, United States radio-communication companies had confined their operations primarily to ship-shore service.

Upon the American declaration of war in 1917, the U. S. Navy assumed operation of all of the country's high-powered stations built for transoceanic communication. Under its wartime control, the Government combined the patents and scientific resources of all electrical manufacturers. These included use of the Alexanderson alternator and the DeForest tube, which offered a solution to the problem of efficiently generating and receiving continuous electrical waves. By the combining of various other inventions, new devices were developed out of which came practical radio transmitters and receivers satisfactory for wartime purposes. Thus the Navy carried on transoceanic communications during the war, with powerful stations on the Atlantic and Pacific coasts operating on low frequencies (long waves).

After the war, the Government fostered the organization of the Radio Corporation of America (RCA) in 1919 to solve the patent tangle and keep American radio communications free of foreign control. Prior to its

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incorporation, an attempt to obtain exclusive rights to the Alexanderson generator had been made by the British Marconi Company and negotiations with General Electric had been practically completed when the Navy Department indicated its objection to the ownership of this and other American radio patents by a foreign interest. As soon as RCA was organized, it purchased the assets and patent rights held by the American Marconi Company controlled by British interests. In 1920, RCA entered into exclusive cross-licensing agreements whereby it obtained rights to the use of other important patents, including the DeForest tube.

With these rights, the company quickly established direct radiotelegraph circuits to England, Hawaii, Japan, Norway, France, and Germany. Service was inaugurated to Italy in 1921 and two years later to Poland. After the advent of long-distance high-frequency transmissions in 1927, circuits were established to Java, French Indo-China, the Philippines, and Hong Kong.

As these services grew, RCA established two subsidiaries--Radiomarine Corporation of America and RCA Communications, Inc. (RCAC) --to conduct the business which previously had been operated by company departments. RCAC confines its operations largely to point-to-point service between land stations, and Radiomarine handles service to and from ships almost exclusively. By 1939 RCAC had established 52 international radiotelegraph circuits, and by 1950 it was operating 69 such circuits.

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After World War I, other radiotelegraph carriers also became active in the international field. By 1926 the Tropical Radio Telegraph Company had established 12 direct radiotelegraph circuits to the West Indies, Central America, and South America, and by 1950 the number had grown to 24.

The International Telephone and Telegraph Company in 1929 acquired the Postal Telegraph and Cable Corporation and, from its international division, organized the Mackay Radio & Telegraph Company to challenge RCAC's monopoly in the worldwide radiotelegraph service. By 1933 Mackay had established 10 circuits and in 1950 had 35 in operation.

Government policy was to grant transoceanic frequencies only on a public utility basis, and not for private use. As a result, the Robert Dollar Steamship Company organized Globe Wireless, Ltd., and the Firestone Tire & Rubber Company created the United States-Liberia Radio Corporation to meet their special requirements, although the facilities were made available to any customers. Those systems and that of the South Porto Rico Sugar Company offer public service only to a limited number of points.

When the Federal Communications Commission was organized in 1934, its initial practice was to deny applications for circuits to countries already served by other American radiotelegraph carriers. With the outbreak of World War II in 1939, however, the Commission generally

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granted applications for new circuits, regardless of whether other carriers already were operating to the points concerned.

In January 1942, the Defense Communications Board (later succeeded by the Board of War Communications) adopted as a wartime measure a policy encouraging establishment of parallel circuits from the United States to overseas points, to be operated by two American companies. Where possible, different locations were to be used in the country with which parallel circuits were set up. In April of that year, the policy was amended so that, if parallel circuits could not be established because of lack of suitable equipment, every effort would be made to establish duplicate circuits to allow two or more American companies to communicate with the same point abroad.

Under these policies, the Mackay company established circuits to Russia, Italy, Eire, and Greenland between 1939 and 1942, and after that time set up communications with 12 more countries.

Press Radio.--The value of international radio communication for the expeditious handling of news was recognized early by American press associations and newspapers.

Soon after Marconi's original experiments, the New York Herald set up a radio station in New York Harbor to gather news from ships at sea and to send out daily news summaries to them. This station continued in operation until World War I. After the war, the New York Times established its own station to communicate with European stations, and soon thereafter similar facilities were installed by the

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Associated Press, the International News Service, and the Chicago Tribune.

As the demand for frequencies grew, the Federal Radio Commission in 1929 entered an order calling for the formation of a single public utility to serve all the American press. This action led to the organization of Press Wireless, Inc. Although it was established to serve the press exclusively, the company's charter does not limit holding of stock to press interests, and its corporate powers extend to and include the operation of fixed public service as a communications common carrier. By 1936 Press Wireless had established six international radiotelegraph circuits, and in 1950 was operating 17 such circuits. In addition to its special services for individual newspapers and press associations, the company handles multiple-addressed press material and program and radiophoto services.

Radiotelephone

Experiments in the field of radiotelephony were begun in 1915 by the United States Government, in conjunction with the American Telephone and Telegraph Company. Messages were sent from the naval station at Arlington, Va., and from Washington to such distant points as San Francisco, Honolulu, and Paris. Interrupted by World War I, tests were continued after the war.

Speech was transmitted to England in 1923, and by the end of 1926 successful test operations were being conducted between New York and London. The first international radiotelephone circuit for

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general use was established between those cities by A.T.& T. in January 1927. Soon afterward service was extended beyond the terminals of the radio circuit, by means of wire lines, to all of Great Britain and the United States. Cuba and a part of Canada were added for service by the end of 1927 and the following year service was extended to many countries of Western Europe, utilizing the extensive wire telephone network connecting London with the Continent.

By the end of 1933 transatlantic service was in operation for most of North America and the principal countries of Western Europe. Ten direct radiotelephone circuits had been established. In certain cases, a direct circuit was provided to a distant terminal; in many others, the establishment of direct service with several countries was provided on a so-called "forked" circuit basis; in still others, either of these two types of radio channels was used in connection with line wire extensions to countries beyond the distant radio circuit terminals.

Overseas circuits radiating from the United States were centered at three main focal points: New York, Miami, and San Francisco. By 1936 the A.T.& T. had established 27 direct radiotelephone circuits. Fifty-seven such circuits were in operation in 1950.

The Radio Corporation of Porto Rico also engages in limited international radiotelephone service, operating the San Juan terminal of the A.T.& T. circuit between the United States and Puerto Rico.

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The Honolulu end of the U.S.-Hawaii radiotelephone circuit is operated by the Mutual Telephone Company of Hawaii. Its radiotelephone transmitters and receivers in turn are operated by RCAC under a lease agreement with the Mutual company.

Regulation of Commercial Systems

Under the Communications Act of 1934, as amended, the Federal Communications Commission is charged with regulating, among other things, international communications by telephone and telegraph, whether wire, ocean cable, or radiobroadcast and other forms of radio services. These functions do not, however, include control of facilities operated by the Federal Government.

Among the provisions of the Act are those affecting common carriers and reflecting Congressional policy that the public interest in adequate public communications service and reasonable rates is to be protected and promoted by Federal regulation.

The Commission's responsibilities in the international common carrier field require it to be active in the area of foreign relations as they pertain to that field.

The United States is a member of the International Telecommunications Union. As such it participates in the negotiations stemming from the Union that relate to international telephone and telegraph questions. Additionally, there are other bilateral and multilateral agreements on the subject in which the United States is concerned. Because the Commission has large responsibilities in the field as indicated above, it must be alert to the effects of such international negotiations upon the public interest, convenience, and necessity as related to

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non-Federal Government international communications.

Among the regulatory interests of the Federal Communications Commission in this field are merger, circuit arrangements, frequency management, equipment and operating techniques, processing of applications, conference preparation and negotiation, rate schedules, acceptance and delivery practices, distribution of traffic, records, and finance.

One significant matter (Docket No. 8777) has been pending for some time. This case grew out of applications involving the question of whether and to what extent the Commission will authorize a second direct radiotelegraph circuit to countries already served directly by one carrier. This question contains many facets relating to merger, frequency utilization, national defense, and competition between American carriers.

Adequate regulation, however, has been somewhat hampered in recent years because of budgetary limitations.

Development of U. S. Government Systems

Apart from the facilities established during World War I and some minor systems operated between the wars to maintain communication with overseas military bases, ships at sea, and aircraft over the sea, the United States Government had not developed any extensive international communication facilities of its own until the beginning of World War II.

Responding to the requirements of global operations, the Army (including the Air Force) and the Navy then created new worldwide networks for communications. Certain non-military agencies of the Government also established more limited systems. In the early years of the war, these agencies leased some commercial radio and cable facilities until they could install their own equipment and operate it. Certain of these leased facilities, however, were continued

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throughout the war period and some of them are still in leased use today.

Many of the overseas facilities installed by the Government for war use also have been continued in operation. Some of course were abandoned, but the postwar international situation has required retention of many facilities which otherwise might have been curtailed or eliminated, as well as the installation of additional ones.

Department of Defense

Following unification of the armed forces in 1947, a Joint Communications-Electronics Committee was established as an agency of the Joint Chiefs of Staff in the Department of Defense to coordinate telecommunications activities of the several services and to provide liaison with Government departments and with other public and private agencies having interests in the field. As a result of the committee's work, the Department of Defense has established principles for the integration of telecommunications functions among commands and services.

As the General Services Administration has managerial responsibilities for Government telecommunications services specified under Public Law 152, the GSA and the Department of Defense have agreed on areas of understanding on the procurement of telecommunications facilities in order "to obtain the maximum economy consistent with the requirements of service."

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U. S. Army.--Before the turn of the century, the Army was devoting attention to wireless telegraphy with a view to adapting it for military purposes. These tests led to the installation of four radio stations in 1900 and within the next eight years the Army was operating 17 stations in the United States, Alaska, Cuba, and the Philippines, plus radio stations on five Army transports.

By the time of the United States entry into World War I, the Army radio network had expanded to 51 stations in the United States and 10 overseas, and 53 Army vessels also had been equipped with radio.

The Army radio net was officially organized in January 1922. In June of that year, 218,000 words were handled over this system. Because of budgetary difficulties, the Army's use of telecommunication facilities grew little until the limited national emergency was declared by the President in 1939. At that time, the Army radio net connected Washington with the Corps Area Headquarters in the United States and its overseas Department Headquarters such as the Philippines, Hawaii, Puerto Rico, and Panama. This net then handled about 5,000 messages a day.

During the early months of World War II, the Army leaned heavily upon the commercial facilities of Western Union, Mackay, A.T.& T., and RCAC. But commercial facilities did not completely fill the bill. Direct circuits and greater security were required. In the circumstances, the Army and the Air Corps drew plans to build worldwide communications to serve the armed forces.

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The plan comprehended a "pipe-line" around the world. The first leg put in on the "pipe-line" was from Washington to Asmara, Eritrea, on a multi-channel teleprinter basis. By early 1943 an around-the-world belt line had been completed, extending from Asmara to New Delhi, from New Delhi to Brisbane, from Brisbane to San Francisco, and thence on to Washington. The network's message volume reached 50,000 a day in March 1943.

Before V-E day, the Army Communications Service had been extended into an unprecedented global system, employing the most modern equipment and operating techniques known to U. S. telecommunications experts, and providing instant communications to all overseas forces and missions and allied countries. By January 1, 1949, this network had been contracted and rearranged, but 14 overseas trunk circuits were still in operation. The Army, in addition, utilizes the services of the international carriers to locations where it has not been necessary to establish Army facilities. The Army also handles radio traffic for some of the other Government agencies when spare circuit capacity is available.

U. S. Navy.--Radio communications on an operating basis were established by the U. S. Navy as early as 1903 for the purpose of communicating rapidly between ship and shore and between ships. Later, radio communication facilities also were provided between shore establishments both at home and abroad. As the Navy grew and the communications art developed, the Navy's communication system became larger and more complex.

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Before 1940 the Navy operated several point-to-point multi-station radio telegraph circuits and one Morse wire circuit within the continental United States. In 1941, however, the Morse circuit was converted to private teletypewriter operation. This conversion marked the commencement of the transition from radio to landline for intracontinental circuits.

Today, with the far-flung interests and missions of the Navy, its communication system meets the requirements for essential continuous, and immediate communication between Navy air, surface, and sub-surface operating forces wherever they may be and between those forces and Navy shore establishments.

The stated mission of the Naval Communication Service "is to provide and maintain an adequate and secure communication system for the Navy, based on war requirements; and to ensure operation thereof to best meet the requirements of the operating forces and the shore establishment, wherever located, primarily to serve command and to facilitate administration."

To implement this mission the Navy provides facilities at strategic locations. These are classified as primary, major, and minor communication centers, and tributary offices. The six primary communication centers are strategically located to furnish,

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as far as practicable, complete radio communication coverage for the major portions of the ocean areas of the world. Major centers provide more limited area coverage. Minor centers provide fleet communication support as may be required. Tributary offices are served from the primary, major, and minor communication centers.

Certain channels of the radio trunk circuits, particularly overseas circuits, combine with nearly all of the landline circuits of the Navy to form the Naval Teletypewriter System (NTX), which employs the tape-relay method of distributing traffic.

Navy point-to-point radio trunk circuits are integrated with continental point-to-point wire circuits. Many of these circuits were designed and established about 1910 for manual telegraph operation. As the demand for greater speed and capacity increased, these and newer circuits were converted to automatic operation in a progressive transition from Wheatstone and single channel radio-teletypewriter to duplex, multiplex, and finally single-sideband teletypewriter multi-channel operation.

U. S. Air Force.--The need for an airways communication system capable of supporting military operations under all weather conditions was brought home to the Air Corps in 1934 when a

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flight of new bombing planes was sent on maneuvers across the United States. All that was available at the time was a series of radio ranges and rotating light beacons operated by the Department of Commerce. Communication between the ground and aircraft was restricted for the most part to short-range voice contacts with the range stations. Messages from point of departure to point of intended arrival were sent by Western Union.

It took four years to get funds and assemble equipment to make the beginnings of what is now the Airways and Air Communications Service (AACS). At its inception, AACS established 33 stations consisting of a combination of control towers, ground-air, point-to-point, and radio range facilities. A personnel total of 3 officers and 300 enlisted men was authorized.

From 1938 to 1941, the East and South were fairly well covered, while most of the Middle West and North West had little coverage. Existing installations serviced practically all the permanent Air Corps stations of that day.

Operations outside the U. S. were begun in April 1941, when an AACS party was sent to Newfoundland to start work at Gander Lake. From this beginning grew the extensive wartime ferry routes to England, over the North Atlantic and later to Africa through the Azores.

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During all of 1942 the AACS was fully occupied in building up ferry routes to all overseas theaters and in developing its plans for further expansion. The leased bases in the Antilles were manned for anti-submarine operations and also as way stations on a South Atlantic route to India through Central Africa. In the Pacific, the pre-war air route to Manila through Midway and Wake was closed off by the enemy and was replaced in early 1942 by a South Pacific route through Fiji and New Caledonia to Australia. In Alaska and Western Canada a ferry route to Siberia and an airway along the Aleutians were developed.

The years 1943 and 1944 were spent improving the routes started in 1942 and in building new stations as offensive plans proceeded. Operations in support of the Air Transport Command's flights over the "Hump" in Southeast Asia were perhaps the most spectacular, but concurrently a number of stations were established in China for the 14th Air Force and later for the early raids of the B-29's from China bases.

In the spring of 1945, communications had to be provided for the air power assembled at Okinawa for the projected assault on Japan. In France, the Lowlands, and Germany, the Allied offensives secured new airdromes which had to be tied into the airways system.

Meanwhile, the great increase in the air establishment at home called for more installations, but naturally the overseas areas had first priority. Therefore, not until after the war could AACS

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inaugurate its planned Military Flight Service Communications System. This is a network of strategically located stations which primarily furnish point-to-point and ground-air facilities, but also provide aids to navigation such as control towers, radio ranges, direction finders, ground controlled approach units and instrument landing systems. This plan was drawn up to complement the communications of CAA.

Since the end of hostilities AACS has devoted itself to improving its service. Facsimile is rapidly taking the load off the point-to-point radioteletype circuits which transmit weather data. Multi-channel equipment is being installed as rapidly as possible. A global system of communications is in process of development.

AACS has participated in all the major Air Force operations since World War II. It supplied all the airways communications and navigational aids for the Berlin Airlift. It took part in large-scale joint service maneuvers. It supplied communications to the Lucky Lady II on its round the world non-stop flight. It also was responsible for airways communications in Korea.

Department of the Treasury

The only international communications facilities of the Department of the Treasury are those of the United States Coast Guard, which is a part of the department in peacetime. The Coast Guard operates as a service in the Navy Department in time of war, or when the President directs.

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The peacetime functions of the Coast Guard include law enforcement or assistance in enforcing all applicable Federal laws upon the high seas and waters subject to the jurisdiction of the United States and promotion of safety of life and property in those areas. These functions require the use of radio for point-to-point, radiolocation, and mobile services.

The Coast Guard operates and maintains ocean stations in both the North Atlantic and North Pacific oceans to provide search and rescue services at sea and over the sea, communications, and air navigation facilities, and meteorological services in such ocean areas as are regularly traversed by aircraft of the United States. It operates land telephone lines along the coastline, connecting lifeboat stations, lighthouses and other units. The facilities include eighteen radio broadcast stations. Medium frequency direction finder stations, previously operated along the coasts, have been discontinued as a navigational aid to the public, owing to the use, generally, of shipboard direction finders in conjunction with marine radio-beacons and the utilization of radar and "loran" systems. The direction finder stations have been continued, however, at strategic points for search and rescue purposes.

During 1949 the Coast Guard maintained 37,309 aids to navigation, many of which require radio transmissions. It also operated 34 fixed "loran" stations along with 14 "racon" stations along the Atlantic and Pacific coasts and in Hawaii, Puerto Rico, and Alaska.

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Department of Commerce

The principal users of radio frequencies in the Department of Commerce are the Civil Aeronautics Administration, the Weather Bureau, and the Bureau of Standards. The remainder of the bureaus and offices of the Department, in their international operations use both commercial communications and the facilities of other Government agencies. Most of their messages are exchanged with the Foreign Service of the United States. Departmental procedures have been established for handling such international communications. Under these procedures, messages to and from the embassies, legations, and consulates of the United States are routed through a liaison office in the Department of Commerce and are handled by the Department of State.

Civil Aeronautics Administration.--The communications and air traffic control systems of the Civil Aeronautics Administration were established to provide for the safety of life and property in aircraft operated on the civil airways and air routes in the United States, its territories and possessions, and between the United States and foreign countries.

Increased use of aircraft following World War I stirred up concern about hazardous flying over unfamiliar territory and during periods of poor visibility. It also gave rise to two other problems: (1) prevention of collision, and (2) expediting the movement of aircraft. Traffic adjacent to large airports and along major routes had become heavy within a short time.

The Post Office Department, whose air-mail service then was the only operator of aircraft during all types of weather, established aeronautical radio stations in 1920. This was the beginning of the present complex aeronautical communications and radio navigation system, which is the end-product of a number of organizational changes through the years.

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The Aeronautical Communications Stations operated by CAA perform the following 14 functions:

Service "A" - Collection and distribution of hourly and special reports on surface weather, airfield conditions, and inoperative air navigation aids, etc.;

Service "B" - Requests for and approval to conduct an aircraft flight; flight plans, in-flight progress reports, and aircraft arrival reports;

Service "C" - Collection and distribution of 3 and 6 hourly weather data; pilot balloon reports, radiosonde, weather forecasts, etc.;

Service "D" - Radio broadcast of meteorological information, advisory messages, and advice to airmen;

Service "E" - Two-way radio communications with aircraft in flight;

Service "F" - Dissemination of messages to assist flow and prevent collisions of aircraft flying under instrument flight rule;

Service "G" - Monitoring radio aids to air navigation and communications systems;

Service "H" - Operation of non-directional type radiobeacons by ground stations;

Service "K" - Flight assistance services;

Service "L" - Operation of lighting facilities (various lighting

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equipment of airports, etc.);

Service "O" - Collection and distribution of overseas and foreign meteorological data;

Service "R" - Operation of radio ranges by ground stations;

Service "W" - Airway weather observational service;

Service "X" - Determining of information relative to the fixed location, bearing, or heading of aircraft.

Four radiotelegraph stations were in operation in 1920 along the transcontinental airway, and the first radio range station was installed at Bellefonte, Pennsylvania, in 1927. Two years later a teletype circuit was placed in operation, connecting 13 stations by means of 700 miles of leased wire. The general use of teletype machines meant that weather information could be transmitted by employees able to type. This change helped to eliminate interference in the crowded radio frequency spectrum. By the end of 1936 there were 203 weather-reporting teletype stations.

Service "B" was inaugurated in 1938. During the same year the need for communications services in the Territory of Alaska, and for the proposed transoceanic aircraft services was recognized, and action was started on both projects.

The first overseas-foreign aeronautical communications station was completed in 1940 at New York. The station was needed to provide two-way radio communication with aircraft operating on the Atlantic air routes. Communications were also inaugurated between New York

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and various points in Europe, the Azores, Bermuda, and Newfoundland to collect meteorological data and to transmit information concerning aircraft movements. In Alaska, 6 communications stations were completed and placed in operation. Most communications with Alaska were by means of radiotelegraph because of the lack of landline facilities.

With the advent of World War II, the civil aviation systems were closely coordinated with the military services. Four communications stations to handle overseas traffic were completed in 1942--at San Francisco; Everett, Washington; Anchorage; and Honolulu. Overseas airway communications facilities were further expanded in 1942 to include stations at New Orleans, Miami, and Balboa, Canal Zone. The additional stations provided services to flights operating to South and Central America and the Caribbean. An estimated total of 64 million words of weather and flight traffic was handled during the year.

Today the subordinate services of CAA use radio to maintain communications with commercial and military aircraft, and also for administrative purposes, weather information and safety requirements.

For international aircraft operations, the Administrator of Civil Aeronautics provides directly, or through an agency sponsored by the Government for the purpose, the basic fixed and mobile telecommunications system for the exchange of the following categories of messages:

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1) Distress messages,

2) Messages for the safety of life and property,

3) Flight safety messages,

4) Meteorological messages,

5) Notices to airmen,

6) Flight regularity messages,

7) Aeronautical administrative messages,

8) Reservation messages, and

9) General airline operating agency messages.

It is the practice to handle without charge the messages in categories 1 through 7. Reservation and general airline operating agency message categories are not accepted when private or commercial facilities are capable of meeting aeronautical communications requirements.

Weather Bureau.--In addition to its many offices and part-time stations within the United States, the Weather Bureau, under agreements with foreign governments, is active along many of the overseas air routes. It maintains, in cooperation with the Coast Guard, ocean weather stations in both the Atlantic and the Pacific, as well as in the Arctic regions. Over 2.2 million weather report words were received collect from foreign points and from commercial ships at sea during 1949.

The Weather Bureau cooperates extensively with the Civil Aeronautics Administration and the Coast Guard in disseminating weather

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information for aircraft and ships.

Although the Weather Bureau does not own and operate any international communications facilities, it does lease international landline facilities to Cuba and Canada for the exchange of weather information.

National Bureau of Standards.--The National Bureau of Standards uses radio for its international frequency-measurement service, for research, and for special tests. It has no facilities for the handling of rapid communications.

The Bureau's station WWV has a worldwide reputation in its field. The station transmits continuously a highly accurate complex signal on specified frequencies. It transmits accurate time signals, Central Radio Propagation Laboratory forecasts of propagation conditions, accurate audio tones, and accurate carrier frequencies. In addition, the listener can obtain propagational data over the path traversed by the signal to the listener's receiver.

Department of State

The Department of State has a two-fold interest in telecommunications. It is responsible for international negotiations on telecommunications matters. It is also a large user of telecommunications for the conduct of its general operations, for the dissemination of informational and educational matter abroad, and for the Voice of America.

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Operational Communications.--The Department of State uses practically all forms of communication to meet its requirement for rapid interchange of instructions and information between Washington and missions abroad. Speed, security, and distance dictate heavy use of telegraph service.

The Department maintains its own internal "message centers." In Washington and at several of the large posts abroad, telegraph centers are established for the centralization of the exchange of traffic with commercial carriers and with communications centers of the armed forces.

With the exception of certain isolated emergency operations, the Department of State neither controls nor operates long distance communications channels, nor does it maintain or operate radio transmitting or receiving stations for the handling of telegraph communications.

The Department of State has a direct leased Western Union cable "varioplex" telegraph channel connection between Washington and the U. S. Embassy in London and another between Washington and the U.S. Embassy in Paris. These two direct channels accommodate regular message traffic charged for at the prevailing message rates.

In addition, the Department of State shares the use of another Washington to Paris telegraph facility over a New York-Horta-Cherbourg cable, which is a split Western Union-Army circuit (Western Union from New York to Horta and Army from Horta to Cherbourg over the former German Emden cable). While this facility terminates at the Army message center in Washington, the Department of State message center

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in Washington can be combined with it when the circuit is not in use by the Army.

Voice of America.--The need of the United States for international high-frequency broadcasting has been greatly increased by the upsurge of interest in programs of international information and educational exchange. Between the two world wars, there was a tremendous growth, especially in Europe, of international broadcasting. Only toward the latter years of that period did American commercial broadcasting interests engage in relatively modest programs of international broadcasting, chiefly directed to the Western Hemisphere. During World War II, however, the U. S. Government created worldwide radio and press services, operated by the Office of War Information and the Office of Inter-American Affairs. These activities were transferred to the Department of State by Executive Order on August 31, 1945, for reduction and incorporation in the small program of information and cultural exchange already started in that Department.

During the period immediately following the termination of hostilities, the program was carried on under authority of annual appropriations acts. Then it came under severe Congressional attack, and was almost eliminated by the summer of 1947.

With the developing world crisis, however, Congress responded to the need for special machinery to tell abroad the story of the United States and of the free world. The presumption of an early return to a peaceful world, which lay beneath the earlier decision to cut the Government program to the bone and let private information agencies

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carry on, was proved false. In January of 1948 Congress passed the U. S. Information and Educational Exchange Act "to promote the better understanding of the United States among the peoples of the world and to strengthen cooperative relations."

High-frequency radio bulked large among the media available to carry out this worldwide commitment. With more and tighter restrictions and barriers to the dissemination of information, high-frequency radio appeared to be the best way to get the truth about the free world into iron-curtain areas. The geographical position of the United States has heightened the value of high-frequency operations in its international radio broadcasting.

The Voice of America not only provides service for its own broadcasts, but also for the United Nations at New York and the armed forces of the United States abroad.

For transmissions from the United States, the Voice of America generally leases transmitter time from various commercial broadcast or communications companies. For transmissions from overseas points the Voice of America, in general, owns its own facilities. It also transmits to certain stations in other countries for rebroadcast by them.

This rapid expansion in the Voice of America poses a serious problem for world telecommunications, especially in the high-frequency band. In November 1950 the Voice was using 69 frequencies on the average of seven hours per day each. These are a substantial percentage of the total spectrum space available to the world for

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international broadcasting under the Atlantic City Table.

Government policy calls for a large increase in radio installations used for the Voice. These increases, however necessary and desirable, may put more pressure on the spectrum during the years immediately ahead. The future after that will depend on the level of international crisis.

Information for the Foreign Press.--In addition to the broadcasts of the Voice of America, the Department of State sends around the world a daily news service of information about the United States for use in newspapers and other media abroad.

For this service, the Department's Division of International Press and Publications operates a teletype communications center in Washington. Into this center pour thousands of words daily for transmission to New York, where they are sent overseas by commercial radiotelegraph facilities.

These Morse transmissions are received by radio operators at United States missions abroad and are reproduced and distributed to press and other information outlets in those countries. Ships and other stations of any nation also may intercept these radio news reports.

Other Government Agencies.--Many independent agencies and commissions of the Federal Government which do not own or lease international circuits transmit and receive international communications through existing Government or commercial company facilities. Between 85 and 90 per cent of this wordage is transmitted over Government

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facilities at practically no cost to the originating office. The Economic Cooperation Administration and the Veterans' Administration, the largest of these users of international communications, route the majority of their traffic through the Department of State and the military services, respectively.

The American Red Cross, although not a Government agency, is privileged to use Government-owned international communications facilities to handle its traffic. During 1949 over 7 million words were transmitted by the armed forces for this organization.

Control of Government Systems

Federal Government agencies now decide, at something less than top level, the amount and type of record telecommunications matter that is to be transmitted to overseas or foreign points by means of facilities controlled by the Federal Government and established primarily for purposes of national defense. Too great a diversion is not conducive to the best health of the nation's telecommunications networks.

If our national policy recognizes the desirability of strong private American companies operating in the international telecommunications field, there must be some form of control to insure that a substantial amount of Government message business is handled by commercial agencies, so that the Federal Government does not, perhaps unwittingly and by unilateral action of independent agencies, bring about a total or partial collapse of commercial facilities by eliminating their largest customer--the Government.

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not yet been granted.

Relationships to Commercial Systems

Though Government-owned facilities handle a large portion of Government communications, the Federal Government is dependent upon commercial overseas facilities to round out its over-all needs for international service. This is true in two major respects. The Government finds in some cases that it is more economical and efficient to lease or subscribe to a circuit or channel from a common carrier than it is to install and operate a facility of its own. For the transmission of small amounts of traffic to remote points, the Government often finds it more economical or convenient to route such traffic via common carriers than to send it part way over Government facilities.

Government also depends heavily upon the existence of common carrier facilities during the early stages of war. Because it is not possible to anticipate the precise nature and locale of hostilities, the armed forces try to maintain a minimum basic system in peacetime and depend upon appropriate expansion in wartime, utilizing common carrier facilities to tide them over.

The Merger Question in International Record Communications

Historical Summary

Proposals for merger of American companies providing cable and radiotelegraph services have provoked vigorous debate ever since radio emerged as a practicable means of international communications. The traditional American policy against monopoly has affected this

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while other Government departments have opposed consolidation. Some of these agencies have shifted their positions from time to time on the desirability of one or another form of merger. At no time have all the interested executive agencies been in agreement on this issue. As of May 1950, this was still the case.

The move for merger in the field of international record communications has never been able to win complete Congressional support because of traditional resistance to monopoly. Numerous hearings have been held by committees of the Congress, but no legislation has resulted. Either the case has not been strong enough, or prevailing international situations have delayed consideration of the various proposals. In the meantime, however, Congress has approved mergers of telephone companies and of domestic telegraph companies, and permits the domestic telephone companies to operate in the international field.

During World War I, when the Government operated the telegraph industry, the U. S. Navy was given control of the transoceanic radio stations in the interest of national security. Immediately after the war, a bill was introduced in Congress providing for the control and operation by the Navy Department of the then existing private U. S. radio stations used for overseas communications. The measure had Navy support. Under its provisions, the Navy was to operate the private stations as well as its own stations for the handling of both commercial and Government international communications. The bill did not become law. The country would not accept

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Government ownership or operation of these facilities.

The first expression of Congressional policy on merger of the privately owned cable and radio companies came in the Federal Radio Act of 1927. This law specifically prohibited mergers of radio with cable companies, and vice versa, if such mergers would lessen competition or restrain trade in interstate or foreign commerce. The Radio Act also declared that anti-trust laws are specifically applicable to the manufacture, sale, and trade in radio apparatus, and to interstate or foreign radio communications.

The Communications Act of 1934 included the same provisions.

In 1939 the Senate Committee on Interstate Commerce requested the FCC to study the merger question afresh. The Commission reported in the following year, recommending permissive merger of the cable and radiotelegraph carriers.

After lengthy hearings, Senator White and Senator McFarland introduced a bill in 1941 to permit mergers in both domestic and international telegraph systems. When the measure was before the full committee during the following year, however, the Navy Department, previously a supporter of merger, objected to changing the law to permit changes in the international industry at that time. The Navy thought that the structure of United States overseas telecommunications should not be altered during the war. Provision for this type of merger was deleted from the bill; although the House restored it, the bill was not voted on before the end of the 77th Congress.

The problem of domestic merger was felt to be so urgent, however, that it could not wait for the conclusion of the war. The Postal

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Telegraph Company was deeply in debt, and there appeared no prospect that its financial affairs could possibly be put in order. The 78th Congress took up the question of domestic merger in 1943, and amended the Communications Act so as to permit Western Union to purchase Postal Telegraph. This permissive legislation required Western Union to divest itself of its international business, Western Union Cables, within a reasonable period of time according to conditions and procedure specified in the Act, and with the approval of the FCC. Up to the present time, Western Union and potential buyers of its cables have been unable to agree on terms of sale. Western Union Cables continues from year to year as the FCC renews permission for it to continue in its present ownership. This situation has given rise to suggestions that the provision for splitting domestic from international carriers be stricken from the law.

In 1945 resolutions calling for study of the international merger problem again were introduced in Congress and further hearings were held. No new action resulted from the Congressional hearings, however. Senator McFarland, on discovering that the Department of State no longer supported merger while other executive agencies and the FCC favored it, took the position that Congress could do nothing until the executive agencies arrived at a common policy.

In 1946 the newly organized Telecommunications Coordinating Committee, at the suggestion of the Navy Department, tried to work out a Government policy on merger. The Committee was unable to reach a unanimous recommendation after thorough exploration of the issues by an ad hoc subcommittee. This ad hoc group submitted a report in

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December 1946, which set forth the arguments of proponents and opponents of merger. These arguments are summarized below.

Arguments for Merger

The arguments by proponents of merger of the international record communication companies included the following points:

Frequency Conservation.--By eliminating duplications in circuits and inefficiencies in routing, unification would release a large number of frequencies, which could be used to handle increasing traffic volumes, establish new circuits, improve speed and reliability of existing services, and promote the development of new services. Such an elimination of the wasteful use of frequencies would relieve pressures on the radio spectrum and would strengthen the United States position at international conferences in urging adopting of new techniques designed to make the most efficient use of frequencies.

Economic Savings.--Unification might permit the retirement of a large amount of the telegraph plant maintained by competing carriers. Not all of this plant is necessary to meet the nation's communications requirements. Retirement of some of it would result in savings in communications costs, as well as the ultimate reduction in the investment on which a return is earned, and could be reflected by substantial rate reductions and improved service.

Traffic Routing.--Traffic between the United States and foreign points may be handled over a variety of competing cable or radio routes, some of which are more advantageous than others to United States

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interests. Merger would permit each facility to be used to its best advantage, technically and economically.

Standardization.--Unification would promote the use of uniform operating practices and equipment throughout the unified system, a procedure which would strengthen the United States position in favor of worldwide standardization. Standardization among American companies could be at the highest technical level, since merger would permit a complete interchange of patents and pooling of research activities and talents.

Relations with Foreign Carriers.--Merger would place the American international communications system more closely on a par, so far as influence and bargaining power are concerned, with the foreign monopolies with which it must deal. This would permit the unified carrier to insist on equitable operating arrangements and would enable the United States Government to give more direct guidance and support to the policies of the unified company in its dealings with foreign systems.

Improved Regulation.--Merger would help the Federal Communications Commission to achieve its objectives of providing a worldwide communications system, with adequate facilities at reasonable charges. A unified carrier could be required to extend service to foreign points on a worldwide basis, whereas it might be difficult to impose such a requirement on one out of several competing carriers. Because of the great divergence in earning power among the various carriers, reasonable

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rates for the most prosperous company would tend to drive competing carriers out of business, a circumstance which may deter completely effective regulation. Unification would also facilitate the severance of the telecommunications system from intercorporate manufacturing affiliates and from foreign activities.

Security.--Merger would foster security in the sense that it would provide a more efficient, integrated, and standardized communication system, which would be available for military use and planning, but it would have little or no effect upon cryptographic security, loyalty of communications employees, or anti-sabotage measures.

Arguments against Merger

Of the Government departments represented on the Telecommunications Coordinating Committee, those opposed to merger based their case on these major points:

Monopoly.--United States economic policy, both in the domestic and in the foreign field, traditionally has been opposed to the creation of monopolies, especially those which would receive special Government-sponsored privileges. Generally, a favorable political, economic, and technical climate results from competition tempered to the extent necessary by regulation. In view of this traditional policy, the proponents of merger must sustain a very heavy burden of proof that merger is in the national interest.

Frequency Conservation.--It is recognized that a merger would have the potentiality for the immediate conservation of a substantial

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number of frequencies. However, the strength of a monopoly in its dealings with the regulatory agency might make it difficult to realize this saving.

Economic Considerations.--Substantial economies could be accomplished under a merger. But, even if potential savings might be immediately realized, it is questionable from a long-run point of view whether the continued existence of competition would not result in greater economic advantages.

Regulation.--Experience indicates that regulation of a monopoly is difficult. Standards of performance are not readily available to the regulatory agency. The self-policing of an industry inherent in a competitive situation is not present in a monopoly. These factors outweigh the apparent superficial advantages which a regulatory agency might have in dealing with a merged company.

Other Considerations.--Other considerations such as improvement in traffic routing, increased standardization, and the promotion of advantageous relations with foreign carriers also can be achieved through competition supplemented by vigorous regulation. It was not contended that perfect results would be achieved in those fields, but it was argued that, on the whole, results at least comparable with those under a regulated monopoly would be possible.

Economic Outlook for U. S. Cable and Radiotelegraph Companies

Although many factors have been involved in previous arguments over merger of the international record communication companies, the

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question now appears to rest primarily on whether the companies can survive economically without merging. All of the Board's discussions of the subject with industry and labor leaders and Government officials stressed the economic problem, while other elements of the controversy were given secondary consideration.

For that reason, the Board arranged for an economic analysis of the industry and a forecast as to its future profitability to be made by the engineering firm of Ford, Bacon & Davis. The balance of this Chapter, except for the Conclusions, is adapted from the survey made by that firm.

Description of Facilities

Major Carriers.--The Western Union Company operates 14 submarine cables, of which eight connect the United States with England, two with the Azores, and four with the West Indies. Five of the eight lines to England are leased until the year 2010 from a British company. The 14 cables measure 30,000 nautical miles and permit the company to furnish all classes of telegraphic message service directly, or indirectly through connecting carriers, to all parts of the world.

Three affiliates of the International Telephone and Telegraph Company, all of them wholly-owned subsidiaries of the American Cable & Radio Corporation, are engaged in the American international record communications business. Six cables between New York and Europe, via the Azores, Nova Scotia, and Newfoundland, are operated by the Commercial Cable Company. Total length of its lines is 22,000 nautical miles.

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They make possible cablegram service to all parts of Europe, Asia, and Africa. Through affiliated organizations, the company also provides message service to Latin America. All America Cables & Radio, Inc., has five lines, measuring 24,000 nautical miles, between the United States and South America, Central America and the West Indies. In addition, it operates several cables and a number of international radiotelephone and radiotelegraph stations in South America. Mackay Radio & Telegraph Company, Inc., maintains direct radiotelegraph circuits to some 40 overseas points, furnishing all classes of record communications service on a worldwide basis. It operates radio stations in New York, California, Hawaii, the Philippines, and Tangier. The Tangier station is used to relay messages to points in eastern Europe, North Africa, the Near East, and India.

RCA Communications, Inc., provides worldwide message service through operation of direct radiotelegraph circuits to some 60 overseas points and arrangements with connecting carriers to reach other points. The company has four radio stations near New York City and one near San Francisco, as well as stations in Puerto Rico, Hawaii, the Philippines, Haiti, Dominican Republic, Okinawa, and Tangier. Direct circuits reach Mexico, Central America, South America, the West Indies, Europe, the Near East, the Far East, Australia, Oceania, and North and South Africa. The company also operates a radiotelegraph circuit between New York City and San Francisco for domestic haul of international messages and a leased wire circuit between New York and Washington, D.C.

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Smaller Carriers.--Radiomarine Corporation of America furnishes all classes of radiotelegraph message service from shore-to-ship and ship-to-shore. Transmitting and receiving stations are located on both coasts of the United States and at St. Louis, Mo., Buffalo, N.Y., and Port Arthur, Tex. The company also manufactures, sells and services mobile radio station equipment.

Press Wireless, Inc., provides a specialized radiotelegraph service to newspapers and press associations. It operates radio circuits to some 19 overseas points, and has stations at New York, San Francisco, Manila and in Europe. The company also owns subsidiaries that manufacture and sell communications equipment in Latin America.

Globe Wireless, Ltd., controlled by the Robert Dollar company, furnishes telegraphic message service from the United States to Honolulu, Manila, Shanghai, and Havana. Its radio stations are located in New York City, San Francisco, and Honolulu. Globe also operates a ship-shore radiotelegraph message service.

Tropical Radio Telegraph Company is affiliated with the United Fruit Company. Tropical's message service is carried over direct circuits to Central America and the West Indies and by connecting carriers to the rest of Latin America. In the United States, it operates radiotelegraph stations at Boston, Miami, and New Orleans. In Central American countries, 20 stations provide both radiotelegraph and radiotelephone services.

The United States-Liberia Radio Corporation was established by the

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Firestone Tire & Rubber Company. Its operations are restricted to a radiotelegraph circuit between Akron, Ohio, and Harbel, Liberia.

The South Porto Rico Sugar Company furnishes radiotelegraph service to five Caribbean points and to ships at sea.

Financial Performance

The financial data used in the study were obtained directly from the companies involved. In the course of obtaining the financial information, conferences were held with accounting executives of the principal companies.

The information contained in Tables I, II, and III was secured from the larger companies and included balance sheets, income statements, and various related data for each of the years 1944 to 1949 and for the nine-months period ended September 30, 1950. The principal purpose of this information was to provide a knowledge of financial status and operating results through the recent years and up to the latest date for which actual data were available at the time of undertaking the study.

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TABLE I

INTERNATIONAL RECORD COMMUNICATIONS COMPANIES OF THE UNITED STATES

GROSS OPERATING REVENUES - YEAR 1949

Major Carriers	Revenue (Thousands)	Per Cent of Total
Western Union Telegraph Company (Cable Division) (WUC)	$ 8,208	17.85
American Cable & Radio Corp. Subsidiaries:		
Commercial Cable Company (CCC)	3,951	8.59
All America Cables & Radio, Inc. (AACR)	9,713	21.12
Mackay Radio & Telegraph Co. (MRT)	6,528	14.19
Total A.C. & R. System	20,192	43.90
RCA Communications, Inc. (RCAC)	12,226	26.58
Total Major Carriers	40,626	88.33
Smaller Carriers		
Radiomarine Corp. of America (RM)	1,277	2.78
Press Wireless, Inc. (PW)	1,294	2.81
Globe Wireless, Ltd. (GW)	1,306	2.84
Tropical Radio Telegraph Company (TRT)	1,406	3.06
United States-Liberia Radio Corporation	78	0.17
South Porto Rico Sugar Company	7	0.01
Total Smaller Carriers	5,368	11.67
Total All Companies	$ 45,994	100.00

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TABLE II

AGGREGATE ADJUSTED NET INCOME BEFORE INCOME TAX

MAJOR CARRIERS - INTERNATIONAL INDUSTRY

(Thousands of Dollars)

Year	Basis for * Measure	Adjusted Net Income before Income Taxes	Income in Per Cent of Measure
1946	61,478	1,622	2.6 %
1947	60,830	-2,395	-3.9
1948	61,206	-738	-1.2
1949	60,710	1,177	1.9
1950 (9 mos.)	63,605	2,618	4.1

* The basis for measure of income is in each instance the sum of net property and actual net working capital.

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Table III

Comparison of Gross and Net Operating Revenues
Major Carriers - International Industry
(Thousands of Dollars)

Company	1946	1947	1948	1949	9 Months 1950
Gross Revenues					
WUC	7,790	7,402	8,224	8,208	5,993
CCC	4,445	4,642	4,144	3,951	2,854
AACR	8,639	9,934	9,835	9,713	7,991
MRT	4,767	6,041	5,599	6,528	4,919
RCAC	13,226	11,700	12,386	12,226	9,674
Total	38,867	39,719	40,188	40,626	31,431
Net Revenues					
WUC	1,296	613	1,411	1,505	1,438
CCC	-1,039	-1,896	-1,075	-1,111	-597
AACR	673	554	324	536	1,019
MRT	-1,042	-837	-818	71	224
RCAC	2,481	-29	752	854	959
Total	2,369	-1,595	594	1,855	3,043
Net Revenues in Per Cent of Gross Revenues					
WUC	16.6%	8.3%	17.2%	18.3%	24.0%
CCC	-23.4	-40.8	-25.9	-28.1	-20.9
AACR	7.8	5.6	3.3	5.5	12.8
MRT	-21.9	-13.9	-14.6	1.1	4.6
RCAC	18.8	-0.2	6.1	7.0	9.9
Average	6.1%	-4.0%	1.5%	4.6%	9.7%

As shown in the preceding table, the average ratio of aggregate net revenue to gross revenue has improved since the low point or deficit in 1947. The Commercial Cable Company continues to show a net revenue loss in 1950 although its position has improved. While to some extent the continuing net revenue losses of Commercial Cable

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may be attributed to the decline in gross revenue, it is evident that total operating costs are higher in relation to gross revenues than those of the other major carriers.

Comparative Utility of Services

In making their survey, the engineers prepared a questionnaire to determine the basic objectives sought in using each type of rapid international communications (air mail, telephone, cable, and radiotelegraph) and the experiences of the users with respect to how well these objectives had been achieved. Selected customers were asked whether they were making a conscious effort to change from one type of communication to another. They were also questioned as to amounts presently spent on cables and their estimates as to the amounts likely to be spent in the near future.

Information was sought to determine whether each type of communication did have its definite place in customers' operations. It was believed that if this were true and that each type was serving its purpose, it would be unlikely that the present pattern of services used would change much in the future. If customs and habits have been the main influence in determining the uses of each type, however, material changes in the pattern might occur.

The consensus was that the use of a particular type of communication is dictated by its utility and that each fills its particular need. It does not appear, therefore, that there are any conditions that may materially change the pattern in the near future. Each type has been available for a considerable period of time and the pattern

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has become fairly stabilized.

The survey disclosed that there is a definite field for cable and radio messages in which they are unlikely to be supplanted by either the telephone or air mail. In addition, there are fringe areas in which the use pattern of telephone, telegraph (cable and radio), and air mail is variable. These fringe areas, however, appear to be relatively small compared to the area in which the use of cables and radiograms is fixed.

Answers to the inquiries indicated that the various types of rapid communications are used under the following conditions:

Cables and Radiograms -

1. When speed and certainty of delivery at a definite time are necessary, and
2. When a written record is important, or
3. Where cost is a consideration as compared with long distance telephone, or
4. When immediate responses or a conference are not necessary.

Overseas telephone -

1. When immediate decisions or responses are necessary, or
2. When a conference (back and forth conversation) is desirable.

Air Mail -

1. When high speed is not essential, and

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2. When certainty of delivery as of a definite time is not essential, or
3. Where the length of the message renders a letter preferable, and
4. Where communication costs are of importance in comparison with the amount of the transaction affected.

It was generally agreed that the international telegraph service is, on the whole, very good and reliable. Besides the features noted above, cables and radiograms have the additional advantage of getting prompt attention whereas letters may be set aside temporarily. A large insurance company stated that this is one of the chief reasons it uses cable and radio messages to the extent it does. Some companies attempt to overcome this by writing important air mail letters on special forms that resemble cables but they have found that this practice is not altogether successful.

The delivery time for "ordinary" telegraph messages is said to range, at present, from about ten minutes (in the case of major direct points like London and Paris) to about an hour. A cable or radio message can be sent from New York to London and a reply received in 20 to 30 minutes. Prior to World War II dealers in arbitrage used to send cables and receive replies in from two to four minutes, but such service is not rendered now.

Many companies reported extensive use of the night letter classification of cable and radio service. This is borne out by the records

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of the major international companies which show that about 64 per cent of the public messages sent during the third quarter of 1950 were night letters. This service assures delivery at the start of the following business day, a period of 12 hours elapsed time from New York to London, whereas an air mail letter from New York to London, under minimum pickup and delivery conditions, requires 18 hours. There is, therefore, no question as to the necessity for a cable or radiogram when delivery at the start of the next business day must be assured.

Telegraph service also is preferred to long-distance telephone in many cases except when immediate decisions or discussions are required because (1) delivery at a certain time is more sure, (2) it is usually less expensive, and (3) it gives a written record.

The principal advantages of long-distance telephone messages lie in the ability to engage in discussion, which may be important in clarifying certain situations. They also get immediate attention whereas a telegram or a letter may be put aside. Great strides have been made in international long-distance telephone service and the average elapsed time to put through a call has been materially reduced. The major time-consuming factor, however, is that of locating the person called. This may take considerable time. In fact, it was said to be common practice to send a cable to make an appointment for a telephone call.

While the cost per word on the telephone may be quite low as compared to a telegram, it was the consensus that the actual cost per

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message generally was far less by telegram than by telephone. In the latter case, much time is often wasted in amenities and irrelevant conversation whereas in a telegram the heart of the message can usually be compressed into relatively few words.

While the transmission over the telephone was said to be usually satisfactory, it is not entirely reliable and instances were cited where poor transmission seriously impaired the value of telephone service. This is not apt to occur with telegrams, for if the message can not be sent one way it can be rerouted and will get through by another way.

Although air mail is widely used and has taken business from the cable and radio industry in the past, it appears that this competition has reached a stable condition. Two factors have been cited as limiting the use of international air mail--first, the possibility of planes being grounded or diverted on account of weather conditions, and, second, regardless of the flight speed, pickup and delivery services are time-consuming. Delivery service is said to be particularly poor in all foreign countries except in the major cities. The engineers were advised that for most inland points at least 24 hours should be added to the scheduled 16-hour service to London, Paris, etc. One company having extensive operations in the Near East stated that the normal air mail delivery service from its office in New York to its branches in the field was from five days to one week. This compares with a normal telegram service of a few hours at most for ordinary

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messages and overnight for night letters.

The main drawback, however, appears to be the uncertainty as to delivery time of air mail. While practically all air mail messages might go through on schedule the fact that a few might be delayed is a serious deterrent to sending any message by air mail when certainty of delivery time is of material importance. Air mail is widely used to send longer messages than would be economical by cable or radio, to send documents and confirmations, and to send many messages for which certainty of delivery is not important. For other purposes, however, the uncertainty of delivery of air mail is often too great a risk for the savings involved.

It appears, therefore, that except to correct abuses by correspondents in the use of cables and telephone by periodic expense-saving campaigns, there is little likelihood that air mail will seriously encroach further on the cable and radio business.

Distribution of Business Among International Carriers

Except as specific cable and radio companies have direct service to certain areas, or when they serve certain areas exclusively, customers reported dividing their cable and radio business among the various companies in the industry. One bank said that it follows a policy of reciprocity and distributes its business approximately in proportion to the balances maintained in the bank by the various carrier companies. One large insurance company conducting business mainly with London through night letters reported confining its business

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almost exclusively to one carrier because of the satisfactory service received. However, this is an exception, as most companies said they believed that by dividing their cable and radio business they maintained competition and thus got better service from all carriers.

Potentialities of Merger

Rates, Service and Development.--The fundamental purpose of any merger is to save money. This is generally accomplished by greater flexibility and efficiency in the use of facilities, reduction in duplicated facilities, and savings in administrative and labor costs. A portion of the monetary savings is assignable to the stockholders up to a reasonable return on the investment; that is, a return sufficient to assure adequate financing of current plant investment and reasonable development costs.

It is to be expected that at least some of the savings derived from a merger would be reflected in direct public benefits; principally through reduced rates. Also, it may be reasonably assumed that any development expenses ultimately would be reflected in similar direct public benefits.

The fact that the Western Union-Postal Telegraph merger in the domestic field was followed by reportedly poorer service and higher rates is not a criterion unless it may be shown that the service would have been better and the rates lower if the competitive situation had continued. The evidence at the time of that merger indicated that the Postal Telegraph Company was on the verge of going out of business, in

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which case the service, at least in so far as coverage is concerned, might have been less than now exists under the merged companies. The engineers' survey of communications users, including the State Department, clearly indicated that there was a greater interest in service than in rates. Rate reductions are a measurable public benefit and may, therefore, be overemphasized and given too much weight, to the detriment of service. To this end, it is important that a large share of any merger saving be directed to maintenance of adequate service and to development expenditures having the same ultimate objective.

The allocation of income, after operating expenses and taxes, is generally subject to supervision by the regulatory authority. At the same time, the regulatory authority is expected to police the matter of adequate and proper service and this directly affects operating expenses. Excessive service to the detriment of adequate development or rate decreases may be just as improper as insufficient or relatively poor service. Competition may cause excessive service in competitive areas to the detriment of service in other areas.

The matter of the maintenance of less profitable or unprofitable services is of considerable importance in considering the question of merger versus competition. While competition may serve as an incentive for the preservation of borderline services in competitive areas, obviously the maintenance of dual service, in areas where even one service may not be justified, is uneconomical and has the effect of increasing costs over the whole system which will be reflected

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ultimately in the overall rates of both competing operations. The effect of merger is to:

1. Eliminate unnecessary duplication of services, and
2. Remove the incentive to maintain any service in areas where revenues are insufficient to support costs.

While the first is a beneficial result of merger, the second may be a disadvantage overcome either through an enlightened management or rigid supervision by the regulatory authorities. Actually, a monopoly, through the elimination of duplicated out-of-pocket expenses and general reduction in assignable overhead charges, should be better able to sustain certain borderline operations. Finally, certain other points not now served may become economically feasible to serve under a unified operation.

Customers' Attitude.--The customers consulted were almost unanimous in their reaction to the possibility of a merger of all cable and radio companies. All but one of the customers opposed the suggestion in principle as being detrimental to the type of service they might expect to receive. Although the engineers' questionnaire did not seek their opinions on this subject, practically all of them volunteered their views when the reasons for the survey were explained to them. In substantiation of their views, many cited their experiences with foreign carriers, most of which are monopolies. These experiences indicated to them that, without competition, carriers were very indifferent to customers' reactions. Inquiries regarding confirmation of messages originating abroad often

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were unaswered for several days or disregarded entirely. This condition appeared to be so common as to convince them that it was a definite result of a monopolistic position. Also, while a number of the largest users of domestic telegraph services said that they had not noted any reduction in the quality of domestic service after the Western Union Telegraph and Postal Telegraph merger, another and even larger group stated that they had observed a definite deterioration in the quality of service since that merger. A few users expressed the view that there might be no objection to merging all the cable companies into one group and all the radio companies into another as this would still retain a degree of competition which they believe to be essential to maintaining telegraphic service of high quality.

Labor's Position.--Consideration should be given to the contention that wage scales in the record communications field have been held down to some extent because of the long-standing record of unprofitability of the industry. It is to be anticipated, therefore, that labor would expect a share of any financial benefits resulting from general improvement in the business, whether it be the result of merger or any other cause. Consideration must also be given to the probability of delay in savings on labor costs

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under a merger. It is unlikely that permissive legislation would allow an immediate general reduction in force. Rather, it would probably require retention of employees for periods of time in proportion to their length of employment in the industry.

There does not appear to be any unanimity on the part of labor for or against merger, expressed opinions ranging from unqualified approval through conditional acquiescence to outright opposition. It appears that labor is not satisfied with the results of the Western Union-Postal Telegraph merger. Opportunity for expansion of labor's views would normally be provided through public hearings held in connection with any proposed legislation.

Carriers' Position.--The major international carriers told the engineers that they are in favor of permissive legislation for merger of international record communications. There is no positive evidence that these organizations actually would merge under such legislation. There may be an effort on their part to agree upon a merger but there is considerable difference of opinion among them as to the terms and conditions.

Western Union has suggested not only that the international operations should be merged but that they should be consolidated with

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its domestic telegraph business under its management. This company claims, among other reasons, that the terms of its lease of five cables from Anglo-American Telegraph Company, Ltd., might prove an absolute block to the transfer by Western Union of these five cables into a merged company which did not include Western Union's domestic operations.

American Cable & Radio Corporation and RCA Communications, Inc., adhere to a consolidation of international facilities only.

Because of these differences of opinion, it has been stated that any permissive legislation should at least clearly indicate an intent, if not contain a specific directive, as to the desirability of such mergers. This should be sufficiently emphatic so that it could be used to resolve inter-company differences.

Radiomarine Corporation of America would participate in a consolidation of international facilities only to the extent of its ship-shore communications, but not its equipment manufacturing, selling and servicing operations.

Press Wireless, Ltd., and the South Porto Rico Sugar Company told the engineers that they do not oppose permissive merger legislation of international companies, provided they are adequately protected from unfair competition by the merged organization and from any undue pressure upon them to join any such merged operation. These companies would remain outside of any merged operation resulting from permissive legislation.

Tropical Radio Telegraph Company is the only carrier opposed to

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merger. Should such legislation be written, however, their position is similar to that of Press Wireless. Globe Wireless, Ltd., said that it does not, at this time, desire to express any views on an international merger. United States-Liberia Radio Corporation has not expressed any opinion.

Accordingly, it may be said that the consensus of the industry is for permissive merger of international record communications specifically divorced from domestic operations with provision for adequate protection of the carriers which do not wish to join the consolidation.

Legislation.--There appears to be some difference of legal opinion as to limitations in respect of consolidation or mergers under present laws. It is agreed that a clarification of Congressional intent would be desirable and that any merger of international companies now in competition probably would require specific legislative exemption from anti-trust law provisions.

Company officials said they believed that mandatory legislation is unnecessary, is not in the public interest, and probably would be a step in the direction of ultimate Government ownership.

In general, it appears that any legislative action permitting merger of international record communications companies should contain protections for the independence of companies desiring to remain in an independent status, specifications as to protective measures for labor, and protection from alien control. It should also provide for all possible economies. Resulting savings should be reflected in reduced

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rates after provisions have been made for sufficient earnings to allow for adequate capitalization, reasonable research and improvement in facilities, and good and sufficient service to the public.

Savings under Merger.--The major carriers, in 1949, made studies of their facilities and operations to determine those facilities which would be in excess of the industry's requirements in the event of a merger. A review of these studies indicates that where duplicate telegraph cables or radio transmission and receiving equipment were operated, the oldest facilities were to be abandoned. Where the companies operated competing branch offices at particular points, these would be combined into one office.

The facilities which were determined as excess in the event of merger had a gross book cost of $13,279,000 for cable plant and $6,471,000 for radio plant. The gross costs less depreciation were $3,752,000 and $2,753,000, respectively. Combining the facilities of various companies would involve some expense in consolidating offices and combining cable and radio circuits into one location in order to make possible further savings in operating cost.

The engineers discussed the combining of facilities with representatives of the principal companies which would be involved in a merger and were assured that the capacity of the merged facilities would be sufficient to handle any annual volume of business which the industry might reasonably expect in the future up to 800 millions of words. It was further explained that recent developments in the industry would

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permit an increase in capacity of about 50 per cent in the cable facilities and two or three times the present capacity in the radio facilities. The additional investment required for these increases in capacity would be relatively minor.

The companies also made studies of the personnel and the amount of operating expense necessary to staff and operate the combined facilities properly. Estimates were prepared of expenses for conducting operations and maintenance of the cable and radio facilities and for general and administrative expenses. These estimates involved the projection of the expenses of the individual companies as now constituted and a pro forma estimate of the merged expenses. The difference between them indicated the savings to be realized from a merger of the industry. The annual savings that might be anticipated, as estimated by the companies, if the industry were merged, are as follows:

Company Estimates of
Annual Savings from Merger

	Amount (in thousands)
Conducting Operations Expenses:	
Cable	$ 1,464
Radio	2,633
Maintenance and Repairs Expenses:	
Cable	678
Radio	540
General and Administrative Expenses:	1,565
Total	$ 6,880

The estimated savings resulting from the proposed merger were based

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on a volume of business ranging from 300 millions to 500 millions of words annually. However, since the facilities provided for a merged operation are stated to be adequate to handle a volume of up to 800 millions of words, there should be no necessity for any additional facilities to handle the increased volume of business indicated by the engineers' study of future prospects.

It follows, therefore, that the savings expected from a merger as estimated by the companies in 1949 took into consideration all expenses of a fixed or basic nature that might be eliminated by a merger. Thereafter, if the volume of business increased, any additional expenses would be of a variable nature and would be substantially the same in either a merged operation or an individual company operation.

The engineers did not make any independent estimate of the savings that might be realized from a merger of the several companies, nor was a detailed study made of savings estimated by the companies. However, a review of their working papers indicated that consideration was given to all of the principal factors involved in the merger. The methods and bases used in making estimates were sound and the results seem reasonable. There are, however, certain observations applicable to the companies' estimates which are discussed below.

Since the companies' estimates were prepared in 1949, there has been an increase in wage rates. This would mean an increase in savings from merger over the original estimates. The extent of the wage increase in relationship to wages paid at the time the merged savings

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were computed could not be determined without an exhaustive analysis. A review of the operating expenses of the five major companies in the years 1949 and 1950, however, indicated that there had already been a substantial reduction, particularly in salaries and wages. Such savings may be attributed to modernization of facilities, devaluation in foreign currencies, and some economies of the same nature as those attributed to savings resulting from a merger. To the extent that savings in this latter category have already been made, they could not again be realized in the event of merger but would tend to offset any increase in the savings as a result of wage adjustments. It is also recognized that among the parties to the merger, there are certain differentials in wage scales. In order to place all employes on a uniform basis, the tendency would be to increase some wage rates, which would reduce the indicated savings resulting from a merger.

The companies' estimates made no allowance for savings in depreciation expense. It is to be expected that if facilities were to be reduced, there would be a corresponding reduction in depreciation expense. However, it is recognized that in the event of merger, some arrangement would have to be made with the Federal Communications Commission to amortize the amount of abandoned facilities. Since any estimate of such an arrangement would be largely conjecture, no adjustment of depreciation expense has been made.

The companies, in their estimates of savings, did not give any consideration to changes in pension expenses. Discussion with the

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company representatives led the engineers to conclude that the current pension plans of the individual companies are not comparable. In the event of a consolidation, a uniform pension plan would have to be adopted for the new organization. It is possible that the existing plan which is most favorable to the employes would have to be adopted, and this would tend to increase pension expenses. However, the reduction in the number of employes as a result of merger would tend to decrease the overall pension expense. It is also recognized that the reduction in the number of employes would reduce the amount of payroll taxes, which also was not considered in the companies' estimate.

From the foregoing discussion, it will be recognized that an independent estimate of the profitability of a merger would require a detailed and lengthy study which was not indicated for the purpose of this survey. It was the opinion of the engineers that the savings resulting from a merger as estimated by the companies were reasonable as applied to conditions existing in 1949. The engineers felt that the net effect of the offsetting factors discussed above and changes in conditions since 1949 would not materially alter the companies' estimates and that such savings therefore could reasonably be applied to projected levels of operation.

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Estimates of Future Business

The method used by the engineers in preparing their estimates of future business for international record communications systems included statistical studies and limited customer survey. Statistical studies were made to determine whether any economic indicators could be found that parallel the curve of international telegraph revenues in the past and hence might be used to estimate the revenues in the future. The customer survey was made to find out whether customer policies might materially alter the present pattern of distribution of rapid communications and thus affect the estimates established by the statistical method.

The engineers felt that as the actual users of telegraphic services determine the volume of business, their reactions would establish the pattern for the future. Accordingly, the customer survey sought to find out the conditions under which the various types of rapid communications are used, as well as any indications of intentions to use cables and radio to any greater or lesser extent than in the past.

This survey was conducted by interviews with responsible persons in 35 companies in 12 different industries. The aggregate cable and radio business done by these companies amounts to about $2,400,000 per year, or 7 per cent of the total public outgoing cable and radio revenues in the year 1949.

The extent of the survey was limited by the time available but the unusual uniformity of the responses indicated that a pattern of answers had been established and that it was unlikely that more

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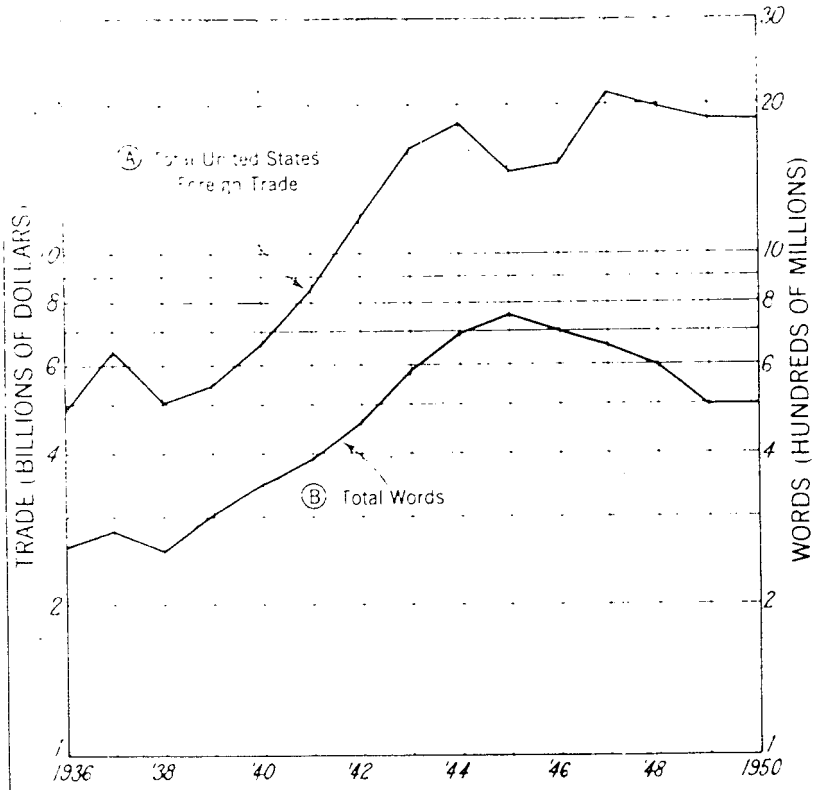


REPORT

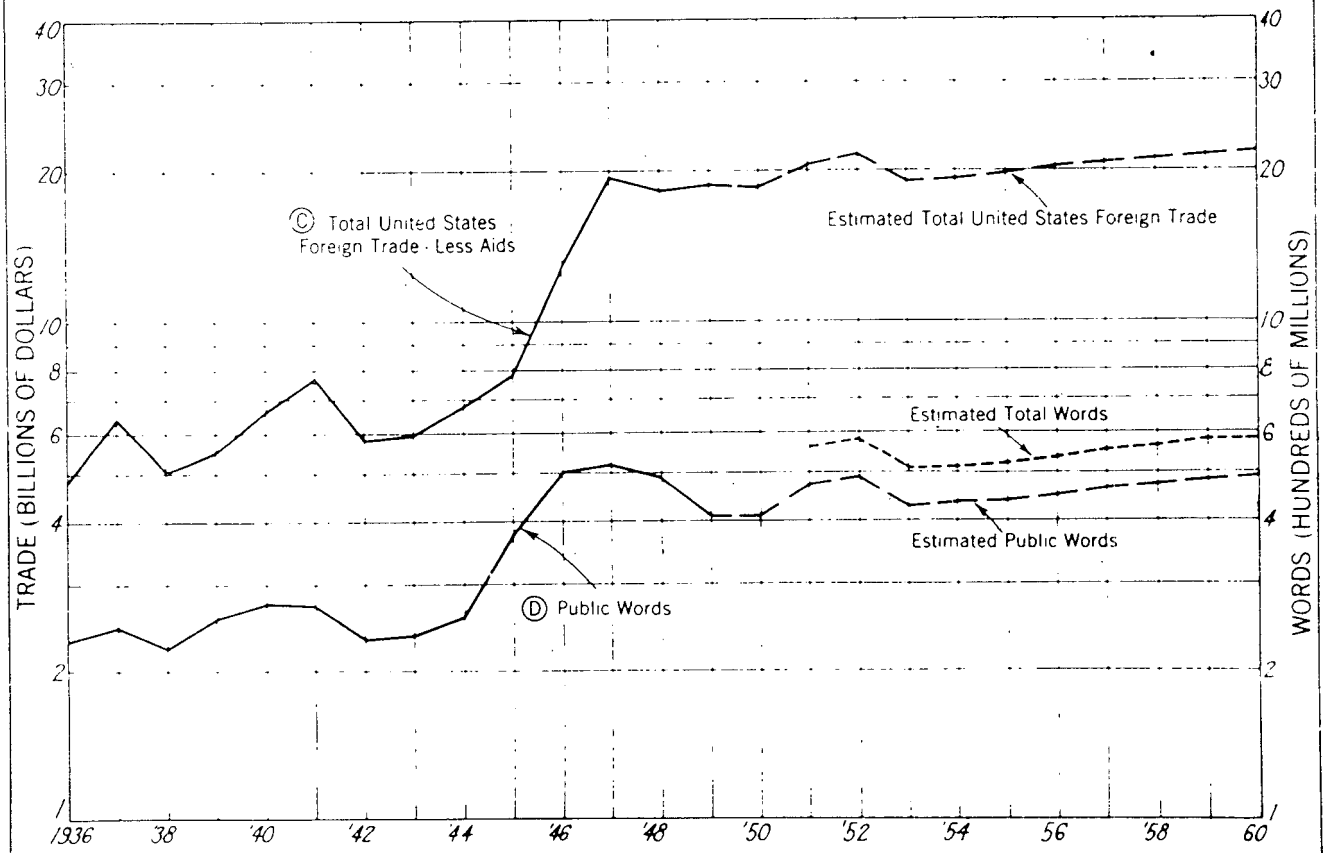
President's Communications Policy Board

Washington, D. C.

INTERNATIONAL TELEGRAPH VOLUMES AND UNITED STATES FOREIGN TRADE

Ford, Bacon & Davis
Incorporated
Engineers

NEW YORK CHICAGO PHILADELPHIA LOS ANGELES



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interviews would materially have changed the picture.

Statistical Indicators.--The engineers tested several statistical indicators to determine their correlation with the volume of telegraph business. Among these, they investigated the possibility of using the volume of foreign trade (total of United States imports and exports) as the indicator of volume in international record communications. To test the accuracy of this economic indicator, the engineers examined the relationship of the volume of words (total of incoming and outbound) and the volume of foreign trade, not only for the world as a whole but for various areas of the world separately and for certain individual countries. In some instances, foreign trade with particular areas varied considerably from foreign trade with the world as a whole. It was found that, in general, there has been a similarity of trends between the volume of foreign trade and the volume of cable words not only for the world as a whole but for the various areas studied. While other factors than trade do, at times, affect the volume of words, foreign trade evidently has had the predominating influence on it.

The relationship of United States foreign trade with international telegraphic business is shown in the accompanying chart by the lines A and B. It will be noted that although there is a general similarity of trends, the correlation is not very close during the period 1941 to 1947. During the war period 1941 to 1945 the normal relationship between the volumes of words of public messages and other messages, including Government and press communications, was distorted. Normally, public

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words account for about 85 per cent of the total words, but in 1944 the public words dropped to a low of 37 per cent. Government words increased from the normal of about 4 per cent prewar to better than 30 per cent in 1944, and press words increased from a normal of about 10 per cent prewar to about 20 per cent in 1944. The remaining 13 per cent of the word volume in 1944 included "miscellaneous" messages, a low-rate classification used during the war for personal messages by members of the armed forces. In the first half of 1950 the percentages resumed the prewar pattern, i.e., public messages were 84 per cent, Government messages 6 per cent, and press dispatches 10 per cent of the total words.

Assumptions.--The projection of volume and revenue into the future involves making assumptions as to conditions that may prevail. The future trend of the indicators of volume and revenue can then be estimated. For this purpose, the Department of Commerce supplied estimates of U. S. imports and exports over the next ten years on the basis of assumptions made by the engineers. Among these were the probability of continued tension in the international situation through 1951 with no outbreak of large-scale hostilities, of a gradual decline in military expenditures beginning in 1953, of normal growth in gross national product after 1952, of no general economic recession during the decade, and of an immediate spurt in stockpiling of imported critical and strategic materials, with the purchases falling off rapidly after 1952. Assumptions which, in view of current conditions, the engineers felt

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were equally conservative were made with respect to exports from the United States.

Future Volume and Revenues.--In the field of international record communications, the preponderance of revenues is directly related to the number of words. The engineers therefore used words as representing the measure of volume of business.

Starting with 1950 conditions, the line for public words (Line D in the chart) was extended parallel with Line C to arrive at estimates of the volume of words for the short-range period 1951 to 1955 and the long-range period 1956 to 1960. The level of public words was then raised from 84 to 100 per cent to determine the volume of total words. On this basis, it was estimated that the average volume of words during the short-range future would be of the order of 540 millions of words per year and for the long-range would be of the order of 565 millions of words per year.

Multiplying the estimated volume of words by the average rate of 8 cents per word, the engineers concluded that the transmission revenues of the international cable and radio companies for the short-range period will be of the order of $43 millions per year and for the long-range period will be $45 millions per year, as compared with 1949 revenues of about $36 millions.

Estimates of Future Profitability.--The estimates of future profitability of the international industry, based on the operation of the carriers as separate corporate entities, were made by the engineers

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for the groups of major and smaller carriers.

The estimated international message revenue was allocated to the two groups on the basis of the average of the actual distribution of this revenue in the year 1949 and the first nine months of 1950. This resulted in an allocation of 90 per cent to the major carriers and 10 per cent to the smaller carriers. To the message revenues thus allocated were added the estimates of other revenues as they applied to the two groups.

The estimates of gross revenues for the major and smaller carriers for the short-range and long-range periods were as follows:

Estimated Gross Revenues
International Industry
(Thousands of Dollars)

	Short-range Average Year	Long-range Average Year
Major Carriers		
International Message Revenue	38,880	40,680
Other Revenues	7,210	7,210
Total	46,090	47,890
Smaller Carriers		
International Message Revenue	4,320	4,520
Other Revenues	1,797	1,797
Total	6,117	6,317

The estimates of future profitability are based on the above estimated gross revenues to which have been applied estimated revenue deductions and other income account items. Actual totals for the year 1949 are included in the following estimates of future profitability of

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Measure of Actual and Estimated Income
International Industry

(Thousands of Dollars)

Major Carriers	Year 1949	Estimated Short-range Average Year	Estimated Long-range Average Year
Basis for Measure	56,596	58,369	58,618
Net Income before Income Taxes:			
Amount	828	5,966	7,308
Per cent of Basis for Measure	1.5%	10.2%	12.5%
Smaller Carriers			
Basis for Measure	8,240	8,988	9,164
Net Income before Income Taxes:			
Amount	309	1,164	1,307
Per cent of Basis for Measure	3.8%	13.0%	14.3%

General Observations

It is clear from what has been set forth above that the privately owned U. S. international telecommunications network is an invaluable asset to this country in peace and an indispensable military facility in time of war. During the early part of World War II, this network was almost the sole means of linking the U. S. headquarters with its forces overseas. During the war, of course, vast additional networks had to be created by the military services.

At the end of the war, those private facilities which had been taken over by the Government were returned to their owners and a portion of the Government network was dismantled. What was left of the Government-built net, however, is still a substantial communications facility,

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and this facility is now to a considerable extent competitive with the private systems. That is, Government-owned facilities built for military purposes are now used by both military and non-military Government departments for administrative and other non-security traffic which might be handled by the common carrier companies. Faced already with serious economic problems, these carriers are now faced also with a Government-owned competition which handles much of the business of the carriers' biggest customer--the Government itself. At the same time, it is to the Government's own best interest to see that the private carriers remain strong, for their facilities may be needed again in time of crisis. Indeed, they are needed now.

The President's Communications Policy Board can hardly enunciate a formula which will at once solve for all time this critical problem. For the problem changes from year to year, almost from day to day. It must be under continual surveillance and Government policies and practices must be flexibly adapted to meet changing conditions.

What has concerned us is that there is no adequate mechanism for dealing with the problem, for examining its nature, or for evolving solutions. For example, Federal agencies now decide for themselves at something less than top level which portion, if any, of their overseas traffic shall be handled by private or by Government facilities. And these decisions are based entirely on considerations of convenience, availability of circuits, or apparent cost and certainly not on consideration of how their actions may affect the health

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or even existence of the private carriers.

We believe the Government must have a mechanism for keeping under continual review the way in which privately owned international telecommunication companies are affected by Government policies and procedures. The Government should adopt the general policy that it will seek in every feasible way to follow such procedures as will maintain the health and strength of the common carriers. The Government should avoid, within limits set by national security, such procedures as weaken these carriers.

Urgent recommendations have been made to Congress that legislation be enacted to permit companies in the international cable and radio field to merge. One of these recommendations calls for one company to handle all American domestic and international record communications, thus providing an integrated system.

The Board finds no urgent or imperative reasons calling for an immediate merger of these companies; we conclude, on the contrary, that recent improvements in the profitability of these companies encourage a continuation of their present independent status. Moreover, in our judgment, a period of partial mobilization is not a good time to undertake a reorganization of these important components of our communications system.

Our conclusions in regard to merger are based on conditions as we now find them and can project them. We believe, however, that the situation can change and that the welfare of our national communications system demands constant attention to the condition and stability

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of these companies. We recommend that the Telecommunications Advisory Board, proposed in Chapter V, take this as one of its assignments, working jointly with the Federal Communications Commission. We are mindful of the strong conviction held by informed members of Congress and others that merger is desirable. While we believe it in the national interest that such a merger be deferred, we, too, recognize that changing conditions may provide compelling reasons for a merger later on. If so, these should be adequately anticipated by the Telecommunications Advisory Board and by the Congress. The kind of merger which might thus be indicated, as well as the timing of it, may be dictated not only by economic forces but by the wisdom of the Government's own policies vis-a-vis these companies and by technological developments. Such technological developments, in fact, may prove to be the conclusive factor in determining the future of these companies.

Conclusions

1. The Government should adopt the policy of maintaining the strength of the private competitive international communications system.

2. There should be a Government agency charged with the responsibility for implementing this policy.

3. Urgent recommendations have been made to Congress that legislation be enacted to permit companies in the international cable and radio field to merge. One of these calls for a single

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CHAPTER V

GOVERNMENT ORGANIZATION

Our study of each of the main telecommunications problems to which we have addressed ourselves has led us to a single common conclusion: The United States Government must strengthen its organization to deal on a continuing basis with telecommunications policies and problems.

In our study of the problem of scarcity of space in the radio spectrum relative to increasing demand, we found an enormously complex problem of frequency management. The Government is trying to cope with this problem by dividing responsibility for frequency assignment between the Federal Communications Commission and the President, and thus establishing a dual system of control over a single physical entity.

In our study of the problem of the relationships of Government communications activities to non-Government activities, we again found divided responsibility and a lack of conprehensive assignment of authority to deal with the problem as a whole. Nowhere did we find any agency or system of collaboration among existing Government agencies dealing comprehensively and continuously with policies or integrated execution of Government programs affecting non-Government telecommunications activities.

In our review of the question of merging the overseas operations of our commercial telecommunications companies, and in our examination of factors affecting the economic health of these and other commercial

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telecommunications carriers, we were struck first by the lack of economic and technical information on which we could base a sound conclusion. Although we decided, on the basis of the facts and testimony we were able to collect, that no Government action need be taken now to assure the financial soundness of these activities for the immediate future, we arrived at the strong conviction that the Government needs to strengthen its existing organization to keep abreast of economic, technical, and other data affecting the health of commercial telecommunications carriers, so that helpful measures can be taken promptly whenever conditions require them.

In our efforts to discover the current state of Government telecommunications policy as preliminary to recommending needed steps toward a total national communications policy, we once more encountered dispersion, confusion, gaps, and deficiencies in the product and performance of those agencies charged with telecommunications policy responsibilities.

Since our appointment, the nation has passed into a state of national emergency, and our country faces deepened crisis and heightened threat of war. Thus we examined the problem of the need for appointment now of a Board or Administrator of Defense Communications, to exercise the President's powers over the nation's telecommunications system, public and private, in the interest of the national security. Again we concluded that neither existing organizations, nor the creation of an ad hoc organization like the Board of War Communications, would suffice. We suggest that the permanent

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agency we describe below, headed by a board, or by a single individual, can discharge these responsibilities.

During the past year we have become aware of the possibility of radical technical developments which may affect fundamentally the economics and the engineering of our present telecommunications system, particularly in the international field. It is impossible for us to foresee the specific impact which these developments may have. But we are more than ever convinced that the Government requires a strengthened telecommunications organization to keep such developments under constant review.

Both the present and the potential threat of unfriendly interference to international communications underline the urgency of the need for this strengthened organization.

Dimensions of the Problem

The telecommunications field is one affected with the public interest.

Telecommunications by wire have long been regarded as such a business, and therefore appropriately subject to regulation by public authority.

Telecommunications by radio fall even more clearly into this class, since the basic medium they use for the transmission of information lies in the public domain.

Nature has presented the inhabitants of this world with what used to be called the "ether," the medium through which radio waves of all frequencies are propagated. Like the air we breathe, the radio spectrum is there for all to use, Unlike the air, there is

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not enough of it to accommodate all claimants. Everyone who uses a portion of the radio frequency spectrum automatically excludes others from using this same portion at the same time, unless the other potential user is far enough away geographically to cause or suffer only tolerable interference. Since impulses of certain frequencies can be sent by low power half way around the earth, the conflicting interests of peoples in all nations of the earth, as well as of all those within a single nation, must somehow be brought into harmony. Otherwise there will be chaos.

Clearly it is a responsibility of every government to manage this world resource, this element of the public domain, in such a way as to maintain an ordered use of the radio spectrum by its own citizens. Each government must also reach agreements with other governments for equitable sharing and mutually compatible use of this world resource.

The Government of the United States has recognized these responsibilities for many years, and has from time to time established a succession of agencies to deal with various aspects of this problem. But as the use of the radio spectrum has grown, as the Government has itself become a major user, and as other nations of the world have sought a larger share of the spectrum, the problem has outgrown the authority and capacity of existing Government agencies to deal with it.

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What are the major issues arising out of the problems and responsibilities the nation now faces in utilizaing its telecommunications resources--including both wire and radio--which existing agencies are admittedly not equipped to handle? We have found five.

1. How shall the United States formulate policies and plans for guidance in reconciling the conflicting interests and needs of Government and private users of the spectrum space--that is, for guidance in making the best use of its share of the total spectrum?

2. How shall the United States meet the recurrent problem of managing its total telecommunications resources to meet the changing demands of national security?

3. How shall the United States develop a national policy and position for dealing with other nations in seeking international telecommunications agreements?

4. How shall the United States develop policies and plans to foster the soundness and vigor of its telecommunications industry in the face of new technical developments, changing needs, and economic developments?

5. How shall the United States Government strengthen its organization to cope with the four issues stated above?

The first four of the questions require brief explanation.

1. Reconciling Uses of the Spectrum. This task--which is known as frequency management--is one of enormous technical complexity. Different portions of the spectrum have radically different propagation characteristics; that is, their range and dependability vary.

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Some are usable for long-distance and others only for short-haul purposes. Their efficiency also changes from night to day, and from day to day, and is affected by atmospheric conditions and by sun spots. Technical advances in the art alter the degree of possible use of a particular band. The difficulties inherent in these facts are aggravated by the increasing congestion of certain spectrum bands.

By better management of the spectrum, much more could be done with frequencies now available. There is opportunity for more effective sharing of frequencies, for more intensive use of individual frequencies, and increased economy in kilocycles assigned to each circuit. Sharing includes division both of time and of geographical area. Frequency-conserving practices call for use of the most efficient and stable receiving equipment available, compatible with economic soundness. These in turn permit smaller allocations of spectrum space to accomplish given tasks.

The assignment of space in the spectrum among private users (including state and local but not Federal Government agencies) is a responsibility of the Federal Communications Commission (FCC). The total amount of such space available for assignment, however, is not determined by the FCC. In effect, it is determined by the President, who is responsible for the assignment and management of those frequencies used by Federal Government agencies. The Interdepartment Radio Advisory Committee (IRAC) is the instrumentality through which frequencies are assigned to Federal users. Thus far,

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no national policy has existed to clarify this dual control of a single resource and thus to aid in governing the apportionment of space between private users and Government users as groups. No criteria have been established for use in choosing between the conflicting needs of a Government and a private agency.

2. National Security. In the present period of recurrent crisis, it is likely that we shall be faced with a continuing problem of adjusting the use of telecommunications--especially radio frequencies--to what may be violent fluctuations in the requirements for national security. Indeed, we may face a situation in which the President's emergency powers to control, take over, or close down communications facilities will have to be invoked, and arrangements for the delegation and exercise of those powers will be essential. We may also be faced with the necessity of creating wholly new telecommunication facilities.

Telecommunications of course play a major role in the economic and cultural life of the nation. They are the vital nerve system of our modern military establishment. Since spectrum space is demonstrably insufficient to meet both the full needs of national security and the full needs of other affairs, the latter must give way to the former in time of emergency. When the emergency has passed, frequencies and facilities must be restored to civilian use. To create an ad hoc agency to meet each crisis as it comes would be a clumsy expedient at best, and indeed, the problems of transfer and retransfer of spectrum space and of facilities for using it are too

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complex for ad hoc control to be adequate. A continuing mechanism is needed for the foreseeable future.

3. International Agreements. Just as the United States has no clear policy for dividing its share of spectrum space, so it has lacked satisfactory means of determining policy as a basis for negotiations with other nations for the world division of the spectrum. The United States, in preparing positions for international negotiations, has in effect asked Federal and other claimants to state their needs, and then presented the total as the United States requirement. In those portions of the spectrum where these totals have been small enough to fit within the world complement, our delegations to conferences have had a negotiable position. In some cases, however, the total stated requirements have exceeded not merely those which could reasonably be put forward as the proper United States share, but have actually exceeded the total physical content of the bands. Furthermore, there is no permanent mechanism by which the stated requirements of the United States users could be adjusted with equity and safety. The imperative need for means of making such adjustments hardly requires elaboration.

4. Maintaining a Sound Industry. The private telecommunications industry of the United States is one of the nation's most valuable assets in peace or in war. The normal life of the country is supported and facilitated by it in numberless ways. In abnormal times, the industry can place at the disposal of the nation its large

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reserve capacity, built up because of its competitive structure. This capacity helps to take up the immediate surge of military requirements. The industry can release radio frequencies, cable capacity, and other communications facilities, when required for Government purposes, without seriously affecting its ability to carry the civilian load.

It is essential that the industry be in sound economic condition. Some of its components, however, have faced serious difficulties. These have arisen in part from changing economic conditions and from new technical developments, and in part from the varying international situation. The industry also has objected to practices and policies of the Government, such as taxation policies, subsidies to competing facilities, and the Government's increasing extension and use of its own communications system. To meet these difficulties, the companies have from time to time taken individual action, and from time to time Government has been of assistance to them in rate adjustments and other ways.

But there has been no long-range study of the question, no long-range planning. There should be. No agency of Government is in a position to take a comprehensive view of the problem. Regulatory authority over all communications common carriers in interstate commerce, wire or radio, is centered in the FCC. However, the FCC does not have power, for example, to require Government agencies to make greater use of private facilities, or even to investigate whether such transfer of traffic would be feasible or desirable from the Government's point of view. There is no agency qualified to advise

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the President in fields where the interests of private and Government telecommunications users are in conflict. Meanwhile, in the absence of guiding policy, the action of Government agencies could seriously handicap the industry.

In addition to these special problems which are directly concerned with telecommunications policies and programs, it is necessary to keep in mind the fact that these policies and programs do not exist in a vacuum; they are part and parcel of the policies and operations both of the Federal Government and of the political, economic, military, and social life of the country as a while. Therefore we must take into account, in estimating the dimensions of the problem before us, the point that telecommunications policies and programs must not be considered as entities in themselves. They should be constantly related to the larger whole of which they are part.

One further fact is important in understanding this problem. All Federal Government agencies have interests as users of telecommunications. The degree of user interest varies; the most prominent users are the Department of Defense, the Department of State, and the Civil Aeronautics Administration. The Civil Defense Administration is vitally concerned with the adequacy and dependability of domestic communications. The General Services Administration has a threefold interest: as a user, as a provider of long-distance communications systems to other Federal agencies, and as the controller and manager of telecommunications (subject to certain restrictions) for all Federal agencies. The Federal Communications Com-

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mission, although not itself a prominent user, speaks in Federal Government councils for the interest of the non-Government user.

While all Federal agencies have greater or lesser interests as users of telecommunications, the use of telecommunications as such is not a major interest or function of any of them, but is a tool to accomplish their missions.

* * * * * *

The problem now facing the Federal Government is how to organize itself to meet its responsibilities for policy formation and program execution in the telecommunications field, which will meet the four special problems just outlined.

Current Organization

We turn now to a study of the existing Government telecommunications agencies to determine the extent to which they can cope with the problem just stated. In order, they are the Federal Communications Commission, the Interdepartment Radio Advisory Committee, and the Telecommunications Coordinating Committee. Their position in the intricate pattern of national and international telecommunications is indicated in the accompanying chart. In our study of

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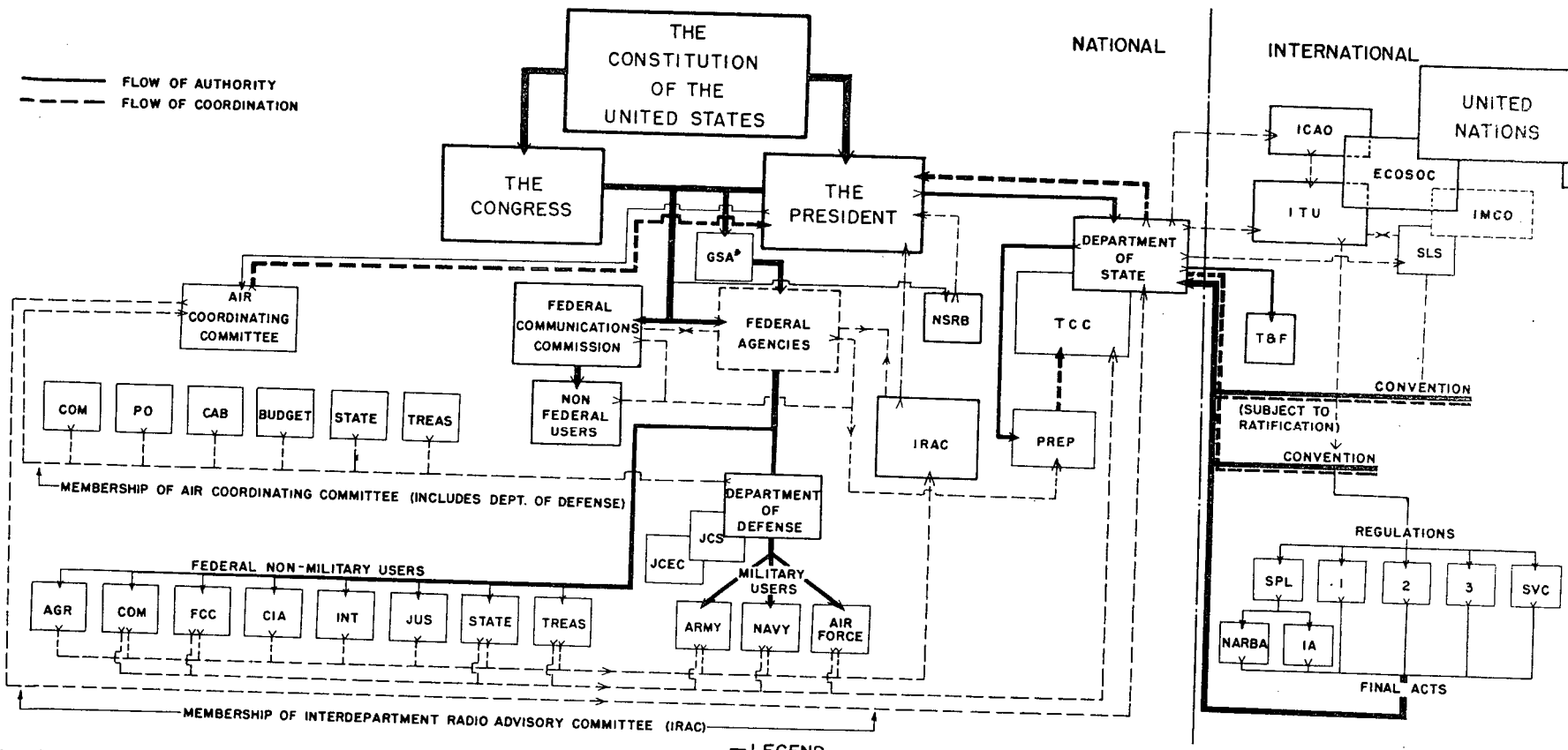
FLOW CHART OF
NATIONAL AND INTERNATIONAL TELECOMMUNICATION AUTHORITY AND COORDINATION



—LEGEND—

AGR – DEPARTMENT OF AGRICULTURE
BUDGET – BUREAU OF THE BUDGET
CAB – CIVIL AERONAUTICS BOARD
CIA – CENTRAL INTELLIGENCE AGENCY
COM – DEPARTMENT OF COMMERCE
ECOSOC – ECONOMIC AND SOCIAL COUNCIL (UN ORGAN)
FCC – FEDERAL COMMUNICATIONS COMMISSION
GSA – GENERAL SERVICES ADMINISTRATION
IA – INTER-AMERICAN CONVENTION AND AGREEMENT
ICAO – INTERNATIONAL CIVIL AVIATION ORGANIZATION
IMCO – INTER-GOVERNMENTAL MARITIME CONSULTATIVE ORGANIZATION
INT – DEPARTMENT OF THE INTERIOR
IRAC – INTERDEPARTMENT RADIO ADVISORY COMMITTEE
ITU – INTERNATIONAL TELECOMMUNICATIONS UNION
JCEC – JOINT COMMUNICATIONS — ELECTRONICS COMMITTEE
JCS – JOINT CHIEFS OF STAFF
JUS – DEPARTMENT OF JUSTICE
NARBA – NORTH AMERICAN REGIONAL BROADCASTING AGREEMENT
PO – POST OFFICE DEPARTMENT
PREP – CONFERENCE AND POSITION PREPARATORY COMMITTEES
SLS – INTERNATIONAL CONVENTION FOR THE SAFETY OF LIFE AT SEA
SPL – SPECIAL ARRANGEMENTS BETWEEN ITU MEMBER COUNTRIES
STATE – DEPARTMENT OF STATE
SVC – RADIO SERVICE CONFERENCES
T&C – TRANSPORT AND COMMUNICATIONS COMMISSION (UN ORGAN)
T&F – TERRITORIAL AND FOREIGN RELATIONS
TCC – TELECOMMUNICATIONS COORDINATING COMMITTEE
TREAS – DEPARTMENT OF THE TREASURY (INCLUDES COAST GUARD)
1 – REGION 1 OF ITU, EMBRACING EUROPE AND AFRICA
2 – REGION 2 OF ITU, EMBRACING NORTH AND SOUTH AMERICA AND HAWAII
3 – REGION 3 OF ITU, EMBRACING AUSTRALASIA

* AUTHORITY UNDER PUBLIC LAW 152 OVER PUBLIC UTILITY COMMUNICATION SERVICES OF EXECUTIVE AGENCIES EXCEPT FOR CERTAIN OF THEIR ACTIVITIES.

PREPARED BY P. C. P. B., DECEMBER 21, 1950.
(PRESIDENT'S COMMUNICATIONS POLICY BOARD) 51 37744

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each of these agencies, we have examined the record and discussed with qualified observers the basic nature of these organizations, their past record and their probable adaptability to meet more adequately the exigencies of the present and future. We have been mindful of the advantages of building on existing men and organizations; we have no wish to add to the number of existing Government organizations unless the need is inescapable; we have looked for ways and means of adapting these agencies so they can more effectively carry out the tasks we think need to be done, or done better.

From this special point of view we have appraised each of these agencies, as a means of arriving at our conclusion as to what should be done to strengthen Government telecommunications policy machinery.

The Federal Communications Commission

The Federal Communications Commission was created by the Communications Act of 1934 as an independent agency to regulate interstate and foreign commerce in communications by wire and radio. The Commission's jurisdiction extends not only to private radio broadcasters and to common telecommunications carriers engaged in interstate and foreign commerce, but to the communications activities of state and local governments as well.

The ultimate public policy embodied in the Act is

> "to make available, so far as possible, to all the people of the United States a rapid, efficient, Nationwide, and world-wide wire and radio communications service with adequate facilities at reasonable charges, for the

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purpose of promoting safety of life and property through the use of wire and radio communication...."

An immediate objective was to secure "a more effective execution of this policy by centralizing authority heretofore granted by law to several agencies and by granting additional authority with respect to interstate and foreign commerce in wire and radio communication...." 1/

The Commission has broad powers to regulate common carriers engaged in interstate or foreign communications activities, and radio broadcasters. The Commission enforces those provisions of the Act which require ships to carry specified radio equipment and comply with procedures for safety at sea. The Commission carries out the necessary inspections and investigations, and can compel actions by those it regulates to conform to the broad purposes of the Act. The Act provides sanctions and empowers the courts to enforce Commission decisions. The Act also specifies elaborate procedural provisions, designed to afford appeals to the courts to any party who is aggrieved by a Commission decision, or whose interests are affected thereby. These provisions for due process of law, these protections against arbitrary or capricious Government action are necessary elements of the Commission's concept and conduct.

1/ Communications Act of 1934, as amended, Sec. 1.

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The Communications Act was passed with the intention of centralizing in one agency the task of viewing non-Federal Government communications as a whole, of developing communications policies for wire and radio on an integrated basis, and of providing for regulation of specific forms of communication with due regard to the effects of particular actions on other forms of communications. It was recognized this was a technical field in which Congress could not hope itself to carry out the quasi-legislative process of rule-making, or the administrative process of applying the standard of "public convenience, interest, and necessity" to numerous specific cases. Those provisions of the Communications Act which require the Commission to study special problems and recommend legislation to cure them explicitly reflect the intent of Congress to give the Commission special policy-forming responsibilities for telecommunications matters.

As such, we considered carefully whether the Communications Commission is not an appropriate place to put the functions we have in mind.

The Communications Act itself, however, suggests otherwise.

Division of Powers between the President and the FCC. The Communications Act vests defense powers in the President alone, and divides Government power to assign spectrum space. While the preamble to that Act recognizes the value of communications to national defense, and implies that the Commission has a direct interest in the

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management of telecommunications for defense purposes, Section 606 of the Act clearly vests in the President the power to take over civilian telecommunications facilities, both wire and radio, for emergency and war purposes. The President need not turn to the Commission for any sort of prior consultation or advice before exercising his powers under the Act. Furthermore, Section 305 of the Act specifically gives the President the power to assign radio frequencies to Government stations, and specifically exempts Government stations from the licensing and other regulatory powers of the Commission when they are operating as such. The Act on the one hand provides no standards to guide the President in assigning frequencies to Government stations; his determination is final. On the other hand, the Act places the Commission under no duty to respect the President's assignments; either the Commission or the President could start a radio war by assigning a frequency already in use to an interfering user.

Similarly in the field of foreign relations, the preamble to the Act suggests the Commission should concern itself with foreign relations by including, as part of the Commission's broad public policy objective, regulation of foreign commerce in part with an eye to fostering a rapid and efficient worldwide wire and radio communication service. Yet it is patent that Congress could not and did not wish to give the FCC powers in the field of foreign relations which

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are constitutionally within the prerogative of the President.

This division of responsibility offered ample room for the Government to get its telecommunications policies and administration into serious snarls. Two factors have worked against this. One is the relatively small need for close coordination between the Commission and the Chief Executive during the early years of the Commission's life; the other is the spirit of sensible cooperation which has marked the relations between the Commission, in particular its chairmen, and the President.

The Communications Act was passed at a time when there was far less conflict than there is now between the requirements of the Government and the requirements of other claimants for radio frequencies. Technological and economic developments kept pace with valid demands for frequency assignments, in the main. Expectations for defense needs were geared to the thinking of the times. The nation's concept of the size and importance of its responsibilities and commitments in the field of foreign relations was also far more modest than now.

Accommodation between the President and the Commission was, however, a de facto political result, not a necessary legal result from the powers and structure of the Commission and legislative specification of its relationship to Congress and to the Executive. The Commission, as an independent regulatory agency, does not report to the President, nor need it consult the President in arriving at its

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decisions in actions before it. Members of the Commission are appointed by the President, with the advice and consent of the Senate. The Commission must come to the Bureau of the Budget in presenting its appropriations requests to Congress. The Commission is subject to presidential power in reorganization and management matters. The President on the one hand has issued Executive Orders affecting the Commission and its participation in Government activities, and the Commission has complied with them. On the other hand, the President has been chary indeed about using his budget and reorganization powers with respect to the Commission. Chairmen of the Commission have voluntarily taken up many policy matters with the White House, and the record shows a high degree of cooperation on matters of joint concern.

Congressional Interest. Relationships between the Commission and the President are always conditioned by the views of Congress--and in particular of those Senators and Representatives who take a special interest in broadcasting or other communications matters--as to the proper role of the Commission and the degree of independence from the President it should enjoy.

Many Congressmen take special interest in matters before the Commission which may affect availability of nationwide outlets for political debate, or which may affect communications activities in their home areas. These interests are largely concentrated in the fields of broadcasting and television. We take account of this fact

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here because of its effect on the Commission's freedom to emphasize the various parts of its total responsibility under the Communications Act according to its own sense of their importance or priority.

Some Congressmen regard the FCC as an "arm of Congress," and are anxious that the Commission maintain a healthy independence from presidential influence and control.

Hoover Commission Views. The Commission on Organization of the Executive Branch of the Government (the Hoover Commission) pointed in 1949 to the dilemma under which the FCC has long suffered: the FCC has been unable to deal effectively with the work-load before it because it has not formulated the broad policies to guide its decisions and thereby expedite its handling of cases; it has been unable to formulate those policies because of the pressure of current business. The Hoover experts also reported that the FCC has characteristically faced its tasks by dealing with problems as they arise, rather than by conscious policy-making, planning, and programing for the broad future of communications regulation and development.

Other Views. Many have pointed to the tremendous burdens placed on the Commission by requirements for hearings and other time-consuming processes needed to furnish protection to the rights of claimants. The FCC has been hampered in the discharge of its full regulatory responsibilities by difficulties in getting funds to make requisite inspections, special studies, and analyses of pressing regulatory

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problems. All these counsels have been urged as reasons why we should not recommend for the Commission new responsibilities for critical policy-making tasks, dealing with frequency utilization both by Government and by non-Government agencies, and treating of other comprehensive telecommunications issues.

We are also impressed by the fact that no Government agency or official with whom we have discussed this matter, including the Chairman and members of the FCC, has recommended that we expand the powers and staff of the FCC to deal with the policy-forming problems we think must be met.

Appraisal. The arguments involving excessive work-load, method of organization, and time-consuming administrative practices are persuasive but not conclusive. The Commission has already taken steps to reorganize itself in line with the Hoover group's recommendations, and expects to complete this process by the end of 1951.

The argument of excessive concentration on the problems of domestic broadcasting and television is even more persuasive. We do not think that the Commission will ever be free from the persistent pressures which force it to devote the majority of Commissioners' time and attention to these portions of the field. The solution of dividing the Commission into panels, already authorized by the Communications Act, is not a complete answer, as suggested by the Hoover Commission report. Similar conclusions were stated in 1949

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by a subcommittee of the Senate Committee on Interstate and Foreign Commerce.[1/] Panel consideration and decision is not Commission consideration and decision. To organize a regulatory commission into panels according to specialized types of work is to divide what should be comprehensive attention to the interrelations of communications problems.

The two most important considerations against placing new functions in FCC, and in our opinion the conclusive ones, are these. First, the FCC in its capacity as representative of the interests of non-Federal communications agencies, is in effect a user. As such, it would never be accepted as an impartial arbiter by other Federal users. Second it would be unwise and improper to give to the FCC the power to make decisions which affect the administration of executive agencies, or which relate closely both to foreign relations and to

1/S. Rept 49, 81st Cong., 1st Sess., Feb. 10, 1949, pp. 2-3. Despite the provisions of Sec. 5 of the Communications Act, the subcommittee thought "that adoption of the panel system without enactment of legislation specifically dealing with the subject is not contemplated by the existing law which contemplates that all decisions must be made by the whole Commission." With respect to the merits of panels, the subcommittee concluded that litigants had a right to expect that decisions on matters affecting them vitally should be made by the entire Commission authorized to decide such issues. However, "the Commission must find a method of speeding up its work and reducing the current backlog of cases, which we are informed represents as much as 15 months' work." The subcommittee made concrete proposals to that end, and recommended reorganization of the FCC into the three functional divisions (broadcast, common carrier, safety and special services) recommended by the Hoover experts and in process of adoption by FCC.

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national defense. These must be made by the President.

The Interdepartment Radio Advisory Committee

The Interdepartment Radio Advisory Committee was created in 1922 by letter to interested Federal agencies from the Secretary of Commerce, for the purpose of coordinating the uses of the frequency spectrum by the several Government agencies. Thus it antedates both the Federal Communications Commission and its predecessor, the Federal Radio Commission. These agencies were brought in on their creation, however, and IRAC has always been the nearest approach to an inclusive body in which the needs of both Government and non-Government agencies for frequency spectrum space could be considered.

IRAC membership has always included those Federal agencies most interested in the use of radio communications. Eleven are now represented: the Department of Agriculture, the Department of the Air Force, the Department of the Army, the Department of Commerce, the Federal Communications Commission, the Department of the Interior, the Department of Justice, the Central Intelligence Agency, the Department of the Navy, the Department of State, and the Treasury Department. The Federal Communications Commission acts as spokesman for non-Government users (that is, all users not within the Federal Government; state and local governments must come to the FCC for frequency assignments). Other Federal agencies are present or represented when matters affecting them are before the Committee.

Thus, IRAC is a group of users.

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As such, it has been severely limited in its capacities as a policy-forming body. The practices and priorities it has generated have always been restricted to those by which a group of users with equal rights could get along.

IRAC's most important task through the years has been to serve as a technical forum in which users could agree on assignment of spectrum space to Federal claimants, and in which Government users could inform the Federal Communications Commission of their comments on proposed Commission allocations and assignments of frequencies to non-Government users. The Commission, as spokesman for the non-Government users, could also comment on the effect of requested assignments to Government users on present or future interests of other users.

IRAC's decisions are incorporated in a Station List which is not available to the public. This list gives all particulars required for coordination necessary to minimize radio interference. These particulars are binding delimitations on the use of the assignment.

IRAC recommends to the President lists of broad assignments of frequencies to Federal users, which are then promulgated in Executive Orders. These orders have recognized IRAC by reference, in giving it power to make interim assignments pending preparation of a new Executive Order. These orders were expected to be issued once every two or three years; nothing is fixed about this period.

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However, the latest order eppeared in 1944, and there is little prospect for a new one in the near future. IRAC, or in effect its sponsoring agencies, has given higher priority to other tasks.

Problems of IRAC. Theoretically, since the IRAC "advises" the President on the use of his power to assign frequencies to Government users under the Communications Act of 1934, an appeal can always be made to the President. Practically, such a case would come up only if an agency felt that it was denied something so important that the agency thought it appropriate to bring its request to the President's attention. As a group of users representing coequal agencies, IRAC has a de facto rule of unanimity in frequency assignment matters. In practice, there have been only three or four cases in which an aggrieved department did appeal to the President. The first of these, in 1928, demonstrated the difficulty of trying to use an inter-departmental committee of coequal users for generating policy, and resulted in a working rule of first-come first-served, with assignments to be made on a non-interference basis. Under formal IRAC procedures, those to whom assignments have been made may enjoy them until they wish to give them up. Practice again, however, is something different. Back of the rule of unanimity and absence of compulsion has lain a complex process of bargaining and accommodation. New users or old agencies looking for new assignments during the more recent years of frequency scarcity have had to engage in a highly skilled, technical process of searching for combinations of frequency, power, time of use,

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direction and area of propagation, and stability of receiving and sending equipment in order to fit new uses into the existing pattern of operations.

Although there has been no compulsion by directive, all the users have been under strong suasion to find mutually agreeable solutions in order to avoid having to seek decisions at a higher but technically unqualified level. Furthermore, to the telecommunications specialist it is fundamental that the alternative to agreement is chaos.

Hence arises the technical reconnaissance and negotiating process which takes place between seeking agencies and possessor agencies whenever new assignments are sought. Requests usually come in to IRAC only after the agencies affected have come to some sort of private understanding.

We have been told that IRAC never concerns itself with "policy" and that Government users are not required to justify their requests for frequency assignments or their retention. IRAC has made some real contributions to policy--as for example its recommended priorities for allocating the spectrum to services which should underlie the United States Government position at the Atlantic City Telecommunitions Conference of 1947. These priorities and policies were not generated, however, for IRAC to follow in dealing with its own business. They were valuable contributions of technical specialists intimately associated with governmental operations, to the formulation of an

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international agreement.

The extent to which Government claimants must justify their requests is important to an evaluation of IRAC's role. The key to the matter is the nature of the group--a group of users, rather than an independent judging body. IRAC points to various criteria which have been decided as relevant to the justification of frequencies in its deliberations.[1/] Whatever the relevance of the criteria, no body of users acting as judge of its own requirements can taken an impartial view of the requests of its members. Security problems have complicated these issues, especially in time of war, when the fact of value to national defense would often be alleged, but no supporting data brought forth on which the claim could be evaluated.

In sum, we find that IRAC has done a good technical job of frequency assignment through the years, within the inherent limitations imposed on it by its constitution. It has taken advantage of the incentives to technical achievement and agreement inherent in its peculiar situation. It should remain as a technical body in which

1/ Eligible reasons include: specific legislative directives; international commitments, such as treaty obligations; national defense requirements; internal security; protection of national resources; essential mobile communications; communications affecting safety of life or property; research and experimental services; and absence, inadequacy, or impracticability of establishment or use of other means of communication. See IRAC By-Laws, 1 January 1950, Article X, "Principles Governing the Assignment and Use of Radio Frequencies."

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the day-to-day tasks of Government frequency assignment can be carried out. It is obvious, however, that a different kind of agency is needed for the future to solve the problems that will arise from congestion of the radio spectrum.

The Telecommunications Coordinating Committee

The Telecommunications Coordinating Committee is an informal, voluntary group created in 1946 by exchange of letters between the Secretary of State and the heads of four other departments and the Federal Communications Commission. The purpose of this move was to create a body to consider telecommunications policy questions, and thus to fill for the postwar period the gap left by the demise of the Board of War Communications. The Committee is composed of one representative each of the Departments of State, Treasury, Commerce, and of the Federal Communications Commission, and three from the Department of Defense (one each from the Departments of the Army, Navy, and Air Force). The Bureau of the Budget is represented by an observer. Representatives are designated by the heads of each agency; they are supposed to be of the Under Secretary or Assistant Secretary level for the non-military agencies and the chief communications officers of the armed services. Several efforts have been made by member departments to set up the organization more firmly by Executive Order. This has never been done. Subsequent to its formation, other departments have from time to time sought membership

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but have been excluded by the Committee on the ground that membership is restricted to those agencies having a "high policy" interest in telecommunications. The Committee, as a matter of practice, includes in its meetings, and in the composition of any ad hoc working committees, representatives of any agencies having a special interest in the work in hand.

At the outset it was thought this committee could formulate policies and develop plans and programs which would promote the most effective use of wire and radio facilities. The FCC, however, pointed to its statutory responsibilities for policy formulation and advice to Congress on such matters, and stated that its participation in any group such as TCC could not relieve it of these obligations or bind it in any way. The State Department reiterated its initial view that the TCC could work only by unanimity, and that there must be no intrusion on the statutory or other authorized responsibilities of any of the component agencies. TCC accordingly adopted a more modest charter in which it was agreed by the members that its mission was

> "The coordination of policies of the various departments and agencies of the United States Government relating to domestic and international communications matters...; and advise on problems of an international nature including preparation for international telecommunications conferences. The Committee shall act in an advisory capacity only, but may take final action when specifically authorized by unanimous concurrence of all Government agencies represented

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> by the membership....In accordance with the foregoing, the primary objective of this Committee is the formulation of a national communications policy." 1/

The TCC is served by a small part-time secretariat furnished by the Department of State. Although it has no formally elaborated organization, it does set up ad hoc working groups.

Problems of TCC. From the evidence before us, and from discussions with participants, it appears to us that the TCC, in its present form, is inadequate by itself to play the major role in the formulation of a national telecommunications policy.

TCC is bound by the rule of unanimity. TCC can act when the Government departments are in agreement, or can be brought into agreement by intragovernmental persuasion and diplomacy. TCC can lay out the areas of agreement or disagreement on any issue before it, but, since its members represent agencies with user interests, the Committee cannot easily weigh and evaluate points of disagreement, resolve them, and advise the heads of their agencies, and through them the President, of a national telecommunications policy.

TCC is hampered by the difficulties, found in other technical fields as well, of translating technical differences of opinion into policy alternatives, so they can be dealt with by the President or by Cabinet officers. TCC membership has suffered the decline

1/ TCC Document No. 11, Organization/6, April 8, 1946.

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inevitably to be expected when staff officers are unable to master this thorny task of translation. Under Secretaries and Assistant Secretaries have been replaced at meetings by Directors of Offices; Directors of Offices have been replaced by technical specialists, so TCC meetings are often conventions of IRAC representatives acting under different instructions. This situation might have valuable advantages from the standpoint of continuity of problem consideration and economy of personnel, if it were not true that technical user-oriented personnel do not occupy positions which permit them to act as plenipotentiaries to make policy commitments on behalf of their agencies.

When the Government, after the passage of the National Security Act of 1947, could have replaced the War and Navy Department representatives either by a single Department of Defense representative or by representatives of the three service departments, the choice was for the latter. This meant in practice that TCC is weighted with representatives of military interests and functions, who besides are chiefs of the communications services of the three departments--that is, users and operators of specialized services rather than officials charged with agency-wide responsibilities.

In most instances, this would have been salutary, since close relationships between major operational responsibility and policy responsibility are wanted. The difficulty here arose from the fact

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that much of telecommunications policy formation has to do with dividing scarce resources among military claimants, other Federal Government claimants, and non-Government claimants. Officials heading extensive service agencies, with larger potential demands on their services than they can expect to meet, can hardly be expected to take an impartial view of such questions as the national requirement for a share of the world's frequencies, or division of the national share among all claimants.

TCC has done good work of a preparatory character toward policy formation. But TCC as presently constituted has found it difficult if not impossible to complete policy formation tasks. In those cases where unanimity does not prevail, TCC could never do so. However, TCC, better organized and staffed, could do a far better job of preparatory work so sub-Cabinet level members might go farther than now toward resolution of policy differences, and in any event make possible intelligent resolution of remaining differences at the level of the Cabinet or the Presidency. We believe that reorganization and strengthening of TCC will make possible such a contribution.

The Current Problem Re-Examined

The existing organization for frequency assignment to Government and to private users was set up at a time when--outside of the standard broadcast band--there was enough for all, and the proportion of spectrum space needed for Government purposes was small in relation to the whole. In such circumstances, it was feasible to leave

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Government frequency administration to the Executive Branch, as a proper extension of executive control over the substantive functions of Government which its communications serve; to leave assignment to non-Government users to the Federal Communications Commission as a proper extension of its regulatory functions; and to leave interrelations between the two to good sense and a will to get along.

Government now occupies something under half of the presently usable radio spectrum and was doing so before the Korean crisis. Although the Federal agencies have acquired this large portion of the spectrum under established procedures and with consideration to private interests as represented by the FCC as spokesman, these allocations were made by officials who could not weigh all demands for spectrum space, Government and private, and judge them impartially on the basis of full explanation according to a single set of standards and a well-considered national policy.

We have found conflicting evidence as to the seriousness of the scarcity of frequencies in relation to demands. Some think there is no problem, and that the expected rate of technical advance, continued good will among those competing for space, and the elimination of wasteful uses will meet the nation's requirements for the indefinite future. Others think the problem is critical. Without passing judgment here as to the precise degree of scarcity, we are convinced that pressure of present and future demands is so heavy as to force

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the Government ultimately to consider telecommunications resources as a whole, and to apportion them as a whole to meet the most pressing requirements of the whole nation.

As for telecommunications policy formation, recent experience has demonstrated that the available machinery works only in the case of unanimity, and that the event of unanimity has become increasingly rare. Although there was unanimous acceptance of the Atlantic City Convention, unanimity disappeared when attempts were made to translate accepted policy into practice. The United States thus was unable to devise a reasonable position for implementing an agreement it had initiated and urged on other nations. Neither the TCC nor any specially-devised machinery has so far been able to provide that detailed position.

Conclusions

1. Fundamental changes in telecommunications require the overhaul of Government machinery for formulating telecommunications policy and for administering certain telecommunications activities in the national interest.

2. The Communications Act of 1934 established a system of dual control of the radio frequency spectrum. This dual control arises largely from the fact that the regulation of private telecommunications is a function of Congress exercised through the FCC, while the operation of Government telecommunications is primarily a function of the Executive. For example, the assignment of frequencies to mili-

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tary services is an exercise of the President's powers as Commander-in-Chief of the Armed Forces.

3. The Federal Communications Commission, though needing further strengthening, should continue as the agency for regulation and control of private users.

4. The President has exercised his power to assign frequencies through the Interdepartment Radio Advisory Committee, made up of representatives of the using Government agencies. While this Committee should continue as a forum to arrange the use of the spectrum in such a way as to avoid interference, it is not an adequate means for keeping in order the large portion of the spectrum occupied by Government agencies.

5. The Telecommunications Coordinating Committee has served a useful function and should continue as a mechanism for interdepartmental discussion of telecommunications matters.

6. The whole Government telecommunications structure is an uncoordinated one and will be even less adequate in the future than it has been in the past to meet the ever growing complexities of telecommunications. A new agency is needed to give coherence to the structure.

7. There is need for a better determination of the division in the national interest of frequency space between Government and non-Government users. To achieve that end, close cooperation between the Federal Communications Commission and the proposed new agency will be necessary.

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The Solution Recommended

The urgency of the need for remedial steps in telecommunications organization calls for prompt action.

We recommend the immediate establishment in the Executive Office of the President of a three-man Telecommunications Advisory Board served by a small, highly qualified staff, to advise and assist the President in the discharge of his responsibilities in the telecommunications field. Its task would include formulating and recommending broad national policies in this field, and giving advice and assistance in the formulation of policies and positions for international telecommunications negotiations.

The Telecommunications Advisory Board should exercise on behalf of the President his powers in the telecommunications field--in the main, those powers arising from Sections 305 and 606 of the Communications Act of 1934. Thus the Board would be responsible for assignment of frequencies to Federal Government users, and for the exercise of the President's emergency and war powers over the radio and wire communications of the country. This agency would also be available to discharge any other tasks the President might lay upon it.

While we believe that a three-man board, as suggested above, is preferable, we recognize the possibility of appointing one man, a Telecommunications Adviser, to exercise the functions of the proposed board.

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We believe that an immediate task of the new agency would be to assure that the Federal Government's use of radio frequencies is in as good and economical order as possible and to further the most rational use of the entire spectrum.

Another closely related and important function of the new Board will be to establish and maintain effective working relationships with the Federal Communications Commission for the informal solution of those joint questions of frequency allocation which will inevitably come up under our system of dual control over the spectrum. The vast growth in public demand for television has made acute the problems of deciding how to allocate space in the higher frequency bands as between Government and non-Government users. The claims of a multi-billion-dollar industry with a tremendous potential impact on the daily life of every citizen must be put over against vital needs of Government agencies for services necessary to the security and welfare of the entire nation. If this cannot be done promptly and wisely by joint action of the FCC and the new Board, it may be necessary to seek a change in the Communications Act so as to set up a single authority where such decisions can be made.

We recommend that the Telecommunications Coordinating Committee should be left much as it now is, so far as its legal basis and scope of activities are concerned. We see no particular merit in formalizing it by Executive Order; to do so might unduly institutionalize what should be a flexible, informal interdepartmental committee composed of representatives of those Federal departments and agencies possessing statutory or other formalized responsibilities relating

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to telecommunications. The chairmanship of the TCC should be held by someone primarily interested in telecommunications. We suggest he should be a member of the proposed Board.

We recommend that the Interdepartment Radio Advisory Committee should also continue much as it now does as a specialized agency to perform the detailed work of assigning frequencies to Federal Government users, but under policies promulgated by the Telecommunications Advisory Board. IRAC recommendations for frequency assignments should be made to the Telecommunications Advisory Board for authentication.

We recommend that no changes be made at this time in the powers and duties of the Federal Communications Commission. The FCC should continue to regulate telecommunications common carriers and to control the use of the radio spectrum by non-Government agencies according to the standards of public convenience, interest, and necessity specified in the Communications Act. The Commission should continue to afford to interested or aggrieved persons full opportunity for public hearings and other safeguards of due process of law. The Commission's present efforts to reorganize itself as recommended by the Hoover Commission should be pressed, in order that it may quickly increase its capacity to help in Government-wide formulation of telecommunications policy.

We do, however, think that the FCC should have more funds and a stronger staff to keep up with engineering and economic developments affecting the commercial telecommunications carriers of the

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country. We foresee the possibility of quicker and more radical change in these fields; we think the Commission should be in a position to take necessary action without delays caused by the need to get special appropriations, recruit special staff, and conduct special studies before sound decisions can be made.

We recommend the creation of this Telecommunications Advisory Board after an exhaustive review of alternative solutions. We believe that a board acting to advise the President has the best opportunity within the philosophy of our Government operation to set our communications house in order.

We call attention to the one alternative most frequencly suggested--that is, the creation by Congress of a board having complete power to assign frequencies both to Government and to civilian users. The creation of such a board would mean a fundamental change in the present Communications Act. It would involve, we believe, serious conflicts with the proper exercise of the executive function of the Government. We mention it only as a possible last resort in the management of our communications resources. We hope that the solution proposed here can obviate the necessity of such fundamental change in our communications policy.

The Telecommunications Advisory Board--Qualifications and Emoluments--High caliber of membership is the most important single factor which will determine the success or failure of the proposed Board. The Board should combine sound engineering knowledge with

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experience and skill in governmental affairs. The business of the Board will not be confined to technical questions of electronics and engineering; its problems of Government policy and operation branch out into many fields of public policy. It is therefore important that the members of the Board should be men of broad vision, able to resolve complex telecommunications issues with due attention to probable impact on related fields.

Salaries of Board members should be sufficient to attract men of high qualifications.

The Telecommunications Advisory Board--Detailed Functions and Powers--The Telecommunications Advisory Board should be established preferably by Executive Order. This agency should:

A. Act for the President in carrying out his responsibilities arising from:

(1) Section 305 of the Communications Act of 1934, as amended. (Assignment of frequencies by the President to Government stations or classes of stations.)

(2) Section 606 of the Communications Act of 1934, as amended. (Emergency and war powers over telecommunications common carriers, and protection for telecommunications activities)

The Telecommunications Advisory Board should carry on such planning functions as are necessary to the discharge of its duties under this Order.

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B. Stimulate and correlate the formulation and publication of plans and policies by appropriate existing agencies to insure:

(1) Maximum contribution of telecommunications to the national interest.

(2) Maximum effectiveness of U. S. participation in international negotiations.

C. Recommend to the President and advise him on proposed legislation in the telecommunications field.

D. As preliminary and preparatory steps in the discharge of the duties specified above:

(1) Approve and promulgate engineering standards for allocations and assignments to Government users.

(2) Provide for adequate initial justification and periodic rejustification and reassignment of frequencies assigned to Government users.

(3) Maintain such records of U. S. frequency assignments as it deems necessary.

(4) Make arrangements with the FCC or with other agencies for monitoring and check to determine compliance with conditions attached to frequency assignments, and for other purposes.

(5) Keep abreast of research programs in those aspects of the telecommunications field which bear on radio propa-

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gation and frequency utilization, and stimulate and support research where most needed in these areas by governmental and private agencies.

(6) Stimulate and sponsor such studies pertinent to the broad objectives of the board as are necessary to keep the President informed of the health of the telecommunications industry and the effects upon it of Federal telecommunications policies and procedures.

F. Cooperate with the Federal Communications Commission for the purpose of arriving at an equitable distribution of frequency space between Government and non-Government users.

G. Establish and maintain liaison as required with departments and agencies of the Federal Government.

H. Create advisory bodies, or utilize the assistance of existing advisory groups, as required in the discharge of its duties and responsibilities.

I. Carry on such other duties and responsibilities as may be directed by the President from time to time.

Access to Information--All departments and agencies of the Government, including the military services and the Central Intelligence Agency, should be authorized and directed to furnish to the agency whatever information it requires to make a full determination of the questions before it.

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The Board must always be in a position to receive and consider the most highly classified matter submitted by military or other Government agencies in justification of their proposals. Only thus can it hope to make reasonable judgments based on complete facts. Obviously, the Board must be in a position to protect such confidences.

Discussion of Functions and Relations to Other Agencies--If the new Board acts for the President in carrying out his responsibilities arising from Sections 305 and 606 of the Communications Act, it will have real power. In our view, both of these functions are continuing functions involving the exercise of substantial governmental power. They are the heart of the mission of the new agency.

Section 305 gives the President power to assign radio frequencies to Federal Government users. This is a power vital to national defense and security. Under the growing use of international telecommunications for international information, the power to assign space in a most important medium for disseminating such information is increasingly vital to peace, security, welfare, and prosperity. Radio frequencies are vital to the development of aviation. Radio frequencies are playing a larger part than ever before in domestic security and law-enforcement measures. Because of these developments, problems of priorities of claims on the spectrum are keener than ever before within the Federal Government itself. A continuing agency, with real power to assign and review assignments of frequencies to Government users, is needed to set Government policies

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and to supervise the work of IRAC in carrying them out.

In World War II, Government powers for taking private communications resources for public purposes in time of emergency and war were exercised by an ad hoc agency. This solution is a wise one for periods in which world wars and international crises are far apart. It is hardly prudent in a period of constantly recurring crises with the ever present possibility of world conflagration. We are now in a period of national emergency, which may become even more serious. Plans should be made promptly to see that the nation's communications resources are put to their best use to meet any emergency in an orderly way. These plans must consider the net benefit to the nation of leaving communications wholly or partly in private hands. During emergency or war, there should be constant attention to the best combination of governmental and non-governmental operation of the nation's telecommunications.

Needless to say, the exercise of the President's power under Section 606 calls for advance planning. Obviously no board or single person, assisted by a small staff, can do this job alone. Several existing agencies are charged with related responsibilities and it will be necessary for the new agency to enlist their cooperation. The Department of Defense and its components, the Department of State, and the FCC must be called on; there must also be close working with such agencies as the National Security Resources Board and the Defense Mobilization Administration. The new agency may

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have to avail itself promptly of its recommended power to set up advisory or other working groups to cope with its responsibilities under Section 606.

The role of the new Board in stimulating and correlating the formulation and publication of plans and policies by existing agencies is of great importance. Our own work has been hampered by the lack of comprehensive, correlated, and readily available statements of telecommunications policy. We have encountered examples of the failure of existing policy machinery to meet the requirements of international negotiations or of other Government action.

Yet the answer to this lack is not to create an agency specialized to deal with telecommunications policy formulation. Telecommunications policy must be integrated with policies and programs for the full range of Government and national activities. If it is elaborated in isolation, it is almost sure to be incomprehensive or faulty, and will require reconsideration by other agencies in order to be correlated with other policies and programs.

Our solution leaves the main responsibility for the elaboration of telecommunications policy with existing Government agencies which already must relate telecommunications to other functions for which they are responsible. The new agency will provide a point for stimulus and correlation which we do not think has been satisfactorily provided in the past by the Telecommunications Coordinating Committee.

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Since the new Board is also given responsibility for weighty functions in the telecommunications field, we prevent a divorce of policy formulation from operating responsibility.

Our solution implies the following corollary: Existing Government departments and agencies which participate in this policy-formulating process must markedly strengthen their units for carrying out policy formulation in the telecommunications field, and in adjusting telecommunications policy to related policy.

The Telecommunications Advisory Board has been designed to facilitate formulation of policy helpful in international negotiation. If it is to function effectively for this purpose, it is imperative that the Department of State shall have a strong telecommunications staff, and our plan is predicated on the assumption that such a staff will be maintained and available.

In approving and promulgating engineering standards for allocations and assignments to Government users, the agency should direct major attention to setting up standards which will make it possible for the Government to meet its telecommunications needs with a minimum use of spectrum space. The new agency should have several highly qualified engineers on its staff who will work with engineers already employed by other Government agencies, toward the end that operating equipment and practices be as efficient and economical as possible.

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It is highly important to concentrate upon adequate standards relating to efficiency and stability of equipment, minimum separation of frequency assignments, and sound circuit engineering which relates the load to the band width and number of frequencies necessary to do the work, if maximum use of the spectrum is to be achieved under standards of minimum harmful interference.

Our suggestion that the agency should provide for adequate initial justification and review of frequency assignments to Government agencies is designed to correct a basic fault in the present situation: protection to first-comers irrespective of the relative needs of conflicting claimants later on, which results in premature requests for frequencies. While many factors in the present situation temper the potential evils of our present system of assignment to Government users, we are not convinced that the present system can yield as good results as the country should have. All Federal requests for frequencies should go to IRAC in the first instance, where they should be screened for conformity to current policies and for potential interference. Where IRAC cannot act, conflicts should be carried to the new agency. One of the most difficult problems under this system will be to prevent IRAC from failing to settle anything and referring every problem to higher authority. Every encouragement should be given to IRAC to settle problems itself. This calls for firm leadership.

We have suggested the new Board maintain such records of U. S.

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frequency assignments as it deems necessary. IRAC now keeps reasonably complete records of Federal assignments; the FCC, of non-Federal ones. However, there is no one central place where a complete list now exists. While the new agency should not maintain more in the way of records than it needs for its own purposes, it should take strong steps to see to it that somewhere in the Government a comprehensive and current record of U. S. assignments is maintained. The FCC is the most logical place for this. If lack of funds or staff block achievement of this purpose, Congress should remedy it.

We wish strongly to stress the need for more intensive and comprehensive research on problems of radio propagation and frequency utilization. In the recent past, critical decisions about use of the spectrum, including geographical and frequency separation of stations, have had to be made in the absence of sufficient scientific data.

The Board should not itself engage in research; indeed there is no necessity for it to contemplate such a role. The newly established National Science Foundation, whose principal concern will be the fostering of basic research, provides one avenue for the Board's support of projects in this field. The Research and Development Board in the Department of Defense, moreover, is in a position to deal with problems closely related to telecommunications.

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At the beginning, the agency should try to improve the coverage of research on pressing problems by suggesting research projects to agencies already equipped to conduct them. Such projects should include research on propagation in particular sets of conditions, and for particular bands of the radio spectrum. The board should be represented in the Executive Council of the Central Radio Propagation Laboratory. If stimulation in the form of funds is needed, the agency should encourage an existing Government department to seek such funds and to allocate them or expand them as executive agent for the particular research envisaged.

If the Board is properly to advise the President, it should also conduct and stimulate other studies pertinent to the various phases of its mission.

There is also a continuing task of considering basic Government policies for the handling of the Government's business with privately owned communications companies. This is not a regulatory matter appropriate for the FCC, although it has important implications for regulatory decisions. Government traffic is proportionately so large a part--and promises to become an even larger part--of private communications business that its terms and conditions can affect the health, the scope, and the serviceability of private communications companies. This task involves questions of Government economy, of efficiency and promptness of telecommunications service, of the impact of future telecommunications capabilities for

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defense and for economic progress; it is thus a continuing question appropriate for the new Board.

The General Services Administration deals on a day-to-day basis with these questions of telecommunications management. It is our opinion that GSA should turn to the Telecommunications Advisory Board in the first instance for the determination of those issues of high policy relevant to the discharge of GSA's telecommunications management responsibilities.

Inherent in our concept of the Board and its duties is the conviction that the Government has a responsibility to preserve the present free enterprise status of the telecommunications industry.

The Board should be authorized to create if necessary, and to utilize such existing panels, advisory groups, working committees, and ad hoc working parties as are required to carry out its responsibilities. It should use, where feasible, the personnel and services of existing departments and agencies of the Federal Government, and of state and local governments on a reimbursable or other mutually agreeable basis.

Only thus can the Board take full advantage of existing resources in knowledge, skills, and people, and itself remain a small organization.

While the agency should be small, we recognize that it may have to take on certain operating functions necessary to the full

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completion of its major missions. We recommend it be flexibly constructed so it can do so if necessary.

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It should be clear from the foregoing that it is our intention that the new Board should not supplant or encroach upon the responsibilities of existing Government agencies. We do not wish to lessen the normal responsibilities of the Department of State in the field of foreign affairs; we wish to facilitate the formulation of national telecommunications policies on which policies and positions for telecommunications negotiations can be based, and thus to fill a gap which the Department has had increasing difficulty in closing.

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Federal Communications Commission.--Our desire is to make the tasks of the Federal Communications Commission more manageable and to take full advantage of its resources. As an independent regulatory agency, the Commission bears major responsibility for assuring to private persons full consideration of their rights, interests, and claims in telecommunications matters. The courts see to it that this is done. Nothing we propose will infringe on the Commission's powers to assure such procedural protection. The Commission should remain in this role. Because of the burden thus placed on the Commission, especially the Commissioners themselves, we have thought it

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prudent to supplement the Government's machinery for arriving at comprehensive telecommunications policy.

It is neither appropriate nor desirable to try to put the FCC in a position to tell executive agencies what are the most important uses of the radio spectrum. Nor would it be proper for executive agencies to decide for the Commission how to carry out its regulatory and policy responsibilities under the law. We know of no neat solution to this governmental dilemma. We see no reason to reorganize the regulation of privately owned communications carriers, placing it under the President. The good sense and accommodation which have marked legislative-executive relations in this field in the past can be expected to continue.

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If the new Board is to work harmoniously with the Telecommunications Coordinating Committee and the Interdepartment Radio Advisory Committee, these latter organizations need to be strengthened. The particular changes required are discussed in the paragraphs that follow.

The Telecommunications Coordinating Committee.--The Telecommunications Coordinating Committee should work out for itself clarified terms of reference; it should also be authorized to establish necessary subcommittees and special working groups, and be equipped with an adequate secretariat.

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This Committee should remain an advisory and coordinating body. It should be a forum in which Government agencies possessing substantial responsibilities or interests in the telecommunications field can meet in an attempt to work out a coordinated policy in telecommunications matters arising out of those responsibilities. In case of agreement, each agency affected can take administrative action within its own established powers to put agreed decisions into effect. In case of disagreement, the matter involved can be promptly referred to the new board for consideration of the reasons for disagreement and for evaluation of the probable consequences for the nation of following alternative courses of action. Thus in effect the Committee would be a means for taking the first important steps toward the formulation of a comprehensive telecommunications policy; it would uncover areas of agreement and disagreement, permit action in case of the former, and point up policy choices in case of the latter. The rule of unanimity would no longer block action, since participating agencies could always act by reporting their differences.

It is recommended that the level of membership be determined through the appointments by the heads of those agencies to be represented on TCC. The present membership is supposed to be of the Under or Assistant Secretary level, but it is well known that these officials rarely attend. One reason for this is the fact

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that rarely if ever have problems been well enough prepared so persons of this level can deal with them expeditiously. Technical issues have not been well enough translated into policy choices. TCC has failed as a top policy organization because of its lack of substructure.

Level of membership should be left flexible, and agency representatives should be as high as necessary to deal with the particular policy issues under consideration. The Committee needs a competent and energetic full-time Executive Secretary as well as the power to create whatever working committees it requires to deal with special fields or non-recurring problems. With such resources, the Committee should be able to solve many interagency problems at the working level, and to reserve for higher officials the consideration of policy choices which could not or should not be resolved by specialists.

The TCC should consider carefully the merits of associating industry representatives with its subcommittees as observers. The Air Coordinating Committee has done so with marked benefits. The Telecommunications Policy Staff in the Department of State should continue to call on industry advisers to help in preparation of positions for international conferences. The Federal Communications Commission should continue to carry the main load of industry relationships. Other Government departments should continue or increase their efforts, where appropriate, to base their particular planning and operating responsibilities on sound industry

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relationships.

As suggested above, the top responsibility for systematizing and recommending Federal Government frequency assignment policies should rest with the new board; the Telecommunications Coordinating Committee should serve as the forum in which spokesmen for Government agencies meet to lay out the existing pattern of views. If TCC is to do this job completely, it must include within its membership or afford rights of representation to all Federal agencies with substantial interests in telecommunications.

The Interdepartment Radio Advisory Committee.--The Interdepartment Radio Advisory Committee should be continued as a specialized working body to assign frequencies to Government users under policies promulgated by the new agency. Frequency assignment priorities have been generated in IRAC by the stream of day-to-day decisions. We think that this process should be replaced by conscious policy consideration at the appropriate policy level.

IRAC recommendations for assignments of frequencies by Executive Order should be transmitted to the new telecommunications Board, and IRAC should keep the Board informed as to interim assignments. IRAC should take on the new task of periodic review of assignments to Government agencies, and should hear in the first instance justifications of agency requests to retain assignments already made. These tasks are considerably larger than those IRAC now carries;

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representatives of agencies composing IRAC may have to devote most or all of their time to IRAC business. The new agency should spot-check IRAC assignments to determine compliance with presidential policy. IRAC should be kept flexible to participate as technical adviser to the various Government agencies in the formulation of Government telecommunications policies and positions.

IRAC's membership should include as a matter of course every Federal agency which is a substantial user and operator of radio communications.

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CHAPTER VI

TOWARD A NATIONAL POLICY

In our study of existing telecommunications policy, we find little to go on. Extant policy is meager, and varies from self-evident generalities about very broad issues to filigreed treatment of highly specialized detail. The policy statements in this Chapter have been assembled by the Board in the course of its work. They include:

(1) statements of published policy drawn from treaties, laws, and expressions by committees or other groups dealing with telecommunications, which are enclosed in quotation marks;

(2) statements of commonly accepted policy, not hitherto formally expressed, which are indicated by <u>underscoring</u>; and

(3) statements of newly formulated suggested policy, which are presented in roman type without special indication.

We have arranged this material in a logical order to produce an integrated statement of general policy and specific policy actions. As far as possible, the Chapter has been circulated informally to interested organizations in the United States for comments and suggestions, many of which have led to improvements.

The time available to the Board did not allow us to obtain judgments and observations on all phases of the subject; nor could we pursue the ramifications of telecommunications policy into related policy for other fields. Hence this compilation is not considered as conclusive or binding, nor in itself sufficient for guidance

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in telecommunication activities. Rather, it is regarded as a starting point from which national telecommunications policy can be further developed.

The concept is not new; it has proved its value to the establishment of efficient national procedures in comparable fields. For example, "A Statement of Certain Policies of the Executive Branch of the Government in the General Field of Aviation," prepared for the President by the Air Coordinating Committee in 1947, is a valuable document setting forth policies essential to the advancement of United States aviation.

In the preparation of this effort at a kindred statement regarding United States telecommunications, their relationship to the national defense and security and to the national welfare and prosperity has been taken into account. Telecommunications are here considered to relate to national defense as part of the resources which the nation uses in combating hostile armed forces; to national security as part of the organized effort to maintain the national strength and to safeguard the nation against harmful influences, internal or external; to national welfare as they are used for the growth of national enlightenment and health; and to national prosperity as they aid in the growth of trade, in the production effort of the nation, and in the resultant enhancement of the nation's influence in world affairs. These relationships, taken as a whole, comprise the national interest.

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I. General Telecommunications Policy

A. Public Communications--Purpose

There shall be "available, so far as possible, to all the people of the United States a rapid, efficient, nationwide and worldwide wire and radio communication service with adequate facilities at reasonable charges. . . ."

B. Public Communications--Policy

1. The radio frequency spectrum is a world resource in the public domain. Our Government must adopt policies and measures to insure that this resource is used in the best interests of the nation, with due regard to the needs and rights of other nations.

2. The United States, almost alone among the nations of the world, relies on privately owned telecommunications companies to play the principal part in the country's telecommunications system. It should continue to be the policy of the United States Government to encourage and promote the health of the privately owned companies as a vital national asset.

3. The United States telecommunications system is essential to the national security, to international relations, and to the business, social, educational, and political life of the country. Hence Government must remain alert to the problems of this system, and be prepared to support measures necessary to insure the continued strength of the telecommunications system as a whole.

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C. National Defense

In time of war or national emergency, as proclaimed by the President, the Government of the United States shall have available to it the total telecommunications resources of the nation for utilization with due regard to the extent of the war or emergency and to the continuing operation of services considered to be essential or desirable for the welfare and interest of the United States during such a time.

D. Safety at Sea

"The national security, the nation's sea commerce, and the assurance of adequate safety of life and property at sea require an efficient, integrated, standardized system of radio and electronic aids for marine navigation. . . .

"In consequence, it is vital to the national interest that the United States play a leading role in the development, investigation, selection and standardization of a world-wide system for marine navigation. . . .at the earliest practicable moment consistent with open-mindedness and sound technical judgment directed toward the attainment of optimum results, with due consideration for the cost to ship operators being kept as low as possible. . . .

"To simplify standardization, to effect the greatest economy in operation and to further the most economical use of the radio spectrum, the joint use of radio aids by both air and sea craft is. . . .

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advocated where mutually advantageous." (See Appendix II)

E. Safety in the Air

The nation's air travel and the assurance of safety of life and property in flight require an efficient, integrated, standardized, systme of radio and electronic aids to long-distance air navigation; therefore "The United States will support and promote a single system of electronic long-distance aids to (air) navigation for United States and world-wide standardization. . . .

"The United States will take the necessary steps to obtain and maintain at all times the qualitative and quantitative data by which the choice of electronic long-distance aids to navigation can be determined and furthered internationally." (See Appendix III)

F. International Communications

1. The United States considers the International Telecommunications Union to be the competent and appropriate international forum for the purpose of negotiating world-wide agreements on telecommunication matters.

2. The United States should be appropriately represented at any international telecommunications conference when such a conference is considered to be related, directly or indirectly, to the national defense, security, welfare, or prosperity.

3. The United States should foster and encourage the participation, for the purpose of providing advice and information, of experts

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from its commercial communications enterprises in the work preparatory to and at telecommunications conferences which involve the commercial communications interests of the United States.

4. The fact that both cable and radio facilities are required by the United States for its overseas telecommunications system shall guide consideration of any material matters which affect the availability, in the form of continued operation, of either medium.

II. Specific Policy Actions

A. Radio Frequencies

1. The United States considers that a basic guide to follow in the normal assignment of radio frequencies for transmission purposes is the avoidance of harmful interference.

2. Long-range radio frequencies for other than overseas circuits normally shall be used only when other forms of communication, notably wire communication, are not adequate.

3. Priorities in the normal peacetime assignment of radio frequencies shall be as follows in the order named:

(a) Frequencies used predominantly, primarily, and directly for national security and defense, which means that such frequencies are used for purposes which are vital to the safety of the nation.

(b) Frequencies used primarily, predominantly, and directly to safeguard life and property in conditions of distress.

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(c) Frequencies used in services that have no other adequate means of rapid communication, when such communication is considered to be necessary or desirable in the national interest.

(d) Frequencies used for all other purposes, the assignment of which must be judged upon the merits of individual need.

B. Radio Spectrum Utilization

1. In view of the limitations of the usable radio spectrum, and to insure the best possible return from the use thereof, it is in the best interests of the United States in time of peace to require all of its users to:

(a) Justify, in a satisfactory and equitable manner, any except an emergency request for radio frequencies prior to the assignment of such frequencies, and

(b) Confirm periodically, in terms of pre-determined standards, that the use of a frequency since its latest assignment, justified the assignment, and

(c) Submit evidence to indicate whether the continued assignment of a frequency is necessary.

It will further be in the best interests of the United States, in consideration of (a), (b) and (c) heretofore (among other considerations to decide by high-level impartial determination, the disposition of any frequency or frequencies not assigned or re-assigned to a claimant user.

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2. Common standards of performance and efficiency of radio spectrum utilization shall be developed and applied to each type of radio operation. All users of the radio spectrum shall be required to adhere to these standards.

C. Miscellaneous

Fixed Service

1. Frequency-conserving techniques shall be applied whenever practicable in radio operations and particularly in the operation of point to point radio circuits. These techniques include such developments as single sideband operation and frequency-shift keying.

Aeronautical

1. Public correspondence shall not be transmitted on frequencies exclusively allocated to the aeronautical mobile service.

2. The United States supports a system of radio communication between aircraft and the stations of Maritime Mobile Service, which provides a means for the exchange of public correspondence between aircraft in flight and the general public on a world-wide basis, and enhances safety.

Maritime

1. Use of the distress frequency of five hundred kilocycles, as prescribed by the current International Radio Regulations, shall continue to be the means primarily employed to summon assistance or to safeguard life and property on the high seas.

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Amateur

1. The Amateur Service shall be fostered and encouraged because the immediate availability to all world areas of the Amateur Services's frequencies and the amateurs who utilize them, is vital during times of emergency, whether such emergency be of a localized nature or national in scope.

2. The United States considers its own Amateur Service to be vitally necessary to the national defense and security because it provides a pool of personnel trained in the techniques of telecommunications, including skilled operators.

Telegraph

1. The Government of the United States should operate domestic communication circuits as it considers necessary for the conduct of Federal Government business; further, such domestic communication circuits shall be available for any Federal Government use if such use is considered to be practicable and to afford economy; provided, that such domestic circuits operated by the Federal Government be leased or rented, whenever possible or practicable, from the commercial communications companies. The Government should not, in general, install its own domestic circuits wherever adequate and efficient facilities may be economically leased or rented from commercial sources.

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2. The United States subscribes to the standardization of the 5-unit code of International Telegraph Alphabet Number Two.

3. The United States advocates the elimination of special rates for Government telegrams in the International Service.

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APPENDIX I

STATEMENT BY THE DEPARTMENT OF DEFENSE
OF MILITARY DEPENDENCE ON THE
DOMESTIC (COMMERCIAL) COMMUNICATIONS FACILITIES
OF THE UNITED STATES

1. General. The nerve system of National Defense is the sum total of all communications systems that are available, operationally and potentially, for the prosecution of any emergency or war effort. The operational existence of nation-wide systems of rapid voice and record communications in peacetime is indispensable from the standpoint of meeting the wartime requirements of both the Military Services and the civil economy. As the intensity and complexity of warfare continues to increase, correspondingly greater demands will be placed on the communications systems of the nation from the standpoint of both circuit capacity and flexibility of operation. It is, therefore, considered in the vital interest of National Defense that there be maintained within the United States to meet that need, as many nation-wide commercial communications systems as are economically feasible.

2. Military Policy Regarding Use of Commercial Facilities.

It is impracticable to employ similar concepts and standards in assessing military and commercial communications requirements. In the development of commercial facilities, expected revenue must of natural consequence be a prime consideration. Military communications, on the other hand, as an essential element of command must first satisfy military needs with economy of force or funds an important but secondary

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consideration. As a result of this fundamental difference, it is impossible for the Military to enunciate a policy which will under all conditions prescribe the specific degree to which it will utilize or depend on commercial communications facilities. It is incumbent on all military commanders, in compliance with the basic principle of economy of force, to make maximum possible use of all existing facilities available to them including commercial service. Before reaching a decision to employ other than strictly military facilities, each commander based on the conditions prevailing in his area must weigh any advantages from the standpoint of economy against the resulting effect on military security and control, dependability of service and the rapid flow of military messages. As general policy, therefore, it may be stated that the Military Services will, whenever practicable, utilize commercial facilities and service in the interest of economy of force or funds provided that acceptable military standards of security, control, and service can be maintained.

3. Military Use of Commercial Facilities in the Zone of the Interior.

During the early period in the development of national communications systems, it was necessary for the Military Services to construct and operate their own communications facilities in the Zone of the Interior. Today, however, extensive, dependable commercial communications networks cover the length and breadth of the United States. From the standpoint of security, the risk normally involved in partial military control of its communications has been considered as being relatively

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low within the continental United States. This condition is a result of the close working relationship that exists between the Military Services and the commercial communication organizations and the existence of adequate legislation to permit prompt government operation and control if deemed advisable in the national interest.

Under these conditions, the construction and maintenance of completely separate communications systems within the United States for exclusive military use would entail an unjustifiable outlay of funds, manpower, and equipment. Military policy concerning use of commercial communications facilities in the Zone of the Interior may, therefore, be summarized as follows:

> "Within the continental limits of the United States, the Military Services, in establishing communications networks for the purpose of interconnecting their various headquarters, installations and activities, will by lease or other contractual arrangement, utilize commercial facilities and services when available and feasible except where unusual security or operational conditions are required. The terminal facilities including communications centers and relay stations of these networks will be operated and controlled by the Military Services."

4. <u>The Commercial Communications Networks as a Source of Trained Personnel for Military Service</u>.

The Military Services can maintain in peacetime only the nucleus of a wartime communications system. It is also well established that

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the impact of a state of war or national emergency on military communications systems is instantaneous and can only be met through immediate expansion of both trunk and terminal facilities.

Modern communications facilities while extremely efficient require a comparatively long lead time in the training of operator and maintenance personnel. Hence in the critical period between the outbreak of hostilities and the time when military training programs can meet over-all demands, the commercial systems of the United States represent an important source of additional trained communications personnel for military service.

In this connection, it is the policy of the Military Services to maintain a close, working relationship with the commercial communications companies of the nation in order that anticipated wartime military requirements may be reflected in peacetime expansion and training programs and to the end that emergency military needs for trained communications personnel may be met and with minimum effect on the continued operation of vital domestic communications facilities. Further, to facilitate the transition of commercial communications personnel from civilian to military operation, it is the policy of the Military Services to utilize fixed communications equipment of standard commercial design to the maximum possible extent and to prescribe similar operational and maintenance techniques.

5. Trends in Military Use of U. S. Domestic Communications Facilities. The Military Services do not foresee the necessity for any

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material change in current policy concerning their use of commercial facilities within the Zone of the Interior. In both peace and war, these facilities have proven to be operationally reliable and fully responsive to military requirements. This, in effect, means that for continuous, effective coordination of military operations within the United States, the Military Services will remain largely dependent on the commercial communications systems of the nation. Hence, while not being in a position to pass judgment on measures designed to improve the economic well-being of the commercial companies, the Military Services will have a vital interest in any changes which might adversely affect the capacity and operational efficiency of the commercial systems.

The advent of long-range, highly destructive warfare, including intensive infiltration by subversive elements, will require greatly increased defensive measures on the part of both military and civilian agencies. The impact of this increase on the domestic communications facilities of the nation has not been fully determined, but may reasonably be expected to be of considerable proportion.

Instrumentalities now exist which provide that in time of war or national emergency, the total telecommunications resources of the nation can be placed at the disposal of the government. The Military Services are mindful, however, that any successful prosecution of a war effort will require that all agencies contributing to this effort

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be afforded use of these facilities on a just and equitable basis, and in addition, must insure reasonable safety, comfort, and security for the civilian populace. To this end, the Military Services believe that the domestic communications systems of the United States should be as efficient and dependable as sound engineering, reasonable economy and good operating practices will allow, and that their capacity should reflect not only the ability to handle greatly increased wartime volume, but maximum flexibility in terms of as many alternate routings and types of facilities as can be had consistent with the ability of the commercial companies to realize a reasonable profit from their investments.

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APPENDIX II

UNITED STATES POLICY FOR RADIO
AND ELECTRONIC AIDS FOR MARINE NAVIGATION

The national security, the nation's sea commerce, and the assurance of adequate safety of life and property at sea require an efficient, integrated, standardized system of radio and electronic aids for marine navigation.

A multiplicity of new radio and electronic devices and systems possessing potential applicability for marine navigation have been developed during recent years, both at home and abroad. In fact, the devices and systems which have been developed and made potentially available as aids to navigation are so numerous that standardization is mandatory if the encouragement and development of United States sea commerce is to take place economically and realistically.

In consequence, it is vital to the national interest that the United States play a leading role in the development, investigation, selection and standardization of a world-wide system for marine navigation. This role should be played at the earliest practicable moment consistent with open-mindedness and sound technical judgment directed toward the attainment of optimum results, with due consideration for the cost to ship operators being kept as low as practicable.

An open-minded attitude shall be maintained toward novel systems and devices which eventually may develop to be superior to existing systems. This attitude, however, shall not be permitted to retard the adoption of a world system based on systems already proved and in wide use over a large part of the world's waterways.

To simplify standardization, to effect the greatest economy in operation and to further the most economical use of the radio spectrum, the joint use of radio aids by both air and sea craft is hereby advocated where mutually advantageous.

The policy contained herein is applicable for domestic guidance as well as for use as a basis for international discussions on standardization of devices, systems and performance.

For the present and at least the immediate future the following devices and systems are advocated as being practicable.

I. Navigation

A. Anti-Collision.

The use of radar shall be encouraged in order to enhance safe and economical operation primarily to reduce the risk of collision

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B. Position Fixing.

1. Distances over fifty miles.

(Aid to ocean navigation requiring accuracy of 1% and allowing 15 minutes to obtain position fix.)

(a) Loran - This system shall be continued, improved and expanded.

(b) Shipboard MF/DF with radiobeacons (useful up to 200 miles). This system shall be continued, improved and expanded.

2. Distances between 50 and 3 miles.

(Aid to approaching land, coastal navigation and port approach requiring one-half mile to 200 yards accuracy and allowing 5 minutes to one-half minute respectively to obtain position fix.)

(a) Shipboard MF/DF with radiobeacons. This system shall be continued, improved and expanded.

(b) Shipboard radars. Their use shall be encouraged and the devices shall be improved.

(c) Radar aids, both active and passive. They are necessary for the special marking of navigational aids, dangers and shore features, to facilitate identification by radar. Their further development for purposes of operational evaluation should be continued.

3. Distances less than 3 miles.

(Aid to harbor entrance requiring 50 yards accuracy and instantaneous position and track fixing.)

(a) Shipboard radars (high resolution). Their use should be encouraged and the devices shall be improved.

(b) Radar aids, both active and passive. They are necessary for the special marking of navigational aids, dangers and shore features, to facilitate identification by radar. Their further development for purposes of operational evaluation should be continued.

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(c) Shipboard MF/DF with radiobeacons. This system shall be continued, improved and expanded.

II. Harbor Control and Harbor Communication.

A. Harbor Control Radar.

This service shall be provided as required.

B. Harbor Control Communications.

VHF Radiotelephone channels for harbor control purposes shall be provided. The channels and modulation should be standardized internationally.

III. Frequencies.

The United States shall advocate the international standardization of frequency allocations for use or operational evaluation with respect to the above devices and systems.

It is believed that the frequency allocations recommended to the Department of State by the Interdepartmental Radio Advisory Committee and the Federal Communications Commission will meet the operational and technical requirements of the radio navigational devices and systems herein designated. These are as follows:

A.	Shipboard Radar:	3000 to 3246 Mc
		5460 to 5650 Mc
		9320 to 9500 Mc
B.	Radar Beacons:	3256 Mcs ± 10 Mc
		5450 Mcs ± 10 Mc
		9310 Mcs ± 10 Mc
C.	Loran:	1800 to 2000 kc
D.	LF/MF Radiobeacons	280 to 320 kc
E.	Harbor Control Communications in the Band:	152 to 162 Mc

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APPENDIX III

UNITED STATES NATIONAL POLICY ON ELECTRONIC LONG-DISTANCE AIDS TO NAVIGATION*

POLICY

1. The policy of the United States in respect to electronic long-distance aids to navigation is as follows:

a. The United States will support and promote a single system of electronic long-distance aids to navigation for United States and world-wide standardization.

b. At the present time the aids which the United States has adopted and now supports and promotes are Loran and high-power LF/MF Non-Directional Beacons in that order of preference.

(1) "Loran" is considered as one type of aid regardless of the frequency employed.

(2) Loran will be continued, improved, and expanded to provide needed coverage. The choice of a frequency for Loran installations in any particular area will be governed by the requirements to be met and the frequencies available in that area.

(3) Wherever it is technically, economically or operationally desirable, the United States supports LF/MF Non-Directional Beacons of sufficient power to meet requirements in a specific area.

(4) Recognizing the special recommendations set forth in Attachment A of the draft document, "Annex 10 to the Convention of International Civil Aviation," during the interim period the continued use or extension of other systems will not be acceptable if such system or systems require airborne or shipborne equipment in excess of, or different from, that required for the use of Loran or LF/MF Non-Directional Beacons.

c. The United States will take the necessary steps to obtain and maintain at all times the qualitative and quantitative data by which the choice of electronic long distance aids to navigation can be determined and furthered internationally.

*Approved by TCC (Document No. 557), January 31, 1950
Approved by ACC (Document No. 58/5D), April 19, 1950

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APPENDIX IV

REFERENCE SHEET

I. General Telecommunications Policy	
A. Public Communications--Purpose	Communications Act of 1934
B. Public Communications--Policy	New
C. National Defense	Executive Order #8546, dated September 24, 1940, defining functions and duties of Defense Communications Board
D. Safety at Sea	United States Policy for Radio and Electronic Aids for Marine Navigation, 1947
E. Safety in the Air	Air Coordinating Committee Document 58/5D, April 19, 1950
F. International Communications	Present practice
II. Specific Policy Actions	
A. Radio Frequencies	1. Atlantic City Convention 2. IRAC Report to Subcommittee of the House Committee on Interstate and Foreign Commerce, 81st Congress, 2nd Session
B. Radio Spectrum Utilization	Proposed
C. Miscellaneous	
Fixed	Atlantic City Convention, Art. 42 Atlantic City Radio Regulations, Sections 396 and 398
Aeronautical	Atlantic City Radio Regulations, Article 27
Maritime	Atlantic City Radio Regulations, Articles 5 and 33
Amateur	Present Practice
Telegraph	U. S. proposals to International Telegraph and Telephone Conference, Paris, May-August, 1949, (Report of Chairman of U. S. Delegation, dated Oct. 31, 1949).

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Appendix I. Military Statement re Domestic U. S. Communications, (Department of Defense)

Appendix II. "United States Policy for Radio and Electronic Aids for Marine Navigation." Prepared by an ad hoc committee headed by Admiral Merlin O'Neill, U.S.C.G., and representing all major U. S. maritime interests. Approved by the Telecommunications Coordinating Committee on September 4, 1946, TCC Document 112.

Appendix III. ACC-TCC Document on Electronic Long-Distance Aids to Navigation.

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HISTORY AND ORGANIZATION

President's Communications Policy Board

Shortly after the appointment of the President's Communications Policy Board on February 17, 1950, the Chairman came to Washington to discuss plans and programs with officials in the Executive Office of the President.

On March 10, the Board held its first meeting in the offices of the Federal Communications Commission. Federal agencies concerned with telecommunications problems were represented. The meeting was devoted to a review of specific issues related to the Board's mission. At this meeting, the Signal Corps invited the Board to set up its offices in the Pentagon, and undertook to provide necessary administrative services. During the next month, the Board commenced organization of its staff.

The Board held 59 sessions. Procedure was informal and off the record. Much of the time in these sessions was spent in discussion and analysis of major telecommunications problems and policies with specially qualified people in Government, in industry, and in private life. This procedure enabled the Board to secure a maximum of pertinent data in minimum time.

The Board also requested and received formal statements on the issues before it from a large number of Government and private

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officials and experts. Members of the Board and its staff drew heavily on these and other sources on an informal basis as well.

A small and highly competent professional staff was set up to make detailed studies and analyses of telecommunications policies and problems.

The Board wishes to express its indebtedness to Charles A. H. Thomson, Staff Director and chief executive officer, for his effective management of the staff work of the Board. It also wishes to thank Fred C. Alexander, who ably organized and directed the technical studies, particularly on frequency utilization, which have contributed so much to the report.

Other senior members were William E. Plummer, William F. Minners, Ralph O. Smith, Ernest C. Shaffer, and John J. Keel. These senior members were assisted by Julia M. Gilbert and Charlotte Hazard. Margaret J. Myers and Doris Gates served as Secretary to the Board. Carol Ashworth, Robert J. Eames, and Betty T. Walters gave secretarial and clerical assistance.

F. G. Fassett, Jr., and Charles Schwarz gave special help in writing and editing the report.

All members of the Staff contributed time and energy beyond any normal call to duty, and in a very real sense shared in the work of the Board.

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The Board contracted with Ford, Bacon and Davis, engineers, for a study of the economics of the record communications industry, and with Dr. Bonnar B. Brown of the Stanford Research Institute for special economic consulting service.

Many Government departments and agencies--in particular, the Federal Communications Commission, the Department of Defense, the Department of State, and the Department of Commerce--made available a large mass of detailed information about telecommunications operations and policies. These agencies prepared special reports for the use of the Board which permitted a more comprehensive view of the telecommunications system of the country than had previously been available in any one place.

Without this opportunity to tap special resources, the Board could not have, in the time available, covered the ground necessary to completion of its report.

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UTILIZATION STUDY OF THE HIGH FREQUENCY PART OF THE RADIO SPECTRUM

A Supplementary Report by the President's Communications Policy Board

February 19[illegible]

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Executive Registry
1-6021A

TO : AD/SO
Attention: Cmdr. Johnson
FROM : Exec Asst to DCI

1 March 51

Our comments have been requested by March 10 on the following points:

1. The need for a top-level telecommunications agency;
2. The functions of the Telecommunications Advisory Board;
3. The location of the proposed Board in the Executive Office of the President;
4. The structure of the proposed agency;
5. Its relationship to other agencies, particularly IRAC and the Telecommunications Coordinating Committee.

Would you let me have your comments by 8 March.

LBK

Attx: No. 76

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PRESIDENT'S COMMUNICATIONS POLICY BOARD
WASHINGTON 25, D. C.

February 16, 1951

The President
The White House
Washington, D. C.

Dear Mr. President:

The President's Communications Policy Board, pursuant to your request to its Chairman for a study of the growing scarcity of frequencies in relation to demand, has studied the utilization of the high-frequency part of the radio spectrum used for trans-oceanic communications. To the best of our knowledge, no such study has previously been made.

For reasons of security and because of possible embarrassment to the United States in its international negotiations, we have not included this study and its findings in our public report. They are set forth in detail in the attached confidential report. A brief summary for your information is included.

The results of our study suggest that the radio frequencies in the supposedly crowded long-distance transmission band are not being fully utilized by either Government or private stations. These results emphasize the need, if the United States is to forestall an actual shortage in the days ahead, for more effective national management of the radio spectrum, as pointed out in Chapter V of our public report.

There is also an immediate urgent international problem of implementing the Atlantic City Treaty. No effective machinery was available to cope with this problem. Therefore, as a temporary expedient, we recommended to the Under Secretary of State, the Deputy Secretary of Defense, and the Chairman of the Federal Communications Commission the prompt appointment of an ad hoc group to work on implementation of the Treaty. This group has been appointed and we have made our study available to it. The lack of a permanent mechanism within the Government equipped to perform this task is another example of the need for an agency such as we have recommended in our public report.

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We recommend that the attached study be transmitted for the confidential information of the heads of those Government agencies named in the accompanying list and that the Federal Communications Commission be authorized to send copies to the companies on the list. If you accept our recommendation to establish a new Telecommunications Advisory Board in the Executive Office of the President, this study and its supporting data should be turned over to it as well.

Respectfully submitted,

/Signed/

Lee A. DuBridge

William L. Everitt

James R. Killian, Jr.

David H. O'Brien

Irvin Stewart, Chairman

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Y

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The Secretary of State
Mr. Dean Acheson

The Secretary of the Treasury
Mr. John W. Snyder

The Secretary of Defense
General George C. Marshall

The Attorney General
Mr. J. Howard McGrath

The Secretary of Agriculture
Mr. Charles F. Brannan

The Secretary of the Interior
Mr. Charles Sawyer

The Chairman of the Federal
Communications Commission
Mr. Wayne Coy

The Director of Central
Intelligence
General Walter B. Smith

The Administrator
General Services Administration
Mr. Jess Larson

The Director
Bureau of the Budget
Mr. Frederick J. Lawton

Mr. R. V. Howley, President
Tropical Radio Telegraph Company
80 Federal Street
Boston, Massachusetts

General David Sarnoff, Chairman
Radio Corporation of America
30 Rockefeller Plaza
New York, N. Y.

Mr. William J. McCambridge, President
Press Wireless, Inc.
1475 Broadway
New York, N. Y.

Mr. Leroy A. Wilson, President
American Telephone & Telegraph Co.
195 Broadway
New York, N. Y.

Col. Sosthenes Behn, Chairman
International Telephone & Telegraph Co.
67 Broad Street
New York 4, N. Y.

Mr. R. Stanley Dollar, President
Globe Wireless, Ltd.
311 California Street
San Francisco, California

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of the
H I G H F R E Q U E N C Y P A R T
of the
R A D I O S P E C T R U M

A SUPPLEMENTARY REPORT BY THE

PRESIDENT'S COMMUNICATIONS POLICY BOARD

February, 1951

C O N F I D E N T I A L

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C O N F I D E N T I A L

Copy No. 76

UTILIZATION STUDY OF THE HIGH FREQUENCY PART OF THE RADIO SPECTRUM

(Performed under the direction of the President's Communications Policy Board, August through December, 1950.)

SUMMARY

INTRODUCTION

A. Scope of the Study.

B. Methods used.

(a) Selection of Spectrum Space.

(b) Station Observations.

C. Results of Monitoring before Analysis.

D. Factors Governing Analysis.

E. Tabular Results. Tables II to VI.

F. Discussion of Scope, Method and Results.

(a) Purpose and Value.

(b) Assumptions and Interpretations made for Purposes of Analysis.

(c) Reasons for Non-use or Limited Use of High, Long-Distance Radio Frequencies.

(d) Relationship of Results to Other Services.

G. Conclusions.

H. Recommendations.

C O N F I D E N T I A L

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FREQUENCY UTILIZATION STUDY

SUMMARY

On approaching the problem of the generally alleged scarcity of radio frequencies in relation to increasing demands, the President's Communications Policy Board found no reliable data on which to form a sound opinion. The Board, therefore, decided to undertake a monitoring study of representative slices of the high frequency part of the radio spectrum--where there is a maximum of international competition. Basic monitoring for the study was done by the Federal Communications Commission's monitors, following instructions issued by the Board. Monitoring results were analyzed by the Board's staff. The method and detailed findings of our study are described in the body of this confidential report.

The fundamental objective of this study was to indicate the degree of use the United States is making of its high-frequency radio assignments in the fixed point to point service. This service was selected for study because it was one for which usable data could be secured in the time available.

Analysis of monitoring reports reveals that efficient usage has not been made of all of the frequencies observed.

Of 140 fixed service, U. S. assigned frequencies which were observed, 23 were not used at all during the periods of observation. Sixteen additional frequencies were used to a very minor degree. If we had used less generous assumptions, the latter number

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would have been larger. In addition, these figures are representative of a period when the volume of communications to be handled was abnormally high because of the defense effort.

These results strongly suggest that similar conditions also exist in other parts of the high frequency bands which are allocated to the fixed services, as well as to those used by other services, such as maritime mobile, aeronautical, etc.

Such conditions as these, where they exist, would be harmful to our interests were they to become known internationally, because they would weaken our position at international conferences.

Our findings also point to these further conclusions:

(1) The "increasing scarcity of radio frequencies" is not yet acute. However, users of the spectrum have tried to secure sufficient frequencies to protect themselves from anticipated scarcity. Thus, while new registrations and assignments are hard to get, both Federal Government and other users in the aggregate appear to have considerably more than enough to meet their normal and immediate needs.

(2) These conditions probably exist in other countries as well, varying directly with the number of frequencies used by each country.

(3) The alleged scarcity of frequencies available for registration is a timely warning of the actual scarcity which will gradually be brought about by growth in the

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demand for telecommunications services and for other usages of the radio spectrum, intensified by the current international race for frequencies to be used for high-frequency broadcasting and defense. This trend toward scarcity may be offset in part by application of existing technological advances hitherto retarded by economic or other factors, and by improvements yet to be developed.

(4) Careful monitoring is a vital key to factual knowledge of spectrum utilization. The study confirms the need for further analysis of the data accumulated and for a permanent program of organized monitoring. One important objective of such an effort is to evaluate the frequency usage factors arising out of the growing amount of interference to communications.

These conclusions--in particular the prospect of real scarcity to come--lead us to recommend that the Federal Government initiate and maintain comprehensive studies of the use being made of the radio spectrum both by the United States and by foreign users. Such studies are the indispensable basis for the sound and effective regulation and management of use of the radio spectrum, and for the strengthening of our position at forthcoming international telecommunications conferences.

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UTILIZATION STUDY OF THE HIGH FREQUENCY PART OF THE RADIO SPECTRUM

Introduction

Executive Order #10110, February 17, 1950, and the accompanying letter of the President stressed the need of a study of radio frequency utilization and the "scarcity of radio frequencies in relation to the steadily growing demand." To establish proper background for consideration of the subject, the President's Communications Policy Board created by the Executive Order felt that factual data on present actual use of radio frequencies were necessary.

The Board knew of no current monitoring studies broad enough to indicate the extent to which the United States was using the frequencies registered by it or assigned to it in the high frequency portion of the radio spectrum. Accordingly, the Board decided to make its own study of the current utilization of frequencies by United States users in the 4 to 27.5 Mc part of the radio spectrum. This portion of the spectrum was selected for study because of the technical usefulness of such frequencies for long-distance overseas communications and because of the increasing world demands for them.

To monitor the entire spectrum from 4 to 27.5 Mc would have been too great a task to complete within the time available; it was therefore decided to conduct the study by means of a comparative sampling process. This process in itself involved 7,000 log sheets and the analysis of 175,000 observations. The services of the monitoring stations of the

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Federal Communications Commission were made available to the Board for the purpose, and the FCC was extremely cooperative in permitting the Board to write its own directives to the 19 FCC monitoring stations in the United States, Alaska, and Hawaii.

The Board wishes to express its sincere appreciation not only for the high degree of cooperation given but also for the completeness of the work performed by the stations in a monitoring program larger and more comprehensive than any ever before undertaken by them.

A. Scope of the Study

To secure data sufficient for comparative analyses on which conclusions could be based, the Board sought completion of eight phases of monitoring observation by December, 1950, or in about 16 weeks. The eight phases decided upon were between 6710 kc and 16980 kc, embracing frequencies considered generally representative of international communications. They totaled 995 kc or an average of 124.4 kc per phase. Within them were 140 frequencies with known United States fixed assignments, an average of 17.5 per phase, which were considered in the analysis. Of the 140, 64 were Government, 67 non-Government, and 9 shared. These assignments encompass 598.88 kc. of spectrum space.

The following table indicates the scope of the study in terms of assignments and kilocycles of space in the various bands:

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Number of U. S. Frequencies assigned included in parts of Spectrum monitored and Amount of Spectrum Assigned in each Band

Phase	Band - Kc.	Space Kc.	No. of Frequencies Assigned				Space in Kc.			Totals
			No.	Gov.	non-Gov.*	Shared	Gov.	Non-Gov.*	Shared	
1	6710 - 6815	105	21	7	11	3	24.61	68.00	18.00	110.61
2	7625 - 7735	110	24	13	11	0	39.55	56.50	0.0	96.05
3	9290 - 9410	120	17	9	5	3	31.54	19.00	19.00	69.54
4	10440 - 10550	110	21	6	12	3	9.50	63.00	19.45	70.20
5	13170 - 13290	120	8	4	4	0	3.54	19.00	0.0	22.54
6	14570 - 14700	130	20	11	9	0	47.50	53.00	0.0	110.50
7	15760 - 15870	110	23	9	14	0	27.95	80.50	0.0	108.45
8	16790 - 16980	190	6	5	1	0	4.99	6.00	0.0	10.99
	Total	995	140	64	67	9	189.18	365.00	44.70	598.88

*includes all others except Federal Government

C O N F I D E N T I A L

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B. Methods Used

(a) Selection of Spectrum Space

The confidential IRAC-FCC list of May 24, 1950, showing U. S. assignments in numerical and ascending order of frequency, was used as a guide to ascertain where a preponderance of United States fixed assignments might be found in any band.

It was desired, as far as possible, to observe unbroken portions of the spectrum. Hence the monitoring of selected individual frequencies was ruled out. Frequencies below 6710 kc. and above 16980 kc. were also ruled out, in order to be as fair as possible to all users, because of the greater possibility that active use of these frequencies might be interfered with by the effects of the eleven-year sunspot cycle.

At the time the selection of space for observation was made, the Board had no advance information on how much use was being made of frequencies within a particular part of the spectrum. The only considerations guiding selection of particular portions of the spectrum to be monitored were these:

1. As many bands representative of fixed overseas operation were to be observed as time would allow.
2. Within the limits of the spectrum space embraced by each phase (within the practical limits of about 125 kc.), as many observations as possible of United States fixed assignments were to be made, and observation of a preponderant number of frequencies assigned to any one organization,

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whether Government or commercial, was to be avoided.

3. Observation was to be concentrated, as far as possible, on assignments in the fixed service. The frequencies selected, therefore, included those with a high percentage of assignments to the fixed service as listed in the IRAC-FCC list.

Some aircraft and maritime frequencies were included among those observed, particularly in phases 5 and 8 (13 and 16 Mc bands), but these were eliminated for the purposes of analysis, which was confined to the Fixed Service.

(b) Station Observations

For these observations, a total of 19 monitoring stations, located from Maine to California and from Alaska and Hawaii to Florida, were available. Of the 19 stations, 10 were primary and 9 secondary.

As far as possible, all frequencies were to be observed on a 24-hour basis, regardless of the characteristics of the frequency itself, i.e., whether it was more useful predominantly by day, night, or transition (twilight). The 24-hour observation was possible at the 10 primary stations; at the secondary stations, because of limited hours of operation, only 12 hours of daily observation was recorded. The station locations and classes are shown in Attachment No. 2.

Instructions were sent to the 19 stations outlining their assignments and procedures relative to each phase. Delays in the receipt of these instructions by mail created a lag which staggered the starting times of almost all stations with relation to all phases observed. This

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resulted in about 15 days of observation on a particular assignment, all stations considered. The stations were instructed merely to monitor the spectrum space set forth and to record on special log sheets the observation of any transmissions occurring within that space. None of the stations knew why the work was being done and they, therefore, approached it as intended, objectively, as is borne out by the logs, upon which are recorded both foreign and U. S. transmissions as they occurred. Details covering assignments and the instructions relating to observation, including sample log sheets, are shown in Attachment (1).

C. Results of Monitoring Before Analysis

At the conclusion of the monitoring study, the Board received by airmail approximately 7,000 log sheets. These are in the files of the Board and have been classified as "Confidential." There are no duplicate copies.

They were prepared by the Board especially for this study and show in 5 basic columns (1) the time, (2) frequency upon which a transmission was observed, (3) transmitting station if identified, (4) type of emission and the type of activity (traffic, calling, idling, carrier, etc.), and (5) remarks, which were used to amplify where necessary columns 2, 3, or 4. (See Attachment 3.)

Because of the widespread geographical locations of the listening stations and the propagational characteristics of the frequencies observed, the observations include, in addition to the transmission of the U. S.

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stations, an appreciable amount of transmission from foreign stations. Some unidentified transmission was observed, but the amount was surprisingly low. This may have been due to the experience of the radio operators engaged in this activity, who have become highly familiar with constant transmissions on particular frequencies. The accuracy of the frequencies shown is considered sufficient for the purposes of this study. It would have been too ponderous a procedure in the time available to measure each transmission with a precision frequency meter. In lieu of such a procedure, the stations were given the latitude of calibrating their receivers within the particular part of the spectrum under observation by means of a precision meter, and, in the course of observation, determining by reasonable estimate the frequency heard. It was determined that this method produced a result that was accurate by approximately + or - 500 cycles.

The observations recorded on the log sheets, when considered en masse, are generally representative of the actual transmission on specific frequencies. This results from the fact that 19 stations were under instruction (See Attachment 1) to cover and record all activity heard within an average space of 124.4 kc. (per phase), once each hour. At least three primary stations covered the same part of the 124.4 kc. during the hour for 24 hours, and all nine secondary stations covered the entire 124.4 kc. once each hour for 12 hours daily. The possibility of recording any signal, however intermittent its transmission, was enhanced by the fact that, in accordance with the instructions, no two stations started at the same time to make the hourly observation, except by coincidence.

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D. Factors for Analysis of the Study.

For the purposes of analyzing the study, it was determined to select, from within each phase, the ten days that showed the highest degree of monitoring coverage. This selection necessitated scanning log sheets for approximately 15 days of observation within each phase, occasioned by the varying lag in mail delivery of instructions to stations. This selection earmarked the ten days which had the greatest number of listening stations in simultaneous observation, even though any difference in the number of transmissions observed appeared to be negligible.

As the study was primarily made to observe the degree of activity on the U. S. assignments in the fixed point-to-point service, it was necessary to eliminate U. S. assignments to other services, such as maritime mobile and aeronautical mobile, in addition to the recorded transmissions of foreign stations.

The U. S. fixed service assignments (including aero-fixed) were then carefully reviewed and a number of these assignments eliminated wherever there was reasonable doubt that the monitoring stations could have heard the transmission. As an illustration, a station having an assignment in the 7 Mc band, transmitting from Manila to Tokyo, unshared with any other U. S. station, was eliminated from consideration because there existed a reasonable doubt that U. S. monitoring stations would hear the Manila station during the hours that it was transmitting to Tokyo.

After this weeding out, there remained in the eight phases concerned 140 frequencies upon which there were fixed point-to-point U.S. assignments.

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The approximately 175,000 observations were recapitulated by frequency, call sign, time heard, emission, and nature of transmission activity, i.e., traffic, idling signal, dotting, transmission of call signs or testing, sending steady carrier, or other. These data for the 10 week days monitored by the most stations were then recapitulated by agency and station. Each station intercepted was given credit for one hour if an emission was intercepted once or more within a particular hour. Unidentified emissions which probably emanated from a particular station were credited to that station. The various types of transmission activities were then totaled for the 10 days and the average hours of use per day were determined. Where one agency used a frequency at more than one location the agency was credited with the total time as though used at but one location. In instances of frequency sharing, the total time of use was credited to the frequency.

In order to determine the hours of use possible with the circuit path and propagational characteristics of the frequencies monitored, each assignment was analyzed separately. This was done by reviewing records of transmissions made during the actual monitoring period over essentially the same distance and path. The records were made available to the Board through the courtesy of the Signal Corps.

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E. Results of the Study.

The results of the study are presented in tabular form. Table IIa shows the number of frequencies assigned vs. average hours of use for all probable U. S. transmissions totaled for all types of transmission activity. Tables IIb, IIc, and IId show the same information separately by type of transmission activity; respectively, traffic, idling--call signs--testing, and steady carrier. Table IIa shows that, over a period of 10 week days, of the 140 frequencies monitored 23 frequencies or 16.4% had no U. S. transmissions of any kind. Table IIb shows that of the 140 frequencies monitored, 28 or 20% had no U. S. transmissions of traffic.

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C O N F I D E N T I A L

Table IIa

FREQUENCY UTILIZATION
SUMMARY OF RESULTS OF MONITORING PROGRAM
(All Types of Probable U. S. Transmission Activity)

	1	2	3	4	5	6	7	8	
Freq. Bands Monitored -- KC	6710 to 6815	7625 to 7735	9290 to 9410	10440 to 10550	13170 to 13290	14570 to 14700	15760 to 15870	16790 to 16980	
Spectrum Space--KC	105	110	120	110	120	130	110	190	= 995
# Freqs. U.S. Ass'd	21	24	17	21	8	20	23	6	140
# Freqs. U.S. Ass'd with no U.S. transmissions	5	3	2	0	2	0	8	3	23
# Freqs. U.S. Ass'd with no identifiable U.S. transmissions	6	5	2	0	2	1	9	3	28
# Freqs. U.S. Ass'd with identified U.S. transmissions	15	19	15	21	6	19	14	3	112
# Freqs. U.S. Ass'd with transmissions identified as U.S. or probably U.S.	16	21	15	21	6	20	15	3	117

Number of Frequencies Vs. Hours of Use
(Includes all probable U.S. Transmissions)

Hours of Use	Frequency Bands 1	2	3	4	5	6	7	8	Total	Accumulative Totals
0*	5	3	2	0	2	0	8	3	23	23
1	2	1	1	1	0	0	1	1	7	30
2	2	1	0	2	0	3	1	0	9	39
3	1	1	0	2	0	2	1	1	8	47
4	1	2	0	0	0	2	0	1	6	53
5	1	0	2	0	0	4	1	0	8	61
6	1	4	1	2	0	2	0	0	10	71
7	1	4	1	1	2	2	2	0	13	84
8	2	1	1	0	0	1	1	0	6	90
9	1	3	0	0	1	1	0	0	6	96
10	1	0	1	2	0	0	1	0	5	101
11	1	0	0	1	0	1	1	0	4	105
12	0	0	1	0	0	1	1	0	3	108
13	0	1	2	0	0	0	3	0	6	114
14	0	1	0	2	0	1	2	0	6	120
15	0	0	0	1	2	0	0	0	3	123
16	1	0	1	3	0	0	0	0	5	128
17	0	0	0	1	0	0	0	0	1	129
18	0	1	0	0	1	0	0	0	2	131
19	0	1	2	0	0	0	0	0	3	134
20	0	0	2	1	0	0	0	0	3	137
21	0	0	0	0	0	0	0	0	0	137
22	0	0	0	0	0	0	0	0	0	137
23	1	0	0	2	0	0	0	0	3	140
24	0	0	0	0	0	0	0	0	0	
Total	21	24	17	21	8	20	23	6	140	

1. In the "hours of use" column time in excess of a whole hour was counted as the next higher hour.
2. All forms of emission such as traffic, calls, dotting, idling were included

* - No U.S. transmissions

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Table IIb

FREQUENCY UTILIZATION
SUMMARY OF RESULTS OF MONITORING PROGRAM
(All Probable U.S. Traffic)

	1	2	3	4	5	6	7	8	
Freq. Bands Monitored -- KC	6710 to 6815	7625 to 7735	9290 to 9410	10440 to 10550	13170 to 13290	14570 to 14700	15760 to 15870	16790 to 16980	
Spectrum Space--KC	105	110	120	110	120	130	110	190	=995
# Freqs. U.S. Ass'd	21	24	17	21	8	20	23	6	140
# Freqs. U.S. Ass'd with no U.S. transmissions	4	3	3	0	2	0	8	3	23
# Freqs. U.S. Ass'd with no identifiable U.S. transmissions	7	5	3	1	2	2	10	3	33
# Freqs. U.S. Ass'd with identified U.S. transmissions	14	19	14	20	6	18	13	3	107
# Freqs. U.S. Ass'd with transmissions identified as U.S. or probably U.S.	17	21	14	21	6	20	15	3	117

Number of Frequencies Vs. Hours of Use
(Includes all probable U.S. Transmissions of Traffic)

Hours of Use	Frequency Bands 1	2	3	4	5	6	7	8	Total	Accumulative Totals
0*	4	3	3	0	2	0	8	3	23	23
1	6	2	0	2	0	4	2	1	17	40
2	2	4	1	2	1	5	1	1	17	57
3	0	4	2	2	0	1	1	1	11	68
4	1	3	2	1	0	3	2	0	12	80
5	3	1	0	1	1	2	0	0	8	88
6	3	2	3	4	1	0	0	0	13	101
7	0	2	0	4	0	1	4	0	11	112
8	0	0	2	1	1	0	1	0	5	117
9	2	0	0	0	2	3	0	0	7	124
10	0	2	2	1	0	0	1	0	6	130
11	0	1	0	1	0	0	3	0	5	135
12	0	0	1	0	0	0	0	0	1	136
13	0	0	0	1	0	1	0	0	2	138
14	0	0	0	1	0	0	0	0	1	139
15	0	0	1	0	0	0	0	0	1	140
16	0	0	0	0	0	0	0	0	0	
17	0	0	0	0	0	0	0	0	0	
18	0	0	0	0	0	0	0	0	0	
19	0	0	0	0	0	0	0	0	0	
20	0	0	0	0	0	0	0	0	0	
21	0	0	0	0	0	0	0	0	0	
22	0	0	0	0	0	0	0	0	0	
23	0	0	0	0	0	0	0	0	0	
24	0	0	0	0	0	0	0	0	0	
Total	21	24	17	21	8	20	23	6	140	

1. In the "hours of use" column time in excess of a whole hour was counted as the next higher hour.
2. "Calling" was counted as sending traffic.

* - No U. S. traffic

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C O N F I D E N T I A L

Table IIc

FREQUENCY UTILIZATION
SUMMARY OF RESULTS OF MONITORING PROGRAM
(All Probable U.S. Idling, Dots, Call Signs, or Test)

	1	2	3	4	5	6	7	8	
Freq. Bands Monitored -- KC	6710 to 6815	7625 to 7735	9290 to 9410	10440 to 10550	13170 to 13290	14570 to 14700	15760 to 15870	16790 to 16980	
Spectrum Space--KC	105	110	120	110	120	130	110	190	= 995
# Freqs. U.S. Ass'd	21	24	17	21	8	20	23	6	140
# Freqs. U.S. Ass'd with no U.S. transmissions	7	3	2	5	2	0	9	4	32
# Freqs. U.S. Ass'd with no identifiable U.S. transmissions	11	5	2	1	2	4	11	4	40
# Freqs. U.S. Ass'd with identified U.S. transmissions	10	19	15	20	6	16	12	2	100
# Freqs. U.S. Ass'd with transmissions identified as U.S. or probably U.S.	14	21	15	16	6	20	14	3	108

Number of Frequencies Vs. Hours of Use
(Includes all probable U.S. Transmissions of Idling, Dotting, Call Signs and Testing)

Hours of Use	Frequency Bands 1	2	3	4	5	6	7	8	Total	Accumulative Totals
0*	7	3	2	5	2	0	9	4	32	32
1	8	8	3	3	1	15	8	2	48	80
2	0	7	4	3	5	5	3	0	27	107
3	2	4	5	4	0	0	2	0	17	124
4	1	2	1	0	0	0	1	0	5	129
5	0	0	0	0	0	0	0	0	0	129
6	0	0	0	0	0	0	0	0	0	129
7	1	0	1	1	0	0	0	0	3	132
8	1	0	0	1	0	0	0	0	2	134
9	0	0	0	2	0	0	0	0	2	136
10	0	0	0	1	0	0	0	0	1	137
11	0	0	0	1	0	0	0	0	1	138
12	0	0	0	0	0	0	0	0	0	138
13	1	0	0	0	0	0	0	0	1	139
14	0	0	1	0	0	0	0	0	1	140
15	0	0	0	0	0	0	0	0	0	
16	0	0	0	0	0	0	0	0	0	
17	0	0	0	0	0	0	0	0	0	
18	0	0	0	0	0	0	0	0	0	
19	0	0	0	0	0	0	0	0	0	
20	0	0	0	0	0	0	0	0	0	
21	0	0	0	0	0	0	0	0	0	
22	0	0	0	0	0	0	0	0	0	
23	0	0	0	0	0	0	0	0	0	
24	0	0	0	0	0	0	0	0	0	
otal	21	24	17	21	8	20	23	6	140	

* In the "hours of use" column time in excess of a whole hour was counted as the next higher hour.

- No. U. S. idling, etc.

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Table IId

FREQUENCY UTILIZATION
SUMMARY OF RESULTS OF MONITORING PROGRAM
(All Probable U.S. Steady Carrier)

	1	2	3	4	5	6	7	8	
Freq. Bands Monitored -- KC	6710 to 6815	7625 to 7735	9290 to 9410	10440 to 10550	13170 to 13290	14570 to 14700	15760 to 15870	16790 to 16980	
Spectrum Space--KC	105	110	120	110	120	130	110	190	=995
# Freqs. U.S. Ass'd	21	24	17	21	8	20	23	6	140
# Freqs. U.S. Ass'd with no U.S. transmissions	8	5	4	6	2	0	9	3	37
# Freqs. U.S. Ass'd with no identifiable U.S. transmissions	12	16	8	11	4	10	19	5	85
# Freqs. U.S. Ass'd with identified U.S. transmissions	9	8	9	10	4	10	4	1	55
# Freqs. U.S. Ass'd with transmissions identified as U.S. or probably U.S.	13	19	13	15	6	20	14	3	103

Number of Frequencies Vs. Hours of Use
(Includes all probable U.S. Transmissions of Steady Carrier)

Hours of Use	Frequency Bands 1	2	3	4	5	6	7	8	Total	Accumulative Totals
0*	8	5	5	6	2	0	9	3	38	38
1	8	10	3	7	2	15	5	3	53	91
2	0	4	3	3	0	4	4	0	18	109
3	1	2	3	2	0	1	4	0	13	122
4	3	0	1	1	1	0	1	0	7	129
5	0	1	1	0	1	0	0	0	3	132
6	1	0	0	1	0	0	0	0	2	134
7	0	1	0	0	0	0	0	0	1	135
8	0	1	0	0	2	0	0	0	3	138
9	0	0	1	0	0	0	0	0	1	139
10	0	0	0	0	0	0	0	0	0	139
11	0	0	0	0	0	0	0	0	0	139
12	0	0	0	0	0	0	0	0	0	139
13	0	0	0	0	0	0	0	0	0	139
14	0	0	0	0	0	0	0	0	0	139
15	0	0	0	1	0	0	0	0	1	140
16	0	0	0	0	0	0	0	0	0	
17	0	0	0	0	0	0	0	0	0	
18	0	0	0	0	0	0	0	0	0	
19	0	0	0	0	0	0	0	0	0	
20	0	0	0	0	0	0	0	0	0	
21	0	0	0	0	0	0	0	0	0	
22	0	0	0	0	0	0	0	0	0	
23	0	0	0	0	0	0	0	0	0	
24	0	0	0	0	0	0	0	0	0	
Total	21	24	17	21	8	20	23	6	140	

1. In the "hours of use" column time in excess of a whole hour was counted as the next higher hour.

* - No U. S. steady carrier

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Table III presents the amount of spectrum space in kilocycles (assigned to all U. S. frequencies given in Table IIa) vs. hours of use. This table shows that the sum of the bands of emission for the 23 frequencies shown by Table IIa to have no U. S. transmissions over a period of ten week days is 68.29 kc. This is 10.4% of the sum of the bands of emission assigned to U. S. stations for the 140 frequencies considered. When more than one U. S. assignment was listed for a frequency, the widest bandwidth of emission was used. Table III also shows that over one-half of the entire spectrum space involved (655.88 kc.) was used an average of six hours or less for each 24 hour period.

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Table III

FREQUENCY UTILIZATION
SUMMARY OF RESULTS OF MONITORING PROGRAM
(All Types of Probable U.S. Transmission Activity)

	1	2	3	4	5	6	7	8	
req. Bands onitored—KC	6710 to 6815	7625 to 7735	9290 to 9410	10440 to 10550	13170 to 13290	14570 to 14700	15760 to 15870	16790 to 16980	
pectrum Space—KC	105	110	120	110	120	130	110	190	= 995
pectrum Space S. Assigned	120.61	110.55	72.54	80.2	25.54	116.50	118.95	10.99	655.88
pectrum Space U.S. signed with no U.S. ransmissions	25.1	5.05	3.95	0	9.0	0	22.75	2.44	68.29
pectrum Space U.S. signed with no iden- fiable transmissions	31.1	7.25	3.95	0	9.0	6.0	28.75	2.44	88.49
ectrum Space U.S. signed with iden- fied U.S. ansmissions	89.51	103.3	68.59	80.2	16.54	110.20	90.20	8.55	567.39
ectrum Space U.S. signed with trans- sions identified as . or probably U.S.	95.51	105.5	68.59	80.2	16.54	116.5	96.20	8.55	587.59

Amount of Spectrum Space in KC Vs. Hours of Use
(Includes all Probable U.S. Transmissions)

rs Use	Frequency Bands 1	2	3	4	5	6	7	8	Total	Accumulative Total
	25.1	5.05	3.95	0.0	9.0	0.0	22.75	2.44	68.29	68.29
	7.31	1.1	2.85	10.0	0.0	0.0	10.0	1.31	32.57	100.86
	20.0	1.1	0.0	4.1	0.0	19.0	6.0	0.0	50.20	151.06
	10.0	10.0	0.0	13.0	0.0	9.0	10.0	6.0	58.00	209.06
	6.0	13.0	0.0	0.0	0.0	16.0	0.0	1.24	36.24	245.30
	10.0	0.0	6.0	0.0	0.0	21.2	1.1	0.0	38.30	283.60
	6.0	23.1	3.0	20.0	0.0	6.1	0.0	0.0	58.20	341.80
	10.0	22.0	3.0	3.0	4.24	11.1	13.0	0.0	66.34	408.14
	3.0	6.0	10.0	0.0	0.0	10.0	10.0	0.0	39.00	447.14
	1.2	4.2	0.0	0.0	10.0	10.0	0.0	0.0	25.40	472.54
	6.0	0.0	1.1	4.1	0.0	0.0	6.0	0.0	17.20	489.74
	10.0	0.0	0.0	2.1	0.0	1.1	10.0	0.0	23.20	512.94
	0.0	0.0	0.4	0.0	0.0	10.0	10.0	0.0	20.40	533.34
	0.0	10.0	16.0	0.0	0.0	0.0	9.0	0.0	35.00	568.34
	0.0	3.0	0.0	4.25	0.0	3.0	11.1	0.0	21.35	589.69
	0.0	0.0	0.0	1.7	1.2	0.0	0.0	0.0	2.90	592.59
	3.0	0.0	6.0	7.1	0.0	0.0	0.0	0.0	16.10	608.69
	0.0	0.0	0.0	3.0	0.0	0.0	0.0	0.0	3.00	611.69
	0.0	6.0	0.0	0.0	1.1	0.0	0.0	0.0	7.10	618.79
	0.0	6.0	7.24	0.0	0.0	0.0	0.0	0.0	13.24	632.03
	0.0	0.0	13.0	2.85	0.0	0.0	0.0	0.0	15.85	647.88
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	647.88
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	647.88
	3.0	0.0	0.0	5.0	0.0	0.0	0.0	0.0	8.00	655.88
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	655.88
l	120.61	110.55	72.54	80.20	25.54	116.50	118.95	10.99	655.88	

In the "hours of use" column time in excess of a whole hour was counted as the next higher hour.
All forms of emission such as traffic, calls, dotting, idling were included.
o U. S. Transmissions

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Table IVa shows the number of frequencies vs. average hours of use for identified U. S. transmissions totaled for all types of transmission activity. Tables IVb, IVc, and IVd show the same information separately by type of transmission activity, respectively--traffic, idling--dotting-call signs--testing, and steady carrier. Tabl IVa shows that, over a period of ten week days, of the 140 U. S. frequencies assigned that were monitored 33 or 23.6% had no identifiable transmissions of traffic. Twenty-eight or 20% had no identifiable transmissions of any type of activity. Seven others included in the 22 frequencies shown in Table IVa as being used an average of one hour or less per day, were included therein on the basis of being heard only once during the ten day period. Thus, 35 or 25% of the U. S. assignments observed,were used but one hour or less in the entire ten day period. Table IVa also shows that over one-half of the frequencies were used less than three hours a day.

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C O N F I D E N T I A L

Table IVa

FREQUENCY UTILIZATION
SUMMARY OF RESULTS OF MONITORING PROGRAM
(All Types of Identified U. S. Transmission Activity)

	1	2	3	4	5	6	7	8	
Freq. Bands Monitored -- KC	6710 to 6815	7625 to 7735	9290 to 9410	10440 to 10550	13170 to 13290	14570 to 14700	15760 to 15870	16790 to 16980	
Spectrum Space--KC	105	110	120	110	120	130	110	190	=925
# Freqs. U.S. Ass'd	21	24	17	21	8	20	23	6	140
# Freqs. U.S. Ass'd with no U.S. transmissions	5	3	2	0	2	0	7	3	22
# Freqs. U.S. Ass'd with no identifiable U.S. transmissions	6	5	2	0	2	1	9	3	28
# Freqs. U.S. Ass'd with identified U.S. transmissions	15	19	15	21	6	19	14	3	112
# Freqs. U.S. Ass'd with transmissions identified as U.S. or probably U.S.	16	21	15	21	6	20	16	3	118

Number of Frequencies Vs. Hours of Use
(Includes identified U.S. Transmissions Only)

Hours of Use	Frequency Bands 1	2	3	4	5	6	7	8	Total	Accumulative Totals
0*	6	5	2	0	2	1	9	3	28	28
1	3	4	1	2	1	7	3	1	22	50
2	2	0	1	2	0	4	1	1	11	61
3	2	1	0	2	1	2	4	1	13	74
4	1	4	3	0	0	2	0	0	10	84
5	0	0	1	2	1	0	1	0	5	89
6	2	4	1	1	1	0	0	0	9	98
7	0	2	2	0	0	2	0	0	6	104
8	2	2	0	1	0	1	1	0	7	111
9	1	1	0	1	1	0	2	0	6	117
10	0	1	0	0	1	0	0	0	2	119
11	0	0	1	0	0	0	1	0	2	121
12	1	0	3	2	0	1	1	0	8	129
13	0	0	0	1	0	0	0	0	1	130
14	0	0	1	1	0	0	0	0	2	132
15	0	0	0	1	0	0	0	0	1	133
16	0	0	0	2	0	0	0	0	2	135
17	0	0	0	1	0	0	0	0	1	136
18	0	0	0	1	0	0	0	0	1	137
19	0	0	0	0	0	0	0	0	0	137
20	0	0	0	0	0	0	0	0	0	137
21	0	0	1	0	0	0	0	0	1	138
22	0	0	0	0	0	0	0	0	0	138
23	1	0	0	1	0	0	0	0	2	140
24	0	0	0	0	0	0	0	0	0	
Total	21	24	17	21	8	20	23	6	140	

1. In the "hours of use" column time in excess of a whole hour was counted as the next higher hour.
2. All forms of emission such as traffic, calls, dotting, idling were included.

* - No identifiable U.S. transmissions

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Table IVb

1

FREQUENCY UTILIZATION
SUMMARY OF RESULTS OF MONITORING PROGRAM
(Identified Traffic Only)

	1	2	3	4	5	6	7	8	
Freq. Bands Monitored--KC	6710 to 6815	7625 to 7735	9290 to 9410	10440 to 10550	13170 to 13290	14570 to 14700	15760 to 15870	16790 to 16980	
Spectrum Space--KC	105	110	120	110	120	130	110	190	=995
# Freqs. U.S. Ass'd	21	24	17	21	8	20	23	6	140
# Freqs. U.S. Ass'd: with no U.S. traffic	4	3	3	0	2	0	7	3	22
# Freqs. U.S. Ass'd: with no identifiable U.S. traffic	7	5	3	1	2	2	10	3	33
# Freqs. U.S. Ass'd: with traffic identified as U.S.	14	19	14	20	6	18	13	3	107
# Freqs. U.S. Ass'd: with traffic identified as U.S. or probably U.S.	17	21	14	21	6	20	16	3	118

Number of Frequencies Vs. Hours of Use
(Includes only identified U.S. Transmission of Traffic)

Hours of Use	Frequency Bands 1	2	3	4	5	6	7	8	Total	Accumulative Totals
0*	7	5	3	1	2	2	10	3	33	33
1	5	7	1	3	1	9	2	1	29	62
2	1	2	4	3	2	5	4	1	22	84
3	2	3	1	2	0	2	1	1	12	96
4	1	0	1	1	2	0	2	0	7	103
5	4	3	2	1	0	1	1	0	12	115
6	1	2	1	2	0	0	0	0	6	121
7	0	2	2	3	0	0	0	0	7	128
8	0	0	0	1	1	0	1	0	3	131
9	0	0	1	1	0	0	2	0	4	135
10	0	0	1	2	0	0	0	0	3	138
11	0	0	0	0	0	1	0	0	1	139
12	0	0	0	1	0	0	0	0	1	140
13	0	0	0	0	0	0	0	0	0	
14	0	0	0	0	0	0	0	0	0	
15	0	0	0	0	0	0	0	0	0	
16	0	0	0	0	0	0	0	0	0	
17	0	0	0	0	0	0	0	0	0	
18	0	0	0	0	0	0	0	0	0	
19	0	0	0	0	0	0	0	0	0	
20	0	0	0	0	0	0	0	0	0	
21	0	0	0	0	0	0	0	0	0	
22	0	0	0	0	0	0	0	0	0	
23	0	0	0	0	0	0	0	0	0	
24	0	0	0	0	0	0	0	0	0	
Total	21	24	17	21	8	20	23	6	140	

1. In the "hours of use" column time in excess of a whole hour was counted as the next higher hour.
2. "Calling" was counted as sending traffic.

* - No identifiable U.S. traffic

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Table IVc

FREQUENCY UTILIZATION
SUMMARY OF RESULTS OF MONITORING PROGRAM
(Identified Idling, Dots, Call Signs or Test)

	1	2	3	4	5	6	7	8	
Freq. Bands Monitored -- KC	6710 to 6815	7625 to 7735	9290 to 9410	10440 to 10550	13170 to 13290	14570 to 14700	15760 to 15870	16790 to 16980	
Spectrum Space--KC	105	110	120	110	120	130	110	190	=995
#Freqs. U.S. Ass'd	21	24	17	21	8	20	23	6	140
# Freqs. U.S. Ass'd: with no U.S. idling:	7	3	2	5	2	0	8	4	31
# Freqs. U.S. Ass'd: with no identifiable U.S. idling, etc. :	11	5	2	1	2	4	11	4	40
# Freqs. U.S. Ass'd: with idling, etc., identified as U.S. :	10	19	15	20	6	16	12	2	100
# Freqs. U.S. Ass'd: with idling, etc., identified as U.S. or probably U.S. :	14	21	15	16	6	20	15	2	109

Number of Frequencies Vs. Hours of Use
(Includes only identified U.S. Transmissions of Idling, Dotting, Call Signs and Testing)

Hours of Use	Frequency Bands 1	2	3	4	5	6	7	8	Total	Accumulative Totals
0*	11	5	2	1	2	4	11	4	40	40
1	4	9	4	5	2	15	6	2	47	87
2	2	5	4	3	4	1	3	0	22	109
3	1	3	3	4	0	0	2	0	13	122
4	0	2	2	2	0	0	1	0	7	129
5	0	0	0	0	0	0	0	0	0	129
6	1	0	0	0	0	0	0	0	1	130
7	0	0	0	1	0	0	0	0	1	131
8	1	0	1	1	0	0	0	0	3	134
9	0	0	0	2	0	0	0	0	2	136
10	0	0	0	0	0	0	0	0	0	136
11	0	0	0	2	0	0	0	0	2	138
12	0	0	0	0	0	0	0	0	0	138
13	1	0	0	0	0	0	0	0	1	139
14	0	0	1	0	0	0	0	0	1	140
15	0	0	0	0	0	0	0	0	0	
16	0	0	0	0	0	0	0	0	0	
17	0	0	0	0	0	0	0	0	0	
18	0	0	0	0	0	0	0	0	0	
19	0	0	0	0	0	0	0	0	0	
20	0	0	0	0	0	0	0	0	0	
21	0	0	0	0	0	0	0	0	0	
22	0	0	0	0	0	0	0	0	0	
23	0	0	0	0	0	0	0	0	0	
24	0	0	0	0	0	0	0	0	0	
Total	21	24	17	21	8	20	23	6	140	

1. In the "hours of use" column time in excess of a whole hour was counted as the next higher hour.

* - No identifiable U.S. idling, etc.

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Table IVd

FREQUENCY UTILIZATION
SUMMARY OF RESULTS OF MONITORING PROGRAM
(Identified Steady Carrier)

	1	2	3	4	5	6	7	8	
Freq. Bands Monitored -- KC	6710 to 6815	7625 to 7735	9290 to 9410	10440 to 10550	13170 to 13290	14570 to 14700	15760 to 15870	16790 to 16980	
Spectrum Space--KC	105	110	120	110	120	130	110	190	=995
# Freqs. U.S. Ass'd	21	24	17	21	8	20	23	6	140
# Freqs. U.S. Ass'd with no U.S. steady carrier	8	5	4	6	2	0	8	3	36
# Freqs. U.S. Ass'd with no identifiable U.S. steady carrier	12	16	8	11	4	10	19	5	85
# Freqs. U.S. Ass'd with steady carrier identified as U.S.	9	8	9	10	4	10	4	1	55
# Freqs. U.S. Ass'd with steady carrier identified as U.S. or probably U.S.	13	19	13	15	6	20	15	3	104

Number of Frequencies Vs. Hours of Use
(Includes only identified U.S. transmissions of Steady Carrier)

Hours of Use	Frequency Bands 1	2	3	4	5	6	7	8	Total	Accumulative Totals
0*	12	16	8	11	4	10	19	5	85	85
1	5	5	6	7	2	8	2	1	36	121
2	1	2	2	0	1	2	2	0	10	131
3	2	0	0	0	0	0	0	0	2	133
4	1	1	0	2	0	0	0	0	4	137
5	0	0	0	0	1	0	0	0	1	138
6	0	0	1	0	0	0	0	0	1	139
7	0	0	0	0	0	0	0	0	0	139
8	0	0	0	1	0	0	0	0	1	140
9	0	0	0	0	0	0	0	0	0	
10	0	0	0	0	0	0	0	0	0	
11	0	0	0	0	0	0	0	0	0	
12	0	0	0	0	0	0	0	0	0	
13	0	0	0	0	0	0	0	0	0	
14	0	0	0	0	0	0	0	0	0	
15	0	0	0	0	0	0	0	0	0	
16	0	0	0	0	0	0	0	0	0	
17	0	0	0	0	0	0	0	0	0	
18	0	0	0	0	0	0	0	0	0	
19	0	0	0	0	0	0	0	0	0	
20	0	0	0	0	0	0	0	0	0	
21	0	0	0	0	0	0	0	0	0	
22	0	0	0	0	0	0	0	0	0	
23	0	0	0	0	0	0	0	0	0	
24	0	0	0	0	0	0	0	0	0	
Total	21	24	17	21	8	20	23	6	140	

1. In the "hours of use" column time in excess of a whole hour was counted as the next higher hour.

* - No identifiable U.S. steady carrier

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Table V presents the amount of spectrum space in Kc. (assigned to frequencies given by Table IVa) vs. hours of use. This table shows that the sum of the bands of emission for the 28 frequencies shown by Table IVa to have no identifiable U. S. transmissions over a period of ten week days is 88.49 kc. This is 13.6% of the sum of the bands of emission assigned to U. S. stations for the 140 frequencies considered. When more than one U. S. assignment was listed for a frequency, the widest bandwidth of emission was used. Table V also shows that over one-half of the entire spectrum space involved (655.88 kc.) was used an average of three hours or less for each 24 hour period.

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Table V

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FREQUENCY UTILIZATION
SUMMARY OF RESULTS OF MONITORING PROGRAM
(All Types of Identified U.S. Transmission Activity)

	1	2	3	4	5	6	7	8	
req. Bands onitored—KC	6710 to 6815	7625 to 7735	9290 to 9410	10440 to 10550	13170 to 13290	14570 to 14700	15760 to 15870	16790 to 16980	
pectrum Space—KC	105	110	120	110	120	130	110	190	= 995
pectrum Space S. Assigned	120.61	110.55	72.54	80.2	25.54	116.50	118.95	10.99	655.88
pectrum Space U.S. signed with no U.S. ransmissions	25.1	5.05	3.95	0	9.0	0	22.75	2.44	68.29
pectrum Space U.S. signed with no iden- fiable transmissions	31.1	7.25	3.95	0	9.0	6.0	28.75	2.44	88.49
ectrum Space U.S. signed with iden- fied U.S. ansmissions	89.51	103.3	68.59	80.2	16.54	110.20	90.20	8.55	567.39
ectrum Space U.S. signed with trans- sions identified as . or probably U.S.	95.51	105.5	68.59	80.2	16.54	116.5	96.20	8.55	587.59

Amount of Spectrum Space in KC Vs. Hours of Use
(Includes Identified U.S. Transmissions Only)

rs Use	Frequency Bands 1	2	3	4	5	6	7	8	Total	Accumulative Total
	31.1	7.25	3.95	0.0	9.0	6.0	28.75	2.44	88.49	88.49
	21.31	32.00	2.85	13.00	1.24	35.10	26.00	1.31	132.81	221.30
	20.0	0.0	3.0	4.1	0.0	11.3	3.0	6.0	47.40	268.70
	6.1	3.0	0.0	12.1	0.1	20.0	22.2	1.24	64.74	333.44
	6.0	27.1	9.0	0.0	0.0	11.1	0.0	0.0	53.20	386.64
	0.0	0.0	10.0	13.0	3.0	0.0	3.0	0.0	29.00	415.64
	16.0	17.1	1.1	10.0	1.1	0.0	0.0	0.0	45.30	460.94
	0.0	6.1	10.4	0.0	0.0	20.0	0.0	0.0	36.50	497.44
	11.1	9.0	0.0	3.0	0.0	10.0	10.0	0.0	43.10	540.54
	3.0	3.0	0.0	1.1	10.0	0.0	20.0	0.0	37.10	577.64
	0.0	6.0	0.0	0.0	1.1	0.0	0.0	0.0	7.10	584.74
	0.0	0.0	10.0	0.0	0.0	0.0	3.0	0.0	13.00	597.74
	3.0	0.0	18.0	2.95	0.0	3.0	3.0	0.0	29.95	627.69
	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	2.00	629.69
	0.0	0.0	1.24	3.0	0.0	0.0	0.0	0.0	4.24	633.93
	0.0	0.0	0.0	3.0	0.0	0.0	0.0	0.0	3.00	636.93
	0.0	0.0	0.0	4.1	0.0	0.0	0.0	0.0	4.10	641.03
	0.0	0.0	0.0	3.0	0.0	0.0	0.0	0.0	3.00	644.03
	0.0	0.0	0.0	2.85	0.0	0.0	0.0	0.0	2.85	646.88
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	646.88
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	646.88
	0.0	0.0	3.0	0.0	0.0	0.0	0.0	0.0	3.00	649.88
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	649.88
	3.0	0.0	0.0	3.0	0.0	0.0	0.0	0.0	6.00	655.88
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	655.88
	120.61	110.55	72.54	80.20	25.54	116.50	118.95	10.99	655.88	

the "hours of use" column time in excess of a whole hour was counted as the next higher hour.
l forms of emission such as traffic, calls, dotting, idling were included.
dentifiable U.S. transmissions

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Table VI summarizes the results of the Monitoring Program. It shows the bandwidth encompassed by the program; the number of discrete frequencies assigned to U. S. agencies; the spectrum space included (sum of the individual bands of emission); possible hours of use for the assigned frequencies (based on the actual circuit for which the frequencies are assigned); the hours used as determined from the monitoring program; a utility factor (in %) obtained by dividing hours of use by possible hours of use and an average utility factor arrived at by dividing the total hours used by the total frequency hours per day. This table shows that out of a total of 3360 frequencies hours per day, 1858 frequency hours per day were considered useful. It further shows that 620 frequency hours per day or 34% were used by U. S. stations identified during the course of the monitoring program; and 995 frequency hours per day, or 54%, were used by stations identified as U. S. or considered as probably U. S. stations.

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Table VI

FREQUENCY UTILIZATION

SUMMARY OF RESULTS OF MONITORING PROGRAM

(All Types of Identified U. S. Transmission Activity)

Phase	1	2	3	4	5	6	7	8	Total
Band KC	6710 to 6815	7625 to 7735	9290 to 9410	10440 to 10550	13170 to 13290	14570 to 14700	15760 to 15870	16790 to 16980	
Band Width KC	105	110	120	110	120	130	110	190	995
No. U.S. assign.	21	24	17	21	8	20	23	6	140
Spectrum Space included	120.61	110.55	72.54	80.2	25.54	116.50	118.95	10.99	655.88

AVERAGE UTILITY FACTOR

(Average Hours of Use/Possible Average Hours of Use)

Identified U. S. Transmissions

Possible Hours Use per day	299	345	253	303	90.9	223	267	76	1858
Hours used per day	83.1	87.6	112.8	193	30.8	43.2	65.2	4.8	620.5
Utility Factor (%)	28	25	44	64	34	19	24	6.3	-

Average Utility factor (Identified U. S. Transmissions) 33

Identified as U. S. or probably U. S. Transmissions

Hours used per day	123.5	156.8	166.4	233.8	68.6	110.3	128.5	7.2	995.1
Utility Factor (%)	41	45	66	77	76	50	48	9.5	-

Average Utility factor (Identified U.S. or probably U.S. transmissions) 54

Total Frequency Hours per day = 24 x 140 = 3360 hours.

Ratio of possible hours to total elapsed hours = 56%.

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F. Discussion

(a) Value of the Study

This extent of our sampling of various selected parts of the spectrum within the high frequency range cannot be considered as positive proof that utilization throughout the entire scale of long-range frequencies is relatively poor; nevertheless, on the basis of what the observed frequencies indicate, the Board is of the opinion that this possibility certainly exists. In fact, it is possible that some areas of this part of the spectrum may show even less national use.

The study is regarded as of value because:

i. It is an indication that in the parts of the spectrum studied, at least, the situation is not critical; on the contrary, the percentage of use is comparatively low.

ii. It is an indication that more extensive and continuing studies of the spectrum are necessary if national radio frequency management is to be accomplished in a manner designed to serve the best interests of the United States.

iii. It is an indication that a review of the transmissions of other countries will probably show varying degrees of non-use and the study should be further analyzed in this connection, as this information will be of extreme value at forthcoming radio conferences.

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(b) Assumptions and Interpretations made for Purposes of Analysis.

In the process of collecting the observations by the listening radio stations, no assumptions were made and none appeared necessary. The coverage was considered to be ample both from a standpoint of number and location of the listening points. In fact, review of the log sheets indicated that the number of transmissions recorded was not appreciably increased when a number of stations in the same general location were given identical segments of the spectrum to cover. The stations were instructed to record whatever was heard and they did so.

In the course of the analysis, however, certain assumptions and interpretations became necessary for evaluation of the 175,000 entries contained in the log sheets. These are:

i. Frequency assignments were removed from consideration whenever there existed a reasonable doubt that the monitoring stations could hear them. Foreign assignments and U. S. assignments other than Fixed were not considered in the final total of 140 United States Fixed assignments.

ii. When a transmitter was heard on the assigned frequency but not positively identified by call-sign, station-fix, or other available methods, it was assumed to be the U. S. transmitter to which the frequency was assigned,

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and was given credit accordingly.

iii. When an assigned frequency was shared and used by two or more different stations or organizations, credit was given for the total time of transmission to all the stations concerned.

iv. Credit for transmission time on an observed frequency when heard by one or more monitoring stations was given as follows:

1. Once in any hour counted as a full hour.
2. Once in ten days counted as ten hours for the 10-day phase.
3. Final averages exceeding a whole hour were rounded off to the next higher number of hours.

v. Analysis excluded any transmission occurring on Saturdays and Sundays. It was considered that such records would not be representative of normal transmission and frequency usage.

The cumulative effect of these assumptions and interpretations led to the conservative analysis presented in Tables II to VI. The restrictions imposed upon the analysis probably more than offset, in favor of the user, a possible human error of 10% in monitoring or analysis. The human error, of course, could have been plus or minus. From this point of view, it is quite possible that a new analysis, bolstered by the usage records of the stations to which the frequencies are

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assigned, would show even less frequency utilization than is indicated by these tabular results.

The Board believes that the period during which the study was made was fair to all concerned. During this period the commercial agencies showed a profitable rate of return on their investments, which indicated that traffic loads were not subnormal and the Government facilities were particularly active because of the Korean War and related defense preparations.

(c) Reasons for Non-use or Limited Use of High or Long-Range Radio Frequencies

The reasons that may apply to non-use or limited use of radio frequencies by radio stations are numerous, interrelated, and complicated. Discussion of this subject often results in confusion and impasse, unless those concerned have a sincere desire to reach a conclusion. Some of the more common general explanations of why a frequency is not used to the full by the assignee are:

1. Because of interference, transmissions may be shifted to another frequency. There has always been a need for operating organizations to be prepared to meet an interruption to communication occasioned by the sudden development of interference on an active frequency assignment. Such events have always occurred from time to time because of error, apparatus, technical defect, laxity in operating

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practice, dispute involving priority in registration date or date of use, desire to develop shared use by time difference and geographical separation, and wilful intent. The clearing up of such interferences varies from a few hours to very long periods, particularly if negotiations must be carried on through diplomatic channels. This condition has led to the need for operating agencies maintaining frequency assignments in reserve. The tendency has been to keep such assignments partially active to prevent them from being activated by some other stations. It should be mentioned that the need for such protection has greatly increased during and since World War II, which factor now aggravates the frequency utilization problem.

2. The frequency may be one reserved for emergency, for special intermittent uses, for national defense efforts requiring secrecy of preparation, for training purposes, for use at traffic peaks only, for research and experimentation, or for readiness to serve.

3. Low or high sunspot activity over the 11-year cycle may limit usability of the frequency on a particular path.

4. Temporary reduction of traffic may cause a lapse in operation.

5. Failure of equipment may close down operation.

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6. On shared frequencies, harmful interference may occur during some overlapping periods of time. The effects of interference during such overlapping times may vary from day to day and from season to season due to variable wave propagation conditions.

7. Rearrangements of frequencies to assigned circuits to maintain flexibility of operations may occasion lapses of transmission on a particular frequency.

8. The national interest may require the maintenance of a circuit even with low traffic volume.

These reasons are all valid within themselves, and the application of some of them has undoubtedly contributed to the growth of the national telecommunications networks to their present high state of efficiency and service. They present real difficulty, however, if they are invoked too hastily or too often.

The Board, however, had no desire to investigate frequency usage by individual organizations, nor did it feel that it should attempt such action during the limited period of its life. Accordingly, it decided to view the matter from the standpoint of total frequency utilization and to make the most representative evaluation, as directed by the President, in terms of the National Interest.

(d) Relationship of Results to other Services.

The competition for spectrum space between the various primary services, Fixed, Broadcast, Maritime, Aeronautical and Amateur, has

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greatly increased during the past ten years. This is a healthy condition, viewed from afar, as it tends toward self-regulation and makes it more difficult for any one service to amass vast areas of spectrum space to the detriment of the remaining four.

This study is a partial evaluation of frequency usage in only one service, the Fixed point to point. To apply only the technique of monitoring in order to determine frequency usages in the other services could have been highly misleading. For example, the Broadcast service, given a frequency, normally transmits a program during the hours considered to be useful in the listening audience area. Maritime, Aeronautical, and Amateur services share identical frequencies with hundreds of other users, national as well as internationa within each service. Hence the Broadcast service would probably show, from monitoring records only, practically 100% usage of frequencies and the remaining three services would show highly intermittent usage. Obviously, considerations in addition to monitoring, such as degrees of safety, necessity, and result are necessary to evaluate frequency usages within these other services.

Although the Board was not able in the time available to make conclusive evaluations for these other services, in the course of its monitoring study it did observe evidence of non-use of frequencies allocated to services other than fixed, both U. S. and foreign.

The Board desires to make abundantly clear the fact that while this study indicates that the frequencies observed within the Fixed

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service were not totally used to advantage, the absence of a study for the other services does not imply that they are collectively making adequate use of their frequencies. The Board feels that much useful information would be obtained if detailed studies in the case of these other services were prosecuted.

G. Conclusions

Of 140 fixed service, U. S. assigned frequencies which were observed, 23 were not used at all during the periods of observation. Sixteen additional frequencies were used to a very minor degree. If we had used less generous assumptions, the latter number would have been larger. In addition, these figures are representative of a period when the volume of communications to be handled was abnormally high because of the defense effort.

These results strongly suggest that similar conditions also exist in other parts of the high frequency bands which are allocated to the fixed services, as well as to those used by other services, such as maritime mobile, aeronautical, etc.

Such conditions as these, where they exist, would be harmful to our interests were they to become known internationally, because they would weaken our position at international conferences.

Our findings also point to these further conclusions:

(1) The "increasing scarcity of radio frequencies" is not yet acute. However, users of the spectrum have tried to

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secure sufficient frequencies to protect themselves from anticipated scarcity. Thus, while new registrations and assignments are hard to get, both Federal Government and other users in the aggregate appear to have considerably more than enough to meet their normal and immediate needs.

(2) These conditions probably exist in other countries as well, varying directly with the number of frequencies used by each country.

(3) The alleged scarcity of frequencies available for registration is a timely warning of the actual scarcity which will gradually be brought about by growth in the demand for telecommunications services and for other usages of the radio spectrum, intensified by the current international race for frequencies to be used for high-frequency broadcasting and defense. This trend toward scarcity may be offset in part by application of existing technological advances hitherto retarded by economic or other factors, and by improvements yet to be developed.

(4) Careful monitoring is a vital key to factual knowledge of spectrum utilization. The study confirms the need for further analysis of the data accumulated and for a permanent program of organized monitoring. One important objective of such an effort is to evaluate the frequency usage factors arising out of the growing amount of interference to communications.

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H. Recommendation

These conclusions--in particular the prospect of real scarcity to come--lead us to recommend that the Federal Government initiate and maintain comprehensive studies of the use being made of the radio spectrum both by the United States and by foreign users. Such studies are the indispensable basis for the sound and effective regulation and management of use of the radio spectrum, and for the strengthening of our position at forthcoming international telecommunications conferences.

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Instructions for Special Monitoring

General Explanatory Note

This project is designed to outline, as projected by the log sheets provided, the nature, frequency, degree of activity, and the identity of the stations operating within the spectrum space indicated. For ease of handling and to enable monitoring stations to produce reliable information, the project has been broken down into 2 phases of about 100 kc each.

Sample Log

Form No. 54 Daily Page No.____

SPECIAL MONITORING CASE NO. RE54

(See special instructions for using this form)

Monitoring Station_____ Date (GMT)_____

Band _____kc to _____kc, (incl.)

1. TIME (GMT)	2. FREQ.	3. TRANS. STATION	4. EMISSION ACTIVITY	5. REMARKS

Instructions for Using Form RE54

Col. 1: Self-explanatory.

Col. 2: The frequency upon which the transmission occurs need only be accurately measured once during each Phase and then only by Primary Stations. Each accurate measurement is to be noted in "Remarks." Other frequency observations may be done by reasonable estimate. If more than one station is heard on the same frequency, use a separate line on the log sheet with a note in "Remarks" column if necessary.

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Col. 3: It is desirable that identity of transmitting stations be established and set forth either by call sign or name and location, in this column. However, if it is not possible to establish identity within a brief period, it may be possible to establish, from the traffic or otherwise, the location of the receiving station or stations, which should be noted in "Remarks." It is not expected that identity will be definitely established each time a station is monitored, but it is hoped that the identity of each signal monitored will be established one or more times in the course of Phase 1 and likewise for Phase 2. Reference to previous records in establishing station identity is desirable, as long as care is taken in matching types of emission, frequency, etc.

Col. 4: The type of emission should be indicated in this column, using the standard international symbols such as A1, F4, etc., followed by a coded estimate of activity as follows:

W - Idling signal, dots, call sign, or test.
X - Steady carrier.
Y - Sending traffic.
Z - Other; see remarks.

The two codes employed may be amplified and combined consistent with the circumstances. Some examples follow:

1. A SSB telephone carrier - idling - would be indicated as - "A3-SSB-X."
2. A telegraph circuit - high speed - carrying traffic - would be indicated as - "A1-Hi speed-Y."
3. A DSB telephone - carrying traffic - scrambled - would be indicated as - "A3-Y-Scrambled."

Col. 5: Remarks - Should be used whenever it is considered advisable to amplify previous information to be found in the foregoing columns.

The judgment of the monitoring officer must be called into play in filling out columns 3, 4, and 5, in order that, within the limited time available, as complete a job as possible may be turned out.

It is desired that the band(s) indicated for each monitoring station concerned be covered once each hour. This may be done at any time during the hour.

This coverage must necessarily be accomplished with due regard for emergency operations, etc., and, if unavoidable gaps occur in the log, the notation "Coverage not possible" should be used.

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Schedule for Special Monitoring Case No. RE54

Phase 1 (6710 to 6815 kc (incl.) - 105 kc)

It is desired to initiate Phase 1 of this Case at the earliest date and time possible for all monitoring stations. This Phase 1 comprehends monitoring the bands indicated in the Phase 1 schedule during two consecutive weeks (Monday through Friday of each week). It is not essential, however, that all stations start this Phase at the same time of the day nor on the same day of the week.

Single copies of log sheets, which have been provided, are to be Airmailed* to "Chief, Field Engineering Monitoring Division, Federal Communications Commission, Washington 25, D.C." as soon as practicable after each 24-hour period of monitoring by Primary Stations, after each 12-hour period by Secondary Stations.

*Laurel, Millis, and Scituate - Regular Mail.

Phase 1 Schedule

Monitoring Stations	Frequency Band(kc) to be monitored	Daily Periods (LST) to monitor indicated band(s)	
		Night	Day
Primary			
Millis	6710 to 6745, inc.	7 pm to 7 am	7 am to 7 pm
Laurel	6745 to 6780, inc.	"	7 am to 7 pm
Powder Springs	6780 to 6815, inc.	"	7 am to 7 pm
Allegan	6710 to 6745, inc.	"	7 am to 7 pm
Grand Island	6745 to 6780, inc.	"	7 am to 7 pm
Kingsville	6780 to 6815, inc.	"	7 am to 7 pm
Portland, Ore.	6710 to 6735, inc.	"	7 am to 7 pm
Livermore	6735 to 6760, inc.	"	7 am to 7 pm
Santa Ana	6760 to 6785, inc.	"	7 am to 7 pm
Lanikai	6785 to 6815, inc.	"	7 am to 7 pm
Secondary			
Searsport	6710 to 6815, inc.	None	7 am to 7 pm
North Scituate	6710 to 6815, inc.	None	7 am to 7 pm
Spokane	6710 to 6815, inc.	None	7 am to 7 pm
Twin Falls	6710 to 6815, inc.	None	7 am to 7 pm
Fort Lauderdale	6710 to 6815, inc.	None	7 am to 7 pm
Lexington	6710 to 6815, inc.	None	7 am to 7 pm
Muskogee	6710 to 6815, inc.	None	7 am to 7 pm
Bay St. Louis	6710 to 6815, inc.	None	7 am to 7 pm
Anchorage	6710 to 6815, inc.	None	7 am to 7 pm

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Phase 2 (7625 to 7735 kc (incl.) - 110 kc)

It is desired to initiate Phase 2 of this Case immediately upon completion of Phase 1 by each monitoring station concerned.

Like Phase 1, Phase 2 comprehends monitoring the bands indicated in the Phase 2 Schedule during two consecutive weeks (Monday through Friday of each week). It is not essential that all stations start this Phase at the same time of the day nor on the same day of the week.

Basically, the same general instructions apply, unless modified by dispatch.

Phase 2 Schedule

Monitoring Stations	Frequency Band(kc) to be monitored	Daily Periods (LST) to monitor indicated band(s)	
		Night	Day
Primary			
Millis	7625 to 7664, inc.	7 pm to 7 am	7 am to 7 pm
Laurel	7664 to 7700, inc.	"	
Powder Springs	7700 to 7735, inc.	"	
Allegan	7625 to 7664, inc.	"	7 am to 7 pm
Grand Island	7664 to 7700, inc.	"	
Kingsville	7700 to 7735, inc.	"	
Portland, Ore.	7625 to 7651, inc.	"	7 am to 7 pm
Livermore	7651 to 7678, inc.	"	
Santa Ana	7678 to 7707, inc.	"	
Lanikai	7707 to 7735, inc.	"	
Secondary			
Searsport	7625 to 7735, inc.	None	7 am to 7 pm
North Scituate			
Spokane			
Twin Falls			
Fort Lauderdale			
Lexington			
Muskogee			
Bay St. Louis			
Anchorage			

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Phase 3 (9290 to 9410 kc (incl.) - 120 kc)

It is desired to initiate Phase 3 of this Case immediately upon completion of Phase 2 by each monitoring station concerned, using the same basic instructions previously received.

Like Phases 1 and 2, Phase 3 comprehends monitoring the bands indicated in the Phase 3 Schedule during two consecutive weeks (Monday through Friday of each week). It is not essential that all stations start this Phase at the same time of the day nor on the same day of the week.

Basically, the same general instructions apply, unless modified by dispatch. For convenience in analyzing the data, it is desired that a new log sheet be started at 0000 hours, GMT, and that the same sheet not be used for more than one day. The log sheets should be unclassified.

Phase 3 Schedule

Monitoring Stations	Frequency Band (kc) to be monitored	Daily Periods (LST) To monitor indicated band(s)	
		Night	Day
Primary			
Millis	9290 to 9325, inc.	7 pm to 7 am	7 am to 7 pm
Laurel	9325 to 9365, inc.	"	"
Powder Springs	9365 to 9410, inc.	"	"
Allegan	9290 to 9325, inc.	"	"
Grand Island	9325 to 9365, inc.	"	"
Kingsville	9365 to 9410, inc.	"	"
Portland, Ore.	9290 to 9320, inc.	"	"
Livermore	9320 to 9340, inc.	"	"
Santa Ana	9340 to 9380, inc.	"	"
Lanikai	9380 to 9410, inc.	"	"
Secondary			
Searsport	9290 to 9410, inc.	None	7am to 7 pm
North Scituate			
Spokane			
Twin Falls			
Fort Lauderdale			
Lexington			
Muskogee			
Bay St. Louis			
Anchorage			

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Phase 4 (10440 to 10550 kc (incl.) - 110 kc)

It is desired to initiate Phase 4 of this Case immediately upon completion of Phase 3 by each monitoring station concerned, using the same basic instructions previously received.

Like Phases 1, 2, and 3, Phase 4 comprehends monitoring the bands indicated in the Phase 4 Schedule during two consecutive weeks (Monday through Friday of each week). It is not essential that all stations start this Phase at the same time of the day nor on the same day of the week.

Basically, the same general instructions apply, unless modified by dispatch. For convenience in analyzing the data, it is desired that a new log sheet be started at 0000 hours, GMT, and that the same sheet not be used for more than one day. The log sheets should be unclassified.

Phase 4 Schedule

Monitoring Stations	Frequency Band (KC) to be monitored	Daily Periods (LST) to monitor indicated band(s)	
Primary		Night	Day
Millis	10440 to 10470, inc.	7 pm to 7 am	7 am to 7 pm
Laurel	10470 to 10505, inc.	"	"
Powder Springs	10505 to 10550, inc.	"	"
Allegan	10440 to 10470, inc.	"	"
Grand Island	10470 to 10505, inc.	"	"
Kingsville	10505 to 10550, inc.	"	"
Portland, Ore.	10440 to 10460, inc.	"	"
Livermore	10460 to 10490, inc.	"	"
Santa Ana	10490 to 10520, inc.	"	"
Lanikai	10520 to 10550, inc.	"	"
Secondary			
Searsport	)		
North Scituate	)		
Spokane	)		
Twin Falls	)		
Fort Lauderdale	) 10440 to 10550, inc.	None	7 am to 7 pm
Lexington	)		
Muskogee	)		
Bay St. Louis	)		
Anchorage	)		

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Phase 5 (13170 to 13290 kc (incl.) - 120 kc)

It is desired to initiate Phase 5 of this Case immediately upon completion of Phase 4 by each monitoring station concerned, using the same basic instructions previously received.

Like the previous Phases 1 to 4, Phase 5 comprehends monitoring the bands indicated in the Phase 5 Schedule during two consecutive weeks (Monday through Friday of each week). It is not essential that all stations start this Phase at the same time of day nor on the same day of the week.

For convenience in analyzing the data, it is desired that a new log sheet be started at 0000 hours, GMT, and that the same sheet not be used for more than one day. The log sheets should be unclassified.

It is desired that each station report the number of log sheets remaining at the end of Phase 4 so an additional supply may be furnished if needed.

Phase 5 Schedule

Monitoring Stations	Frequency Band (kc) to be monitored	Daily Periods (LST) to monitor indicated band(s)	
		Night	Day
Primary			
Millis	13170 to 13210, inc.	7 pm to 7 am	7 am to 7 pm
Laurel	13210 to 13250, inc.	"	"
Powder Springs	13250 to 13290, inc.	"	"
Allegan	13170 to 13210, inc.	"	"
Grand Island	13210 to 13250, inc.	"	"
Kingsville	13250 to 13290, inc.	"	"
Portland, Ore.	13170 to 13200, inc.	"	"
Livermore	13200 to 13230, inc.	"	"
Santa Ana	13230 to 13260, inc.	"	"
Lanikai	13260 to 13290, inc.	"	"
Secondary			
Searsport	13170 to 13290, inc.	None	7 am to 7 pm
North Scituate			
Spokane			
Twin Falls			
Fort Lauderdale			
Lexington			
Muskogee			
Bay St. Louis			
Anchorage			

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Phase 6 (14570 to 14700 kc (incl.) - 130 kc)

It is desired to initiate Phase 6 of this Case immediately upon completion of Phase 5 by each monitoring station concerned, using the same basic instructions previously received.

Like the previous Phases 1 to 5, Phase 6 comprehends monitoring the bands indicated in the Phase 6 Schedule during two consecutive weeks (Monday through Friday of each week). It is not essential that all stations start this Phase at the same time of day nor on the same day of the week.

For convenience in analyzing the data, it is desired that a new log sheet be started at 0000 hours, GMT, and that the same sheet not be used for more than one day. The log sheets should be unclassified.

It is desired that each station report the number of log sheets remaining at the end of Phase 4 so an additional supply may be furnished if needed.

Phase 6 Schedule

Monitoring Stations	Frequency Band (kc) to be monitored	Daily Periods (LST) to monitor indicated band(s)	
		Night	Day
Primary			
Millis	14570 to 14620, inc.	7 pm to 7 am	7 am to 7 pm
Laurel	14620 to 14660, inc.	"	"
Powder Springs	14660 to 14700, inc.	"	"
Allegan	14570 to 14620, inc.	"	"
Grand Island	14620 to 14660, inc.	"	"
Kingsville	14660 to 14700, inc.	"	"
Portland, Ore.	14570 to 14610, inc.	"	"
Livermore	14610 to 14640, inc.	"	"
Santa Ana	14640 to 14670, inc.	"	"
Lanikai	14670 to 14700, inc.	"	"
Secondary			
Searsport	14570 to 14700, inc.	None	7 am to 7 pm
North Scituate			
Spokane			
Twin Falls			
Fort Lauderdale			
Lexington			
Muskogee			
Bay St. Louis			
Anchorage			

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Phase 7 (15760 to 15870 kc (incl.) - 110 kc)

It is desired to initiate Phase 7 of this Case immediately upon completion of Phase 6 by each monitoring station concerned, using the same basic instructions previously received.

Like the previous Phases 1 to 6, Phase 7 comprehends monitoring the bands indicated in the Phase 7 Schedule during two consecutive weeks (Monday through Friday of each week). It is not essential that all stations start this Phase at the same time of day nor on the same day of the week.

For convenience in analyzing the data, it is desired that a new log sheet be started at 0000 hours, GMT, and that the same sheet not be used for more than one day. The log sheets should be unclassified.

Phase 7 Schedule

Monitoring Stations	Frequency Band (kc) to be monitored	Daily Periods (LST) to monitor indicated band(s)	
		Night	Day
Primary			
Millis	15760 to 15800, inc.	7 pm to 7 am	7 am to 7 pm
Laurel	15800 to 15840, inc.	"	"
Powder Springs	15840 to 15870, inc.	"	"
Allegan	15760 to 15800, inc.	"	"
Grand Island	15800 to 15840, inc.	"	"
Kingsville	15840 to 15870, inc.	"	"
Portland, Ore.	15760 to 15790, inc.	"	"
Livermore	15790 to 15820, inc.	"	"
Santa Ana	15820 to 15845, inc.	"	"
Lanikai	15845 to 15870, inc.	"	"
Secondary			
Searsport			
North Scituate			
Spokane			
Twin Falls			
Fort Lauderdale	15760 to 15870, inc.	None	7 am to 7 pm
Lexington			
Muskogee			
Bay St. Louis			
Anchorage			

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Phase 8 (16790 to 16980 kc. (incl.) - 190 kc

It is desired to initiate Phase 8 of this Case immediately upon completion of Phase 7 by each monitoring station concerned, using the same basic instructions previously received.

Like the previous Phases 1 to 7, Phase 8 comprehends monitoring the bands indicated in the Phase 8 Schedule during two consecutive weeks (Monday through Friday of each week). It is not essential that all stations start this Phase at the same time of day nor on the same day of the week.

For convenience in analyzing the data, it is desired that a new log sheet be started at 0000 hours, GMT, and that the same sheet not be used for more than one day. The log sheets should be unclassified.

Phase 8 Schedule

Monitoring Stations	Frequency Band (kc) to be monitored	Daily Periods (LST) to monitor indicated band(s)	
		Night	Day
Primary			
Millis	16790 to 16850, inc.	7 pm to 7 am	7 am to 7 pm
Laurel	16850 to 16910, inc.	"	"
Powder Springs	16910 to 16980, inc.	"	"
Allegan	16790 to 16850, inc.	"	"
Grand Island	16850 to 16910, inc.	"	"
Kingsville	16910 to 16980, inc.	"	"
Portland, Ore.	16790 to 16840, inc.	"	"
Livermore	16840 to 16880, inc.	"	"
Santa Ana	16880 to 16930, inc.	"	"
Lanikai	16930 to 16980, inc.	"	"
Secondary			
Searsport			
North Scituate			
Spokane			
Twin Falls			
Fort Lauderdale	16790 to 16980, inc.	None	7 am to 7 pm
Lexington			
Muskogee			
Bay St. Louis			
Anchorage			

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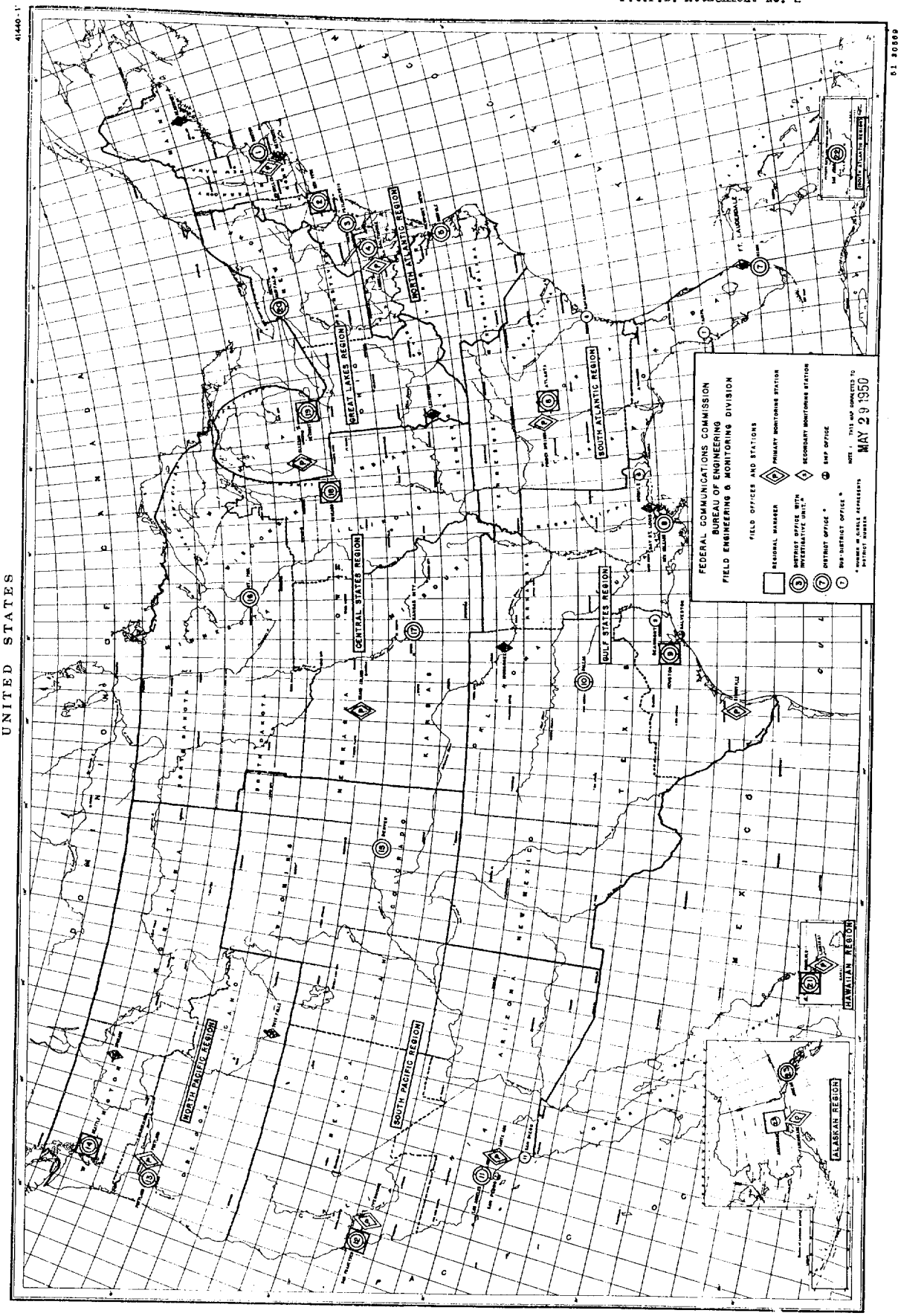

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Form No. 54

Daily Page No ____

SPECIAL MONITORING CASE NO. RE54
(See Special Instructions)

Monitoring Stn._____ Date (GMT)_____

Band_____KC To _____KC (Incl)

(1) ME MT)	(2) FREQ.	(3) TRANS. STATION	(4) EMISSION ACTIVITY	(5) REMARKS

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