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No 105

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Economic Intelligence Report

PLANNED DEVELOPMENT OF TELECOMMUNICATIONS IN EAST GERMANY 1959–75

CIA/RR ER 61-25

May 1961

CENTRAL INTELLIGENCE AGENCY

Office of Research and Reports

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FOREWORD

This report assesses short-term and long-term plan data for the vast development of basic and strategic telecommunications in East Germany and evaluates the impact of this development on the economic, political, and military posture of the country. Because telecommunications can play a consequential role in support of that posture, the over-all approach has been to analyze these plans for possible indications of future intentions of East Germany.

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Essentially this report covers basic telecommunications facilities and services under the management of the Ministry of Post and Telecommunications (MPT). It also discusses certain functional systems, selected on the basis of availability of data, size of system, and importance of use. The systems selected were those controlled and operated by the Central Committee of the Socialist Unity (Communist) Party (SED), the Ministry of National Defense (MINAVE), and the Group of Soviet Forces Germany (GSFG).

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PLANNED DEVELOPMENT OF TELECOMMUNICATIONS IN EAST GERMANY* 1959-75

Summary and Conclusions

East Germany has begun in earnest to build up on a broad front its basic and strategic telecommunications resources. Two plans guide this effort: the Seven Year Plan (1959-65) and the long-range plan (1966-75). In the formulation of these plans the Central Committee of the Socialist Unity (Communist) Party (SED) has asserted a high degree of authority. The Ministry of Post and Telecommunications (MPT) still manages the basic telecommunications system and participates in the planning process, but much of its former planning authority has been lost to the Party as a result of the industrial reorganization of 1958 and the reorganization of the Ministry itself in 1959.

On the basis of decisions of two organizations of the Sino-Soviet Bloc -- the Organization for Cooperation Among Socialist Countries in the Fields of Post and Communications (OSS) and the International Radiobroadcasting and Television Organization (OIRT) -- East Germany, as a member of both, attempts to achieve compatibility of techniques and services, standardization of equipment and practices, and the cohesive benefits of an integrated Bloc-wide arterial network. These two mechanisms, in turn, attempt to adhere to the international standards established by the two technical committees of the International Telecommunication Union (ITU): the International Telegraph and Telephone Consultative Committee (CCITT) and the International Radio Consultative Committee (CCIR).

The Seven Year Plan and the long-range plan are complementary. The Seven Year Plan envisions the construction of a modern high-capacity arterial network to meet present and future needs, and the long-range plan stresses the installation of additional main and tributary facilities that are to be connected to the arterial network to give greater service to all localities of the country. To achieve maximum reliability within reasonable economic costs, this network, already under construction, will feature a balanced installation of "soft" (over-the-surface) microwave radio relay lines and "hardened"

* The estimates and conclusions in this report represent the best judgment of this Office as of 1 May 1961. For a glossary of technical terms, see Appendix A.

(underground) coaxial and multiconductor cable lines. For some key routes, soft and hard media will be somewhat paralleled to attain a rational balance between economics and reliability. When completed, the network will take care of specialized services for air defense and missile activities as well as of growing needs for conventional telephone, telegraph, and broadcast services.

During 1959-65 the strategic functional networks of the SED, the Ministry of National Defense (MINAVE), and the Group of Soviet Forces Germany (GSFG) also will be enlarged. These networks will serve the more extensive political needs of the SED and the expanded needs of the MINAVE and the GSFG, respectively. Plans stress the improvement of existing fixed facilities and the increased use of mobile facilities in order to achieve wider coverage; more flexibility; and, above all, greater reliability regardless of cost.

East Germany also intends to expand its coverage of international broadcasting, especially into underdeveloped areas. Furthermore, as the economy grows, the number of direct international telephone and telegraph circuits will be increased for political and economic purposes. These international projections, taken by East Germany with an apparent determination to establish itself as a major communications "gateway" between Eastern and Western Europe, would seem to strengthen an East German drive for worldwide recognition as a sovereign state.

Investment by the MPT during the period of the Seven Year Plan, excluding that in functional facilities, will be about 2.2 billion DME,* or three times the amount invested during the preceding 7 years. The major part of these funds will be used to construct the arterial network; to expand the facilities of the radiobroadcasting and television networks; and to provide additional telephones, automatic telephone exchanges, and TELEX** facilities. On the basis of these investments, the plan anticipates that the coverage of the frequency-modulated (FM) and television broadcasting networks will be nationwide by the end of 1965, that the density of the telephone network will increase about 45 percent above that in 1958 to 9.3 outlets per hundred persons, and that the capacity of the interurban telephone network will increase 25 percent above that in 1958 to 550,000 channel-kilometers.

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* Deutsche Mark East (East German marks). Unless otherwise indicated, DME values in this report are expressed in terms of current DME and may be converted to US dollars at the rate of exchange of 9 DME to US $1.

** TELEX is a term applied to a system of subscriber telegraph used in European countries. As East Germany has a subscriber telegraph network interconnected with this European network, the term TELEX is used in this report to describe the East German network.

All major goals of the Seven Year Plan are not expected to be met, but the strategic importance of the enlarged functional networks probably will assure their completion during the plan period. Goals for expanding basic facilities, however, appear to be too ambitious for the status of the technical labor force, the materials supply base, and output of electronic equipment. Attainment is not expected, therefore, before 1967. Nevertheless, even this level of performance in so extensive a program would serve not only to meet a good part of growing communications needs but also to accommodate Soviet political and military interests in East Germany and Western Europe.

I. Introduction

Perhaps nowhere else is the cold war brought into sharper focus than in East-West contentions over the status of East Germany and West Berlin. In such a setting an analysis of the planned massive buildup in telecommunications in East Germany, now in progress, may shed useful light on both East German and Soviet intentions. In one sense, much of the buildup may be justified by straightforward needs of the economy. In another sense the scope of the plans, the speed of implementation, and the involvement of noneconomic entities suggest other requirements. Whatever the real purposes, the existence of a reliable wide-coverage, high-capacity telecommunications base in East Germany would facilitate the operation of command-control structures, whether political, economic, or military.

II. Planning Organizations and Processes

The Central Committee of the Socialist Unity (Communist) Party (SED) -- and through it the USSR -- exerts dominant influence over economic planning in East Germany. For the telecommunications sector, this domination is applied to planning for the satisfaction of political and military needs as well as of economic needs. Pressure also is brought to bear for the satisfaction of Soviet telecommunications requirements, such as those imposed by the large Soviet military garrisons stationed in the country and those related to Soviet political and economic interests both inside and outside East Germany.

Plan concepts and objectives of the two countries usually coincide. Conflicts that do arise are almost always resolved in favor of the USSR through its control of the SED, the authoritative voice of Soviet policy in East Germany.

The State Planning Commission (SPC), the central economic organ of the Council of Ministers, manages economic planning. The SPC not only supervises the preparation of both current and long-range plans but also directs their implementation. The Council of Ministers, which is the approving authority, usually accepts with few changes the plans as drafted by the SPC. 1/*

The present dominance of the SPC in the planning function stems from the industrial reorganization of early 1958. Influenced by and modeled after that of the USSR in 1957, the reorganization aims at hastening the "transition of capitalism to socialism" through streamlining the planning and management mechanisms.

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To achieve that transition, numerous specific actions were taken: (1) the staff of the SPC was enlarged and staffed with the most reliable Party personnel to cope with broadened responsibilities; (2) many industrial ministries were abolished, and their functions were transferred to newly established Associations of Nationalized Enterprises (VVB's) subordinate to the SPC; (3) economic councils were established in the 14 Bezirke (districts) of the country, which, under the jurisdiction of the SPC, are responsible for planning and fulfillment within their respective regions; and (4) some control and decision-making powers were transferred to local authorities in order to bring the administration of industry under closer scrutiny of local Party officials. The most pervading effect of the reorganization is the dominant role of the Party over the SPC in planning, controlling, and directing the economy. 2/

In the industrial shuffle the Ministry of Post and Telecommunications (MPT) was not disturbed, but in mid-1959 it was reorganized along lines corresponding to the new structure of the SPC. More authority and responsibility were given to the Bezirk directorates in planning and managing the post and telecommunications activities of their respective areas. Short-range and long-range planning functions of the Ministry were consolidated in a newly established Department for Planning. Within this Department, sections were established for current, operational planning; for long-range planning; and for research and development planning. In line with the general policy of emphasizing Party control over economic activities, politically reliable Party members, regardless of their professional competence, were placed in key positions in all important components of the Ministry. With few exceptions, unreliable personnel were transferred to less important positions.* 3/

In the MPT, planning procedures adhere at present to rigid SPC formulas. In turn, the MPT, through the Department of Planning, establishes planning methods and targets for the Bezirk directorates. Within the framework established by the SPC, the Bezirk directorates in turn call for plans from their local units. On receipt of these plans the directorates consult with their economic councils to insure that the plans satisfy political, economic, and technical needs of their areas. After adjustment the directorates submit these plans to the Department of Planning. After review and amendment the Department, acting for the MPT, submits the consolidated draft plan of the Ministry to the SPC for approval. For its part the SPC reviews these plans to insure consistency with all other plans, both economic and

* The most notable exception was the Minister of Post and Telecommunications, Friedrich Burmeister. Although not a member of the SED, Burmeister was retained in the post that he has held since 1949.

budgetary. After revision the SPC, acting for the Council of Ministers, returns the approved plans to the MPT, along with specific measures governing their implementation. 4/

III. Program for the Development of Domestic Telecommunications, 1959-75

The MPT is responsible for the operation, maintenance, and development of all basic telephone, telegraph, and broadcast facilities and services of East Germany that are carried by overhead wireline, underground cable, and radio facilities. However, the Ministry does not control or operate functional networks such as those serving the exclusive needs of the SED, the Ministry of National Defense (MINAVE), or the Ministry of Transportation. Many of the circuit facilities of these networks are nevertheless derived from the basic system. In many cases the MPT installs and maintains, but does not operate, these networks.

A. Basic Facilities

1. Telephone and Telegraph System

a. Telephone

Local and interurban telephone service, nationwide in coverage, is the major telecommunications service available in East Germany. The system, with 6.45 telephone outlets per hundred persons in 1958, ranked first among those of the countries of the Sino-Soviet Bloc and ninth among those of the more developed countries of the world. In spite of this relatively high ranking, the system is marginal in meeting needs of the government and fails to meet either active or latent needs of private consumers. The Seven Year Plan (1959-65) is aimed at overcoming these shortcomings in local telephone service, but the planned increase in services admittedly still will not meet all demands. It is expected, therefore, that the service will continue to grow during 1966-75 at a rate similar to that planned for 1959-65. 5/

(1) Local

For 1951-58 the estimated number of local telephone exchanges, the estimated exchange capacity and number of main subscriber lines, and the estimated number of local telephone calls are shown in Table 1,* Table 2,* and Table 3,** respectively.

* Tables 1 and 2 follow on p. 8.
** Table 3 follows on p. 9.

Table 1

Estimated Number of Local Telephone Exchanges
of the Ministry of Post and Telecommunications
of East Germany a/
1951-58

	Local Telephone Exchanges		
	Total	Automatic	Manual
1951	1,548	1,027	521
1952	1,553	1,030	523
1953	1,557	1,053	504
1954	1,560	1,097	463
1955	1,559	1,156	403
1956	1,566	1,194	372
1957	1,602	1,254	348
1958	1,617	1,333	284

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Table 2

Estimated Telephone Exchange Capacity
and Number of Main Subscriber Lines
of the Ministry of Post and Telecommunications
of East Germany a/
1951-58

	Thousand Lines				
	Telephone Exchange Capacity			Main Subscriber Lines in Use b/	Use of Telephone Exchange Capacity (Percent)
	Total	Automatic	Manual		
1951	486	417	69	387	79.7
1952	519	448	71	411	79.2
1953	552	482	70	434	78.6
1954	569	505	64	464	81.6
1955	578	520	58	489	84.5
1956	588	533	55	514	87.5
1957	600	546	54	544	90.8
1958	615	567	48	563	91.6

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b. Derived from unrounded data.

Table 3

Estimated Number of Local Telephone Calls Completed in East Germany a/
1951-58

	Million Local Calls
1951	645
1952	700
1953	702
1954	747
1955	742
1956	726
1957	739
1958	749

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At the end of 1958, subscriber lines in use had increased about 45 percent and local telephone calls about 16 percent. As shown in Tables 1 and 2, the MPT has moved steadily ahead since 1951 in automatic (dial) local service. By 1958, 82 percent of all local telephone exchanges were automatic, and 92 percent of the total subscriber line capacity was derived from automatic exchanges. The level of automation compares favorably with that in other industrial countries. In a ratio of capacity of automatic lines to that of total subscriber lines, East Germany ranks fifth behind Switzerland, West Germany, the Netherlands, and Italy, with the US sixth and the USSR fifteenth. 9/

Throughout the period of 1951-58 the supply of service lagged behind the demand. For the most part the needs of government and industry were met, whereas those of private consumers and agricultural enterprises were not. Data which reveal that at the end of 1958 there were only 1.4 telephone outlets per hundred households and 3.6 per hundred agricultural enterprises underscore the high priority given to government and industry. 10/

The Seven Year Plan seeks to improve local telephone service, especially to private consumers and agriculture. Major projects include replacing all manual telephone exchanges with automatic equipment; installing about 200,000 new subscriber lines, of which 79,000 lines will serve rural areas; installing about 620 specially designed exchanges in rural areas; installing about 152,000 multiparty lines through the conversion of 58,000 one-party lines to

multiparty operations; installing about 4,800 public telephone booths; and reconstructing outside plant facilities of telephone exchanges. In the plan period, telephone exchange capacity and the number of main subscriber lines in use are to be enlarged 27 percent, and the number of completed local telephone calls is expected to increase 25 percent, from 761 million calls in 1959 to 948 million calls in 1965. The plan anticipates that by 1965 telephone density will increase about 45 percent compared with that in 1958, to about 9.3 outlets per hundred persons. The rate of growth in telephone exchange capacity and in the number of completed local telephone calls for 1959-65 is shown in the charts, Figure 1 and Figure 2, respectively. 11/

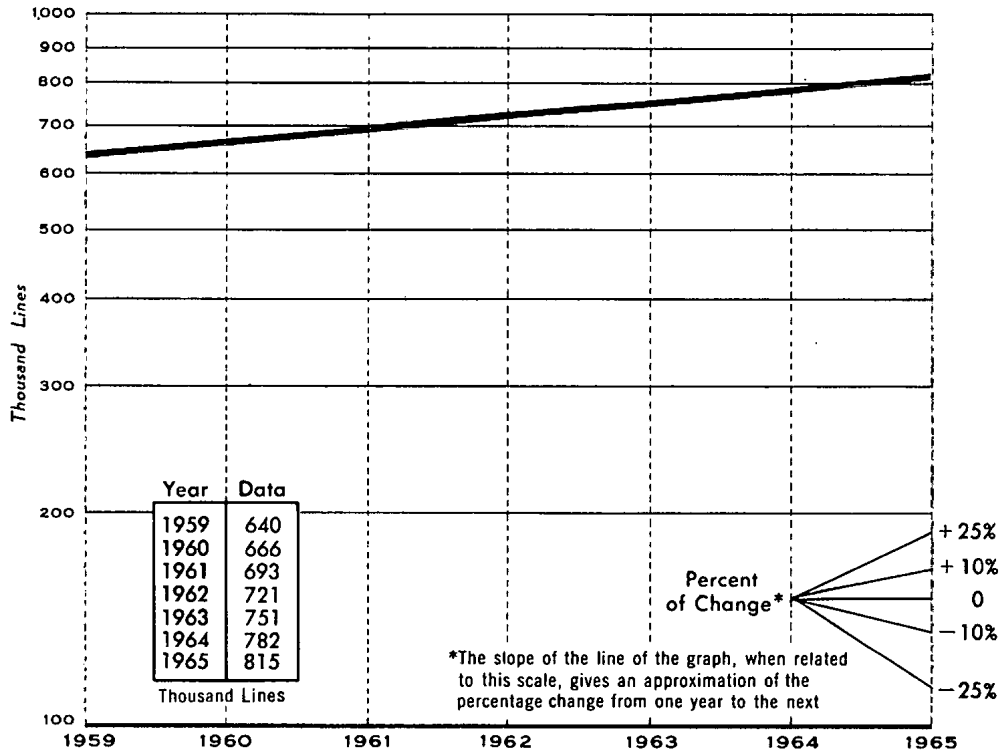

Figure 1. East Germany: Rate of Growth in Telephone Exchange Capacity of the Ministry of Post and Telecommunications, 1959-65.

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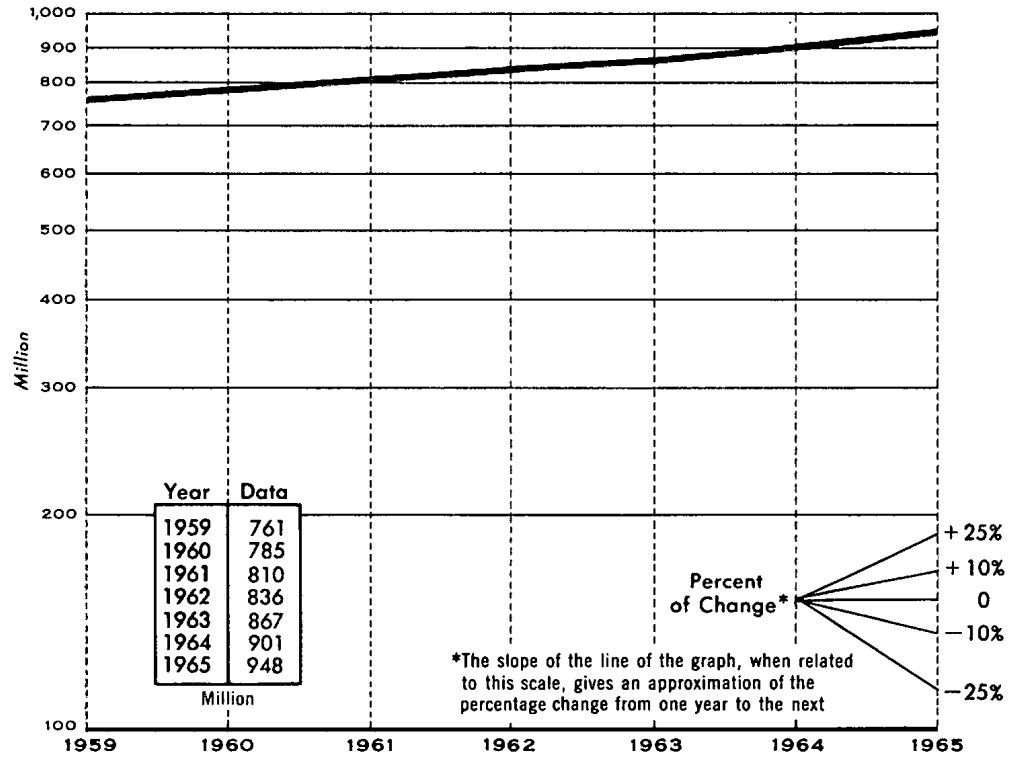

Figure 2. East Germany: Rate of Growth in the Number of Completed Local Telephone Calls, 1959-65.

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This planned growth, if accomplished, will alleviate some of the pressures for service but will still fall short of meeting all needs. Stating that planned telephone density by 1965 will approximate only that achieved by West Germany at the end of 1958, MPT officials estimate that at least 350,000 new subscriber lines will be needed to satisfy all demands for service, a figure 75 percent greater than the 200,000 lines given in the plan.

Long-range plans through 1975 take this need into account in that they direct installation of new small exchanges for the exclusive use of the MPT, modernization of existing exchanges, and installation of additional multiparty lines. If these plans are fulfilled, it is expected that by 1975, with a density of about 20 telephones per hundred persons, supply will meet demand for local service. 12/

(2) Interurban

As shown in Table 4, interurban telephone service increased 49 percent during 1951-58, from 99 million calls in 1951 to 148 million calls in 1958. These calls were handled largely through manual facilities. Of the total calls completed in 1958, only about 8 percent were handled through automatic facilities. 13/

Table 4

Estimated Number of Interurban Telephone Calls Completed in East Germany a/
1951-58

	Million Interurban Calls
1951	99
1952	102
1953	106
1954	117
1955	124
1956	133
1957	140
1958	148

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In spite of this growth, service at the end of 1958 was slow, inefficient, and inadequate. Long delays encountered in completing interurban telephone calls reflected the heavy use of manual facilities and the lack of exchange and wireline capacities. In 1958, for example, only 72 percent of all interurban calls were completed without delay. Permissive waiting periods for completing interurban calls, ranging from 15 minutes to 60 minutes, were in some cases exceeded. 15/

The Seven Year Plan of the MPT stresses over-all improvement of this service. The plan includes the introduction of automatic interurban switching equipment; the installation of about 400 new interurban switchboard positions; the installation of multiconductor cable, coaxial cable, and microwave radio relay facilities; and the installation of 60-channel carrier-frequency (Traegerfrequenz -- TF) equipment on all new cable lines. By the end of 1965 it is expected that 83 terminal offices will use 60-channel carrier-frequency equipment and that the capacity of the interurban telephone network will be

about 550,000 channel-kilometers, an increase of 25 percent above the 440,000 channel-kilometers available at the end of 1958. On that basis the number of completed interurban telephone calls during 1959-65 is expected to increase about 57 percent, from 156 million calls in 1959 to 245 million calls in 1965, and it is likely that 52 percent of all calls completed in 1965 will be handled through automatic facilities. The rate of growth in interurban telephone calls for 1959-65 is shown in the chart, Figure 3. 16/

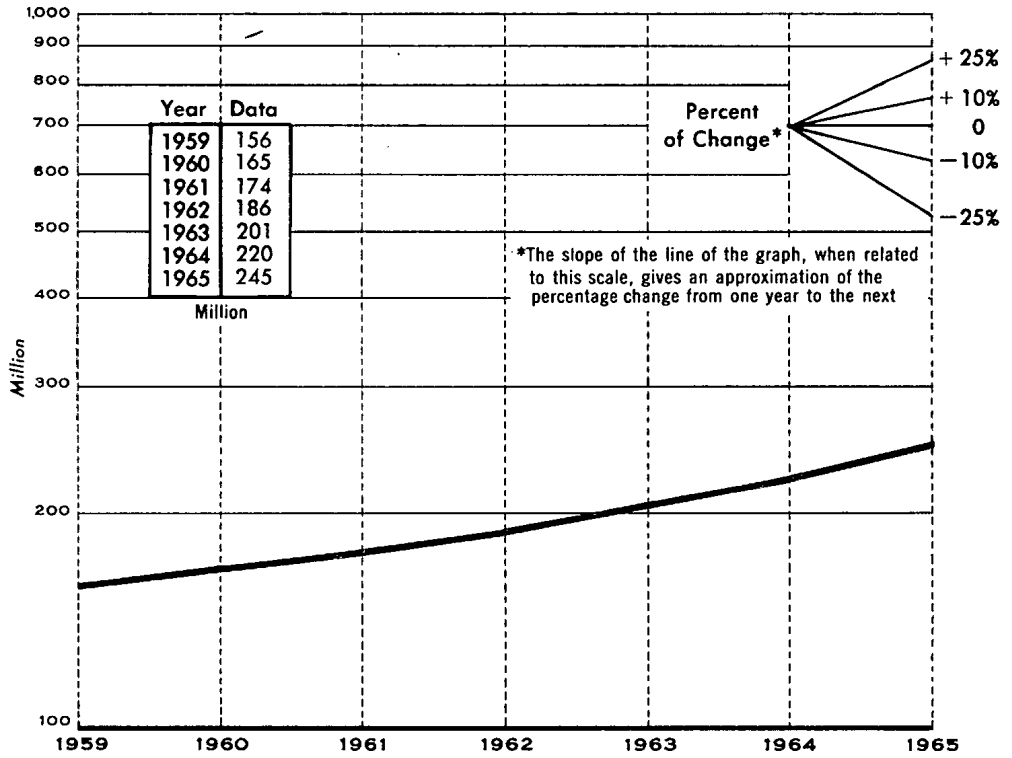

Figure 3. East Germany: Rate of Growth in the Number of Completed Interurban Telephone Calls, 1959-65.

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Long-range plans for 1966-75 specify further growth in interurban telephone service. These plans involve the continued automatization of existing facilities and the installation of new coaxial cable lines having a capacity of 1,920 telephone channels. If these plans are met, by 1975 the quality and quantity of interurban telephone service in East Germany will compare favorably with service afforded in the more advanced countries of the world. 17/

b. Telegraph

Telegraph services in East Germany consist of regular telegraph, TELEX, and facsimile. Of these services, regular telegraph and TELEX are available throughout the country. Facsimile is used more in international than in domestic service. Domestic facsimile service exists between East Berlin and the more important Bezirk capitals. Plans show an intention to improve the quality of regular telegraph service and to expand the coverage and density of TELEX service. Other than the replacement of obsolete equipment with more modern types, no major extension in facsimile service is planned.

(1) Regular Telegraph

The number of telegrams transmitted over facilities operated by the MPT during 1951-58 is shown in Table 5. Although the telegraph network uses modern teletype terminal equipment at present, it uses manual switching equipment for the relay of traffic, thus causing long delays in the transmission of telegrams. In 1958 the average transmission time (excluding delivery to the recipient) for a telegram was about 66 minutes, and the maximum transmission time during periods of peak traffic was about 430 minutes. In that same year the average delivery time was about 87 minutes, with maximum delivery time during daylight hours of about 120 minutes. 18/

Table 5

Estimated Number of Telegrams Transmitted
over Facilities Operated
by the Ministry of Post and Telecommunications
of East Germany a/
1951-58

	Million Telegrams
1951	7.8
1952	7.3
1953	7.6
1954	7.5
1955	7.6
1956	8.0
1957	8.6
1958	8.6

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During the Seven Year Plan, improvement of regular telegraph service rather than its expansion is contemplated. All manual-switching equipment is to be converted to automatic operation. Automatization of switching facilities will eliminate multiple relaying of traffic, thus reducing significantly both the average and the maximum transmission time. By the end of 1965 it is expected that the average and the maximum transmission time will decrease to 12 minutes and 30 minutes, respectively. To expedite delivery of telegrams, an uninterrupted delivery service utilizing either postal carriers or local telephone facilities will be established. Estimates of regular telegraph traffic for the period 1959-65 are shown in Table 6.

Table 6

Estimated Number of Telegrams Transmitted over Facilities Operated by the Ministry of Post and Telecommunications of East Germany a/
1959-65

	Million Telegrams
1959	8.6
1960	8.7
1961	8.8
1962	8.9
1963	9.1
1964	9.3
1965	9.4

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It is quite possible that regular telegraph service will decline in relative importance during 1966-75. In the absence of data this assumption is based on the anticipated rapid growth both in TELEX service and in telephone density, which will absorb what otherwise would be growth in regular telegraph service. 21/

(2) TELEX

The chief subscribers to the TELEX network are the economic organs of government, including the newly established VVB's. In 1956 the network began operating on a fully automatic basis. With East Berlin and Leipzig acting as the primary automatic relay

stations, direct dialing between subscribers was introduced.* At the end of 1958 the network, consisting of 60 TELEX offices and 2,367 subscribers, ranked first among those of the Soviet Bloc in subscriber density and fifth in the world in number of subscribers. The estimated number of TELEX subscribers for 1951-58 is shown in Table 7.

Table 7

Estimated Number of TELEX Subscribers in East Germany a/
1951-58

	Subscribers
1951	653
1952	792
1953	968
1954	1,217
1955	1,370
1956	1,494
1957	1,868
1958	2,367

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The industrial reorganization closely tied together enterprises engaged in joint productive processes and altered the pattern and increased the volume of communications between units in the joint productive process. The need for rapid communications rose because enterprises were widely separated geographically. Inasmuch as communications for productive processes largely require the recording of many alphabetical-numerical symbols, a real-time private functionalized telegraph network tying enterprises together, rather than a nonrecord voice network, normally would meet this need. For East Germany, however, adequate numbers of interurban circuits with which to make up such functionalized networks are not available, and the country is relying heavily on an expanded TELEX network. During the Seven Year Plan the coverage and density of the TELEX network will be enlarged in capacity from 3,100 lines in 1958 to 6,700 lines in 1965, an increase of 116 percent. Of this available capacity, 6,000 lines, or 90 percent, are expected to be in use by 1965 compared with

* The US counterpart system (TWX) still uses manually operated exchanges, although the American Telephone and Telegraph Company has plans to convert to dial operation.

1958, when only 77 percent of such lines were used. The rate of growth in TELEX subscribers for 1959-65 is shown in the chart, Figure 4. 23/

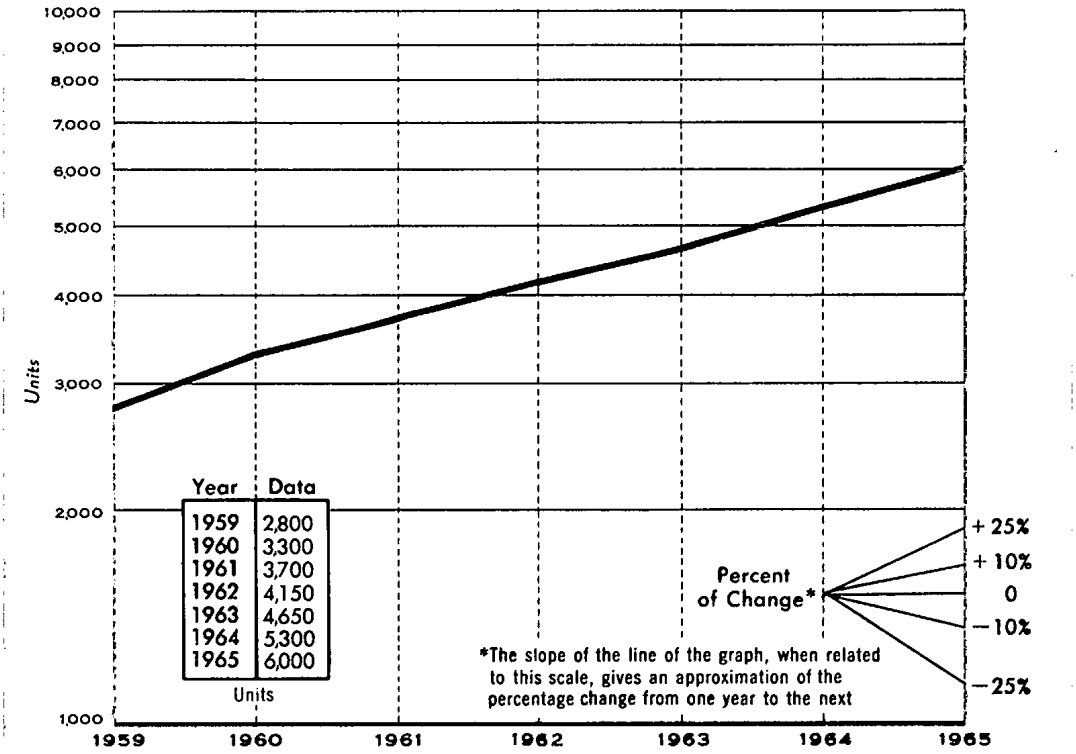

Figure 4. East Germany: Rate of Growth in the Number of TELEX Subscribers, 1959-65.

Investment plans for 1966-75 direct further growth in TELEX service. These plans anticipate that trade and agricultural enterprises as well as administrative organs of government, which in the past were marginal users of this service, eventually will become heavy users. 24/

c. Common Telecommunications Facilities

The ability of the MPT to meet requirements for service is conditioned by the status and operational capability of its common telecommunications facilities. Consisting of wireline, microwave radio relay, and point-to-point radio networks, these facilities are the basic media used for transmission of telephone, telegraph, and

broadcasting services. Until 1957, heavy reliance was placed on the wireline network to meet most needs. Although the microwave network provided for some services, it was a relatively low-capacity system used primarily for the relay of television service. Point-to-point radio was used mainly for international communications. During 1955-58, plans were prepared for the further development of the wireline and microwave networks. These plans put stress on the installation of broad-band, high-capacity facilities that conform to international standards established by the technical committees of the International Telecommunication Union (ITU): the International Telegraph and Telephone Consultative Committee (CCITT) and the International Radio Consultative Committee (CCIR). 25/

The simultaneous enlargement of both networks probably presages the development of a balanced telecommunications system in East Germany. With emphasis on the diversification of transmission resources in order to avoid overdependence on one transmission medium, this system would increase significantly the reliability and flexibility of communications -- a factor of prime importance during wartime or other national emergencies.

(1) Wireline

The wireline network extends throughout the country and provides telephone and telegraph services to all cities and major towns. For the most part the long-distance, high-capacity part of the network uses underground multiconductor cable, but in recent years increased use has been made of coaxial cable. The short-distance, low-capacity part of the network consists mainly of open wirelines that connect with the principal long-distance lines.

To a great extent the status of telecommunications in East Germany is determined by the operational capability of the long-distance part of the wireline network. This part of the network, [redacted] consists of two separate but interconnected subnetworks -- the relatively low-capacity Bezirk cable network and the high-capacity, long-distance cable (Fernkabel -- FK) network. As early as 1950, both subnetworks lacked the capacity to meet all the needs of the country, and existing facilities were incapable of meeting new demands for service. During the ensuing years these difficulties were further compounded by the increased tempo of economic, political, and military activities. To cope with this problem, the MPT expanded capacity during 1950-54 by the more efficient use of existing facilities, but although some gains were achieved, they fell

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far short of the need. In 1955, therefore, the MPT embarked on a high-priority program to enlarge the capacity of its long-distance underground cable facilities through the installation of a new broad-band, high-capacity carrier-frequency cable network. Using 8-pair and 14-pair multiconductor cables and 17-pair coaxial cable,* the program entailed the installation of three carrier-frequency cable rings -- the Ring Around Berlin, the Northern Ring, and the Southern Ring. By the end of 1957 the only feature of the over-all plan that appeared to be on schedule was the installation of the Ring Around Berlin. Little, if any, work had been done on the Northern or Southern Rings. Defections of qualified technical personnel to the West and shortages of equipment and materials resulting from export commitments to other Bloc countries impeded progress. 26/

The industrial reorganization in 1958 and the accelerated production goals of the Seven Year Plan gave added impetus to the need for rapid growth in high-capacity cable lines. Increased demands for telephone and telegraph services expected to result from both programs and the avowed aims of the regime to extend significantly broadcasting services, especially television, further underscored the inadequacies of existing facilities.

The Seven Year Plan contains a solution to the long-distance cable problem. More ambitious than any of its predecessors, this program not only includes most of the goals of the abortive 1955 plan but also provides for the installation of additional quantities of coaxial cable. The plan gives more attention to completion of the Southern Ring, which covers the major industrial area of the country, than it does to the Northern Ring. Extensive use will be made of 8-pair and 14-pair multiconductor cables and 17-pair and 4-tube coaxial cables to interconnect all Bezirk cities by the new network. The following major projects are embodied in the program:

(a) By 1960 a line between East Berlin, Frankfurt-an-der-Oder, Cottbus, Dresden, Karl-Marx-Stadt, and Leipzig is to be completed. This line, the installation of which began late in 1958, uses a 17-pair cable on the Berlin and Frankfurt-an-der-Oder section and 8-pair and 14-pair cables on the remaining parts.

(b) By 1960 a 17-pair cable between Wildpark and Magdeburg is to be installed.

(c) By 1962 a 17-pair cable between Magdeburg and Halle is to be installed.

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* Consisting of 16 balanced pairs and a coaxial tube.

(d) By 1965 a 17-pair cable between Halle and Leipzig is to be installed.

(e) By 1965 or 1966, 8-pair and 14-pair cables between Karl-Marx-Stadt, Gera, and Erfurt are to be installed.

Plans also include the installation of 4-tube coaxial cable lines between Berlin, Dresden, and Prague; between Berlin and Katowice, Poland; and between Dresden and Leipzig. The cables running to Prague and to Katowice are scheduled for completion in 1962 and 1963, respectively. Planned mainly for international telephone, telegraph, and television services, these cables also will be used for domestic services, at least until 1965. 27/

To increase circuit capacity, 60-channel (4-wire) carrier-frequency telephone equipment (V-60) will be installed on all new cable lines. The installation by 1965 of V-60 systems, including about 83 V-60 terminal offices, will increase the total capacity of the network to about 550,000 channel-kilometers, a figure 25 percent greater than the 440,000 channel-kilometers available at the end of 1958. 28/

The concern of the Soviet Bloc as a whole, and of East Germany in particular, for dependability of communications in case of civil or military emergencies is underscored by the physical characteristics of all planned long-distance cable lines and associated facilities. Conforming closely to standards normally associated with "hardened" telecommunications facilities,* all new lines will be buried to depths between 3 to 5 feet and will bypass major industrial and strategic areas. Spur lines will connect these areas to the main lines. Repeater stations consisting of a "tank," or "boiler," buried to a depth of 6 to 9 feet also will be located some distance from all industrial and strategic points. These repeater stations will be installed at 18-kilometer (km) intervals on all 8-pair and 14-pair multiconductor cable lines and at 9-km intervals on all 17-pair and 4-tube coaxial cable lines. The use of this type of repeater station on the Moscow-Kiev coaxial cable line and on the projected Leningrad-Helsinki, Berlin-Prague, and Berlin-Katowice coaxial cable lines strongly suggests their eventual standardized use throughout the Bloc. Sketches of the "tank," or "boiler," type of repeater station in use in East Germany are shown in Figure 6,** which also contains photographs of the station in use in the USSR. Sketches of the cross section of a 17-pair coaxial cable and of a 4-tube coaxial cable are shown in Figure 7.**

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** Following p. 20.

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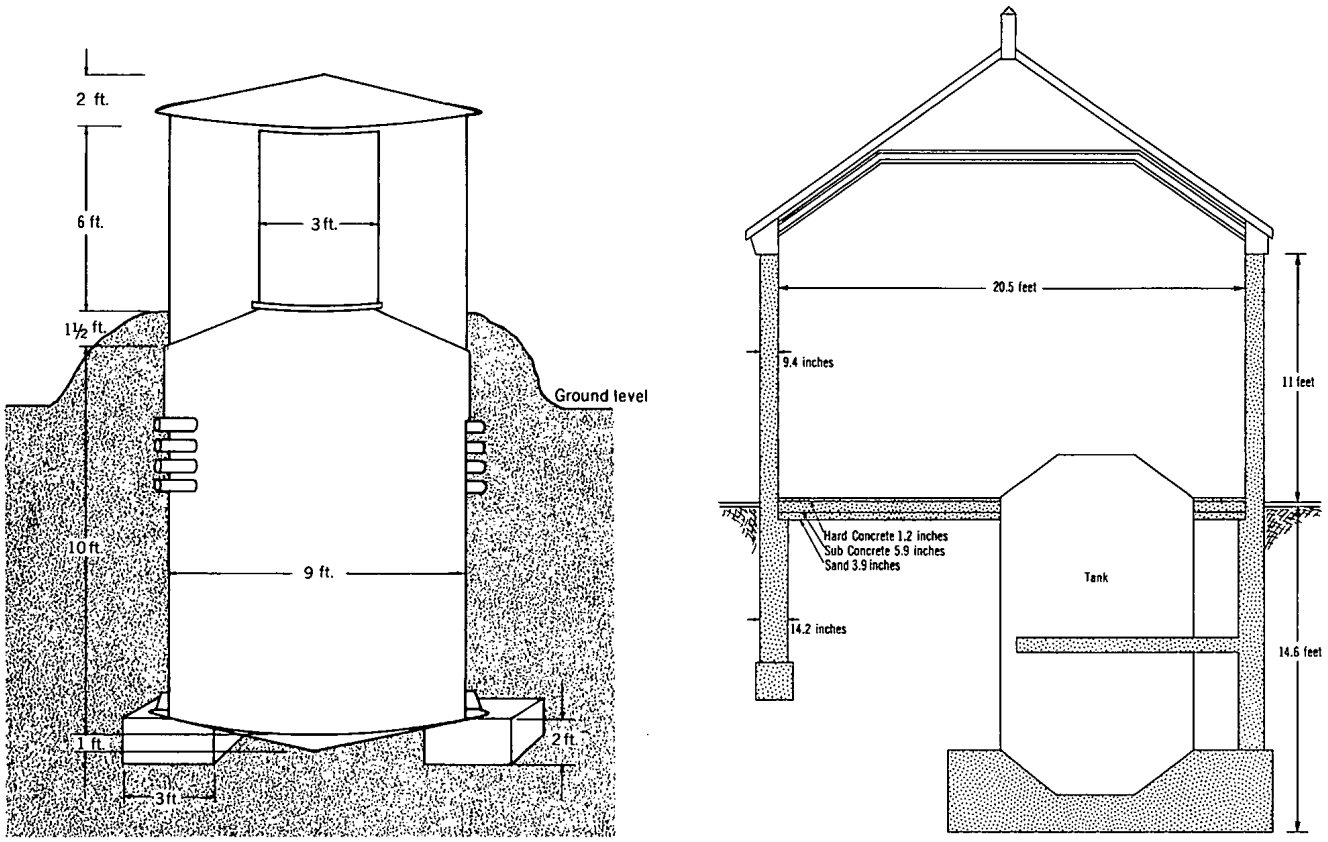

EAST GERMANY

USSR

Figure 6. East Germany: Sketch of an Underground "Tank," or "Boiler," Type of Repeater Station in use on "Hardened" High-Capacity Multiconductor and Coaxial Cable Lines and Photographs of Similar Repeater Stations in use in the USSR, June 1960

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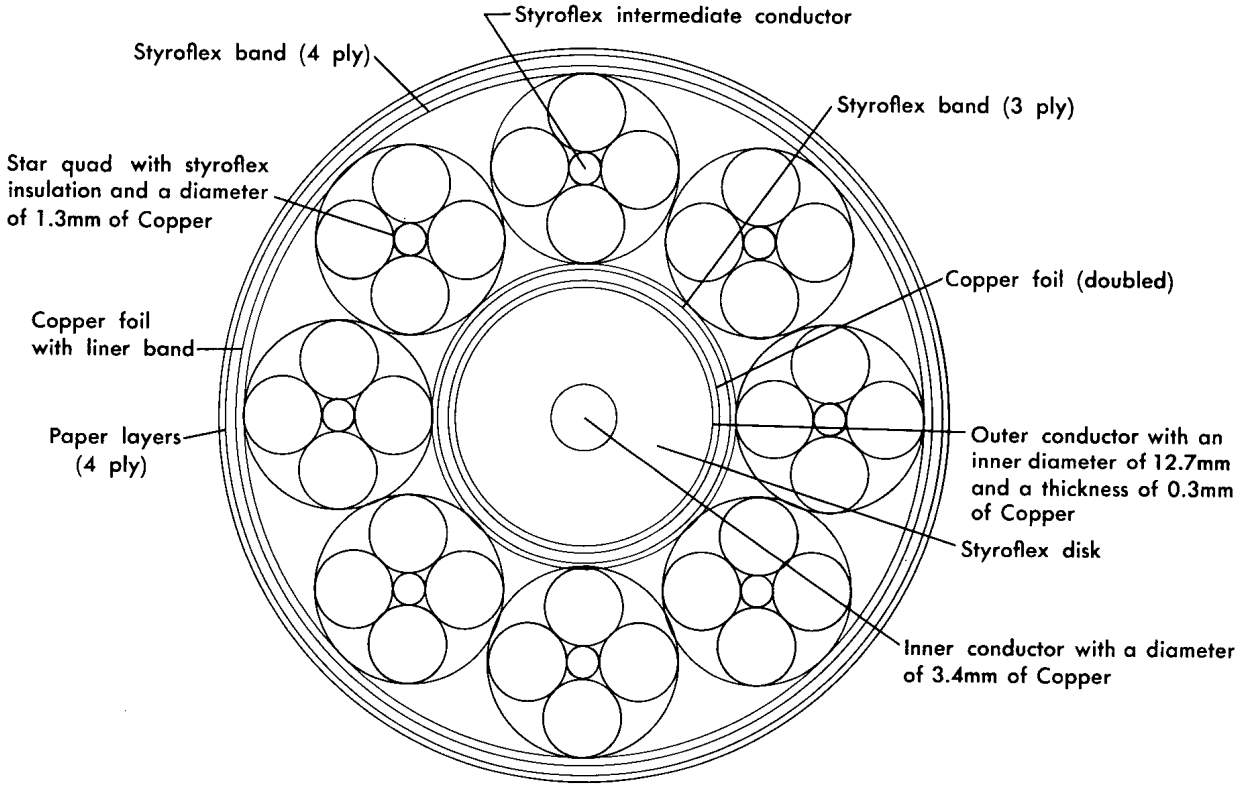
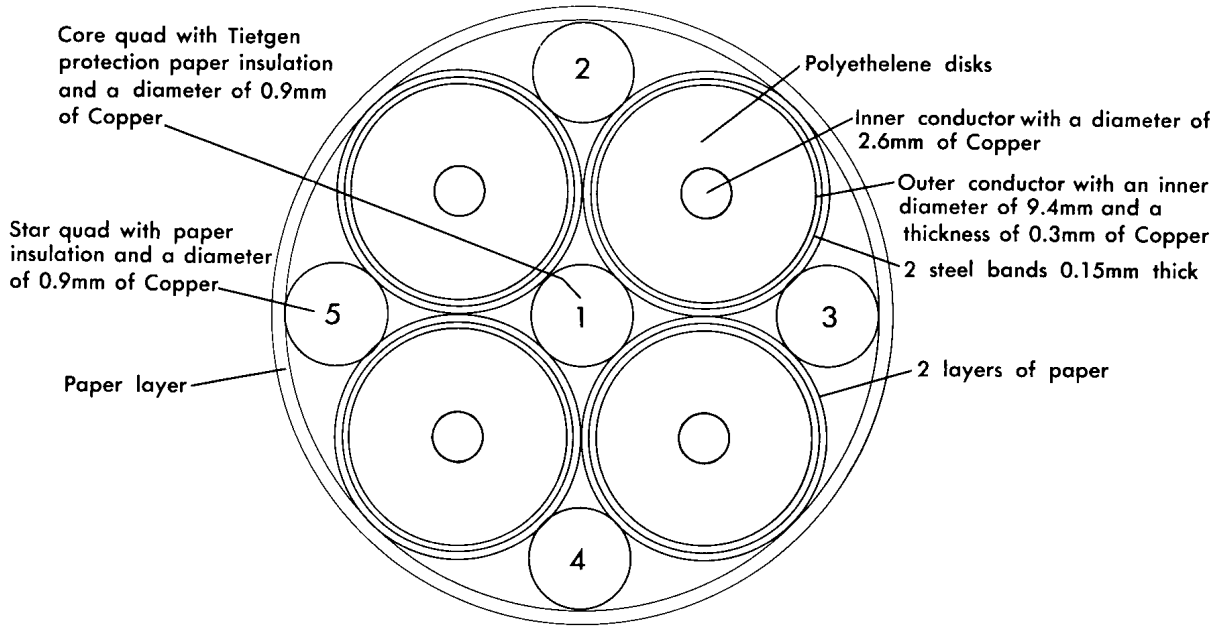


17-PAIR COAXIAL CABLE
Diameter of the cable covered with lead=34.2mm



4-TUBE COAXIAL CABLE
Diameter of the cable covered with lead=29.1mm

Figure 7. East Germany: Cross Section of a 17-Pair Coaxial Cable and of a 4-Tube Coaxial Cable, January 1961

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Carrier terminal facilities associated with all new cables also will conform to the "hardening" concept. These facilities will be three-story structures of uniform design, consisting of two underground stories buried to a depth of 27 to 30 feet and one story aboveground. Both the carrier-frequency and the power-generating equipment will be housed in the underground levels. The carrier-frequency terminal station built at Zeuthen is shown in the sketch, Figure 8.* Similar stations have been built or are under construction at Cottbus, Gueldendorf, Strausberg, Wildpark, Karl-Marx-Stadt, and Dresden. 30/

The enlargement of the MPT long-distance cable network may be related to military needs. [redacted] 50X1
[redacted] East Germany has planned since 1958 to install an early-warning communications network. 50X1 Consisting of multiconductor and coaxial cable lines for telephone, telegraph, and video transmissions, facilities of this network were to connect air-raid warning headquarters located in each of the 14 Bezirke of the country. Because the structure and general layout of the planned MPT network is consistent with this aim, it is highly possible that its installation may be part of a long-range program to develop a "hardened" air defense system in East Germany.

During the Seven Year Plan the Bezirk cable network also will be enlarged. During 1959-65, there will be installed about 7,000 km of new Bezirk cable, 6,500 km of which will be laid in rural areas, with the remainder to be used for replacement of existing open wireline facilities. The extension of the network to rural areas is in keeping with plans for providing these areas with more telephone and telegraph services, whereas the replacement of open wirelines with underground cable lines adheres to the concept of deemphasizing, for reasons of maintenance and physical security, the use of open wireline facilities. 31/

The Seven Year Plan contains provisions for reconstructing and expanding the cable facilities serving the East Berlin area. Although there are extensive cable facilities in and around the city, [redacted] they fail to meet 50X1
existing service needs. Shortages in circuit capacity and lack of adequate exchange facilities have been the principal drawbacks. The severity of the East Berlin problem is highlighted by [redacted] 50X1
[redacted] in 1959 there were more than 25,000 unfilled requests for 50X1
telephone service and that all available subscriber lines in the city,

* Following p. 22.

[redacted] 50X1

except those serving the most important telephone subscribers, were converted from single-party to multiparty operation. 32/

Although specific plans for the expansion of cable facilities in East Berlin are not yet available, [redacted] suggests a two-phase program. During the first phase (1959-62), some new cable and exchange facilities will be installed, but major gains in capacity will stem from the regrouping of existing 100-pair and 250-pair cables into cables with a capacity of 500 pairs. By providing space in existing cable ducts, this aspect of the program will facilitate the laying of new cables. Since the division of Berlin, space for new lines has not been available, because most cable ducts were completely filled as a result of the rerouting of major lines to avoid their passage through the Western sectors of the city. 33/ 50X1 50X1

The second phase of the program (1963-65) will be entirely devoted to the installation of new cable and exchange facilities. Although the types and locations of these new facilities are not known, the allocation of about 35 million DME to carry out this phase of the program points up its importance. Of this amount, 11 million DME will be used for new cable and the remaining 24 million DME for exchange facilities. 34/

Data on the planned development of wireline facilities in the decade following the Seven Year Plan period are obscure. It seems clear, however, that the use of overhead wirelines will give way to high-capacity underground cables. Furthermore, efforts undoubtedly will be accelerated for the early completion of the Northern Carrier Frequency Cable Ring. The installation of this ring -- which will run between Magdeburg, Schwerin, Rostock, Stralsund, Neubrandenburg, and Frankfurt-an-der-Oder -- will complete a nationwide high-capacity underground cable network that will conform to modern standards and technology.

Because pressures will mount for more and better service throughout the 1966-75 period, it is likely that vigorous programs will be pursued for maximum use of all new and existing long-distance cables. These programs, involving the installation of 120-channel and 240-channel carrier-frequency telephone equipment, will serve to increase significantly the capacity of the network and will go a long way toward accommodating expected increases in demand for service.

Toward the end of the 1966-75 period, construction possibly will begin on a nationwide coaxial cable network. Running in an east-west and north-south direction and consisting of 17-pair and 4-tube cables, the network would replace the previously installed 8-pair cable lines. In addition to meeting domestic needs, this new

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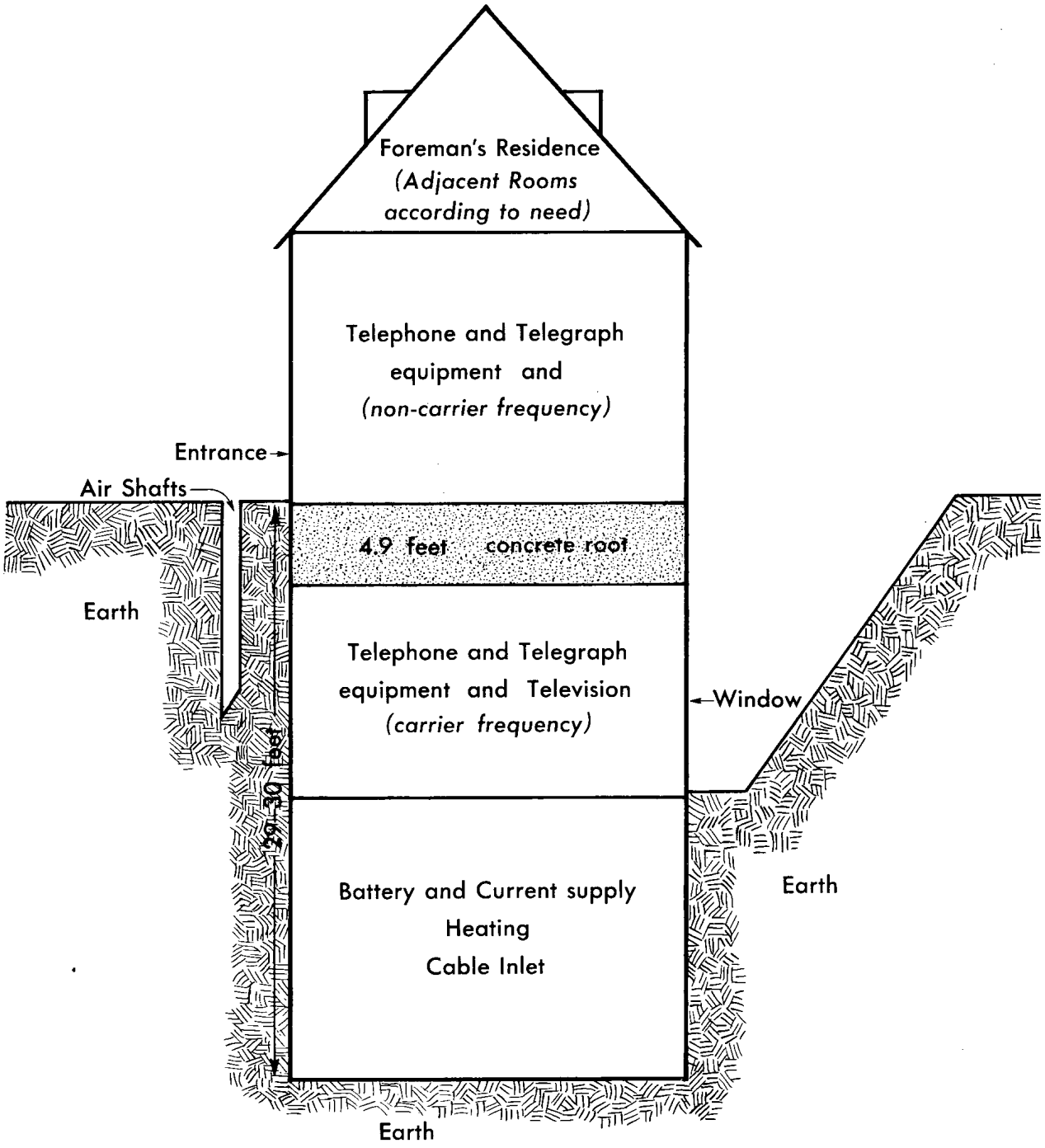

Figure 8. East Germany: "Hardened" Carrier-Frequency Terminal Station Constructed at Zeuthen, 1960

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cable network would contribute to Bloc-wide goals to establish reliable high-capacity telecommunications networks in the more important member countries.

No information is available on the planned development of Bezirk cable facilities during 1966-75. This lack of information may indicate that little, if any, new Bezirk cable is planned for the period and that capacity will be expanded by incorporating within the network existing mainline long-distance cables which are replaced by new carrier-frequency cable lines.

(2) Microwave Radio Relay

There are two major microwave radio relay networks in East Germany, one operated and controlled by the MPT and the other by the SED.* Established originally in 1951 with the installation of a 28-km line between Nauen and East Berlin, the MPT network is used for telephone and telegraph traffic and for the relay of television programs within the country. Although the network was extended during the years following 1951, its operation has not reached maximum efficiency. Major difficulties encountered have been excessive distances between some terminal and relay stations, which have caused the transmission of weak signals over many important routes; the use of low-capacity, obsolete equipment, resulting in limited service capability; and the use of long lead-in, high-frequency cables, which has caused excessive signal attenuation between the equipment and the antennas.

Because of these shortcomings the MPT in 1957 started on a long-range program for modernization of its microwave radio relay network. Scheduled for completion in 1964 or 1965, the major aims of the program are to establish a long-haul, broad-band network capable of handling large volumes of conventional services. For this purpose, new massive concrete towers ranging in height from 197 to 439 feet are to be constructed. Existing steel towers are to be replaced by concrete or brick towers. Additional radio relay and television stations are to be built, and modern microwave radio relay and television equipment is to be installed.

Since its inception this program has been pushed ahead vigorously. Tall towers are under construction at eight sites, and four more, the construction of which should begin early in 1961, are planned at other sites, [redacted] The geographic array of the tower sites clearly shows the pattern of the 50X1

* For a discussion of the SED microwave radio relay network, see B, 1, p. 29, below.

[redacted] 50X1

microwave and associated television network. With these structures serving as the major terminal and relay facilities, the new network will extend east and west and north and south and will consist of three major connected rings -- the northern, the middle, and the southern. Organization into these three rings will provide alternate transmission routes if any part of the network becomes inoperable.

The towers at Dequede, Rhinow, Perewenitz, Bernau/Birkholz, Roitzsch, and Pinnow are completed or are nearing completion. [redacted] the tower at Dequede is already in operation and that the remaining towers will be put in operation early in 1961. The tower in operation at Dequede and the towers under construction at Roitzsch and Rhinow are shown in the photographs, Figure 11.* 50X1

At present the tower at Dequede is employing low-capacity microwave radio relay equipment. Eventually this tower and other planned towers will use broad-band, high-capacity microwave equipment, type RVG-958. This equipment, which is being developed by the Rafena Plant, operates in the 4,000-megacycle band and can provide either 600 two-way telephone channels** or 1 two-way television channel.

Particular significance is attached to the configuration of the enlarged network. The installation of three transmission rings, which in general parallel the rings of the planned carrier-frequency cable network, supports the view that East Germany intends to develop a balanced telecommunications system. Based on the dual use of high-capacity, multipurpose microwave radio relay and "hardened" multiconductor and coaxial cable facilities on all mainline routes, the over-all aim of the program would be to diversify transmission resources in order to avoid overdependence on any one transmission medium. This diversification of media will yield more flexible and reliable communications.

Beyond its conventional use the enlarged MPT network also may serve specialized purposes, especially for passage of air defense data. Since 1958, East Germany, as well as other countries of the Soviet Bloc, has shown interest in a system for the rapid relay of radar information. In this system, special equipment converts radar displays to video transmissions that are then relayed over television or other broad-band circuits to major filter and command centers.

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* Following p. 24.

** A telephone channel can be multiplexed into as many as 24 sixty-word-per-minute teletype channels.

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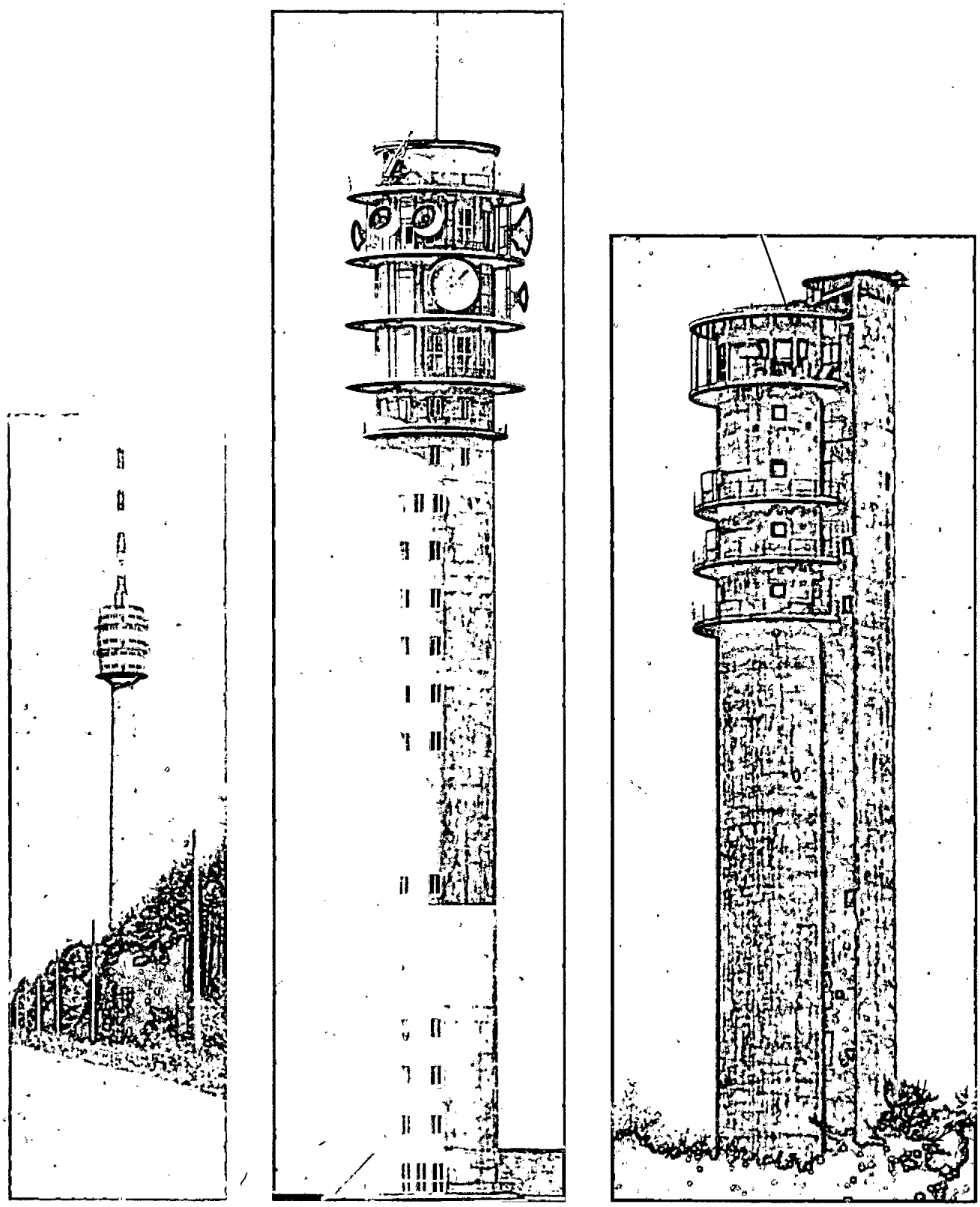

Figure 11. East Germany: Tall Masonry Communications Tower in Operation at Dequede and Towers Under Construction at Roitzsch and Rhinow, May 1960

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A relationship may exist between East German interest in adapting television facilities for rapid transmission of radar displays and the new facilities of the MPT microwave network. [redacted] the tower at Dequede eventually may house radar equipment and that construction of coaxial cable and microwave facilities between Berlin, Frankfurt-an-der-Oder, Warsaw, and Moscow, currently underway, is scheduled for completion in 1962. It is possible, therefore, that the towers between Dequede (near the West German border) and Bernau/Birkholz (just north of Berlin) will form one of the main communications arteries for reporting early-warning information to filter and command centers in the USSR. Using the television channel of the RVG-958 microwave equipment, these facilities could pass radar-video information to Berlin, from which point the information could be relayed to Moscow through Frankfurt-an-der-Oder and Warsaw. This line could improve significantly the space-time air defense capability of East Germany as well as that of the Soviet Bloc as a whole and would be in keeping with Soviet doctrine to integrate the early-warning system of the Bloc.

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The new network also may be used to support guided missile activities. The recent establishment of numerous sites for transportable surface-to-air (SAM) launchers and the reported deployment of Soviet surface-to-surface missile equipment in East Germany creates a need for strategically located, highly reliable communications facilities to command, control, and integrate the activities of these sites. In addition to disseminating commands to missile combat units, communications are needed for coordination between adjacent missile defense zones and with higher military echelons.

Although there is little evidence to support the view that the enlarged microwave network will be used to support guided missile operations, the configuration of the network and the equipment that it will employ make it ideally suited for this purpose. Conceivably the network could provide the lateral and vertical communications necessary for the effective control and coordination of the fixed and mobile missile bases in East Germany. Under conditions necessitating redeployment of transportable SAM sites, major terminal and relay facilities of the network could serve as base stations with which the mobile communications van at the missile site could communicate by microwave radio.

2. Broadcasting System

In support of the aims of domestic and international mass communications, the broadcasting media* of East Germany developed

* In East Germany the MPT operates and maintains all broadcasting facilities. The State Broadcasting [footnote continued on p. 26]

rapidly during 1950-58. The domestic system, which was centered on East Berlin, consisted of radio (both amplitude-modulated /AM/ and frequency-modulated /FM/), television, and wire-diffusion networks.* By 1958 the AM transmission base, comprising 20 medium-frequency and 2 low-frequency stations, covered the country. The FM and the television base, consisting of only 14 stations and 9 stations, respectively, served less than one-half of the country.

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In spite of the generally good level of broadcasting performance at the end of 1958, the drive to develop broadcasting in East Germany continues unabated. This drive is reflected in the programs embodied in the Seven Year Plan and also in the long-range plan extending to 1975. The Seven Year Plan directs the installation of additional equipment to extend the coverage of the FM and television networks to all areas of the country. Inasmuch as the coverage of the AM network is adequate, its improvement is limited to increasing the power of transmitters already in operation. Plans for 1966-75 stress continuation of programs started in the previous plan period and provide in addition for the introduction of color television service. 36/

In support of these goals, the Seven Year Plan envisions the following seven major projects:

a. By 1965, at least 44 FM radiobroadcasting transmitters with 10 kilowatts (kw) of power are to be installed. Produced by the Koepenick Radio Plant, these transmitters will be used to increase the number of FM programs from one to four.

b. By 1965, at least 14 new high-powered television transmitters are to be installed, and the power of present transmitters is to be increased. Of these new transmitters, 10 will have a power of 10 kw and the remaining 4 a power of 20 kw. Most of the

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Committee (Staatliches Rundfunkkomitee), which is directly subordinate to the Council of Ministers, is responsible for the preparation and scheduling of all broadcasting programs.

* The wire-diffusion network is of little significance to the overall status of broadcasting in East Germany. Services of this network are restricted primarily to industrial plants.

10-kw transmitters also will be produced domestically by the Koepenick Radio Plant, but a few will be imported from West Germany. The 20-kw transmitters, probably to be imported from the USSR for installation at Bernau/Birkholz, Dequede, Brocken, and Schwerin, will be used to establish a second program in 1961.

c. High-gain antennas, now under development, will be installed to achieve maximum output of all television transmitters.

d. By 1965, more than 200 low-powered satellite television stations with a range of about 15 to 25 km are to be installed. The function of these stations will be to fill in the gaps in the coverage of primary stations.

e. Mobile television facilities are to be expanded. By 1965, East Germany plans to have a total of 23 mobile units in operation, consisting of cameras and low-powered microwave radio relay equipment.

f. New radio and television studio facilities are to be constructed in Leipzig, Dresden, Rostock, and Berlin/Adlershof. Completion of the facilities at Dresden, Rostock, and Berlin/Adlershof is scheduled for 1965 and at Leipzig for 1967 or 1968.

g. The major facilities of FM and television networks are to be rehoused with those of the enlarged MPT microwave network. The colocation of major facilities of all three networks is reasonable because the MPT microwave network is the primary transmission medium for the relay of FM and television programs in the country.

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Although the avowed purpose of the program is to extend domestic broadcasting services, the heavy involvement of the Party in this program seems to imply that the real purpose is to enhance the status of East Germany in its propaganda war with West Germany. Since the division of Germany the intensity of the ideological struggle between these two political entities has been mounting. In this struggle, both countries have relied heavily on media of mass communications, particularly radiobroadcasting and telecasting, to influence audiences on both sides.

The propaganda struggle between the two countries reached a climax in 1957. In that year, West Germany began installing new radiobroadcasting and television stations along the East German border. These stations extended the coverage of West German broadcasts

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into the heart of East Germany. During 1958 this buildup continued, and in 1959 plans were announced for the establishment of a second television program. Because this new program was tied to the construction of a television station in West Berlin, it is clear that it would be aimed at East German viewers. Significantly the USSR has strongly opposed the construction of this new station, contending that it would violate existing agreements on the status of the city and would heighten the cold war.

East Germany in 1957 countered with a program of its own. The immediate objectives of this program were twofold: the first was to extend broadcast transmissions to West Germany, and the second was to minimize the ability of East German audiences to receive West German broadcasts, especially telecasts. Under the program, additional radio-broadcasting and television transmitters were installed along the border of West Germany, and the power of transmitters already in place was increased. To neutralize the reception base of the country for West German telecasts, East German authorities established a new television transmission frequency and then ordered the modification of all television sets in use so that only the new frequency could be received. Under this scheme, West German transmissions could be received only after an additional adjustment of the receiver, at the owner's expense. [redacted] the East German broadcasting network is "the only one in the world having a larger audience outside its 'national' boundaries than within" [redacted] 50X1 50X1 50X1

The Seven Year Plan for broadcasting continues the program started in 1957. Masked behind the facade of improved domestic services is the probable real aim of maintaining the political and sociological interests of the country as they relate to West Germany. Expansion of domestic services will indeed move ahead, but the main attention is being given to expanded service to border areas now exposed only to West German broadcasts. This strategy will counteract the propaganda advantages achieved by West Germany in these areas and at the same time will extend significantly the coverage of East German broadcasts in West Germany.

The plan schedule gives priority to the rapid extension of television services, perhaps the most effective medium of mass communication. New major television stations, supplemented by satellite stations, will extend service to presently uncovered areas in East Germany. At the same time, these stations, by intent, will give coverage in at least the eastern portions of West Germany. [redacted] the second East German television program initially will provide services only to West Germany. Telecasts from the new station at Dequede eventually will reach the Ruhr, and other 50X1 50X1

planned stations will reach Hamburg, Hannover, and Kassel. Reception in West Germany of East German programs, which reportedly are superior to West Germany's in quality and propagandistic subtlety, may yield, in the absence of effective West German countermeasures, some gains to East Germany in the propaganda war. The major broadcasting facilities of East Germany, in operation and planned, are shown on the map, Figure 12.*

B. Functional Facilities

Although other ministries and agencies in East Germany make heavy use of MPT facilities and services, they also operate independent functional telecommunications networks to meet their own specialized needs. Taken together, such networks represent a significant part of the total telecommunications resources of the country. Of these functional networks, those operated by the SED, by the MINAVE, and by the Group of Soviet Forces Germany (GSFG) warrant special attention because they directly support military and political activities.

1. Central Committee of the Socialist Unity (Communist) Party (SED)

The SED operates an extensive microwave radio relay network known as the "Spinne" network. It is a partly secure multichannel system used to carry telephone and telegraph traffic of the Party. Installed after the uprising of 17 June 1953, it connects SED headquarters in East Berlin with subordinate offices in the 14 Bezirke of East Germany. By this means, effective nationwide control and direction of Party activities are maintained. In 1957 the SED adopted a long-range program to improve this network. The program includes projects to provide direct communications with subordinate offices located in the 215 Kreise (counties) of the country. Such lines of communication are deemed necessary to sustain Party control at the lowest level of government. The over-all program includes the replacement of existing steel towers with concrete or brick structures, the construction of additional terminal and relay stations, and the use of more modern equipment throughout.

Since its initiation the program has been pressed with speed. Under the direction of "Fundament,"** a subordinate organization of the SED, priority has been given to the construction of concrete and brick towers that are destined to become the major permanent stations of the enlarged, rebuilt Spinne network. At present,

* Inside back cover.

** Helmut Weihrauch, a member of the SED who supervised the installation of the original network in 1953, is supervising all "Fundament" activities.

new towers, in some cases colocated with or close to steel towers of the existing network, have been observed in various stages of construction at 77 identified sites. Similar structures have been reported under construction or planned at other, unspecified sites. By their physical characteristics, these new structures fall into two categories -- medium towers and short towers. Identical in design, all medium towers are relatively slender flat-roofed structures, 14 feet square and 110 feet high. The size and shape of the short towers vary, but for the most part they are five-story, flat-roofed structures, 27 feet long, 18 feet wide, and 80 feet high. Of the 77 towers observed to date, 15 are medium towers and 62 are short towers. The medium towers observed at Raben, Wolfslake, and Erleshuegel are shown in the photographs in Figure 13,* and the short towers observed on Peters-Berg and Schneekopf mountains are shown in the photographs in Figure 14.*

The enlarged SED network will use RVG-924 and RVG-934 types of microwave radio relay equipment. Developed and produced by the Rafena Plant, both types were scheduled for delivery in late 1959. Operating in the 2,600-megacycle band, the RVG-924 is crystal-controlled and provides 20 alternative voice channels, 8 of which may be used at any one time. The RVG-934 operates in the 2,450 to 2,700 megacycle range and provides 24 simultaneous voice channels. The medium towers will contain both types of equipment, but the short towers will contain only the RVG-924. The relative assignment of these two types of equipment and the relative number and locations of the two categories of towers imply that the medium towers will be terminal points and the short towers relay points.

Planned production of RVG-924 and RVG-934 equipment during 1959-65 suggests that the enlargement of the network was to be completed by the end of 1962. Peak output was scheduled during 1960-62, after which a sharp cut was to be made. Delays in the development of the RVG-924 and in production of the RVG-934, however, have thwarted production schedules. Consequently, completion of the network probably will be delayed at least 1 year, so that it will not become fully operational until the end of 1963.

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In addition to its use for Party communications, the enlarged SED network possibly will be used by the military for air defense, guided missiles, and tactical communications. The MINAVE has been directly involved in the development of the RVG-924, and its personnel guard and inspect many of the new towers. Some towers appear to

* Following p. 30.

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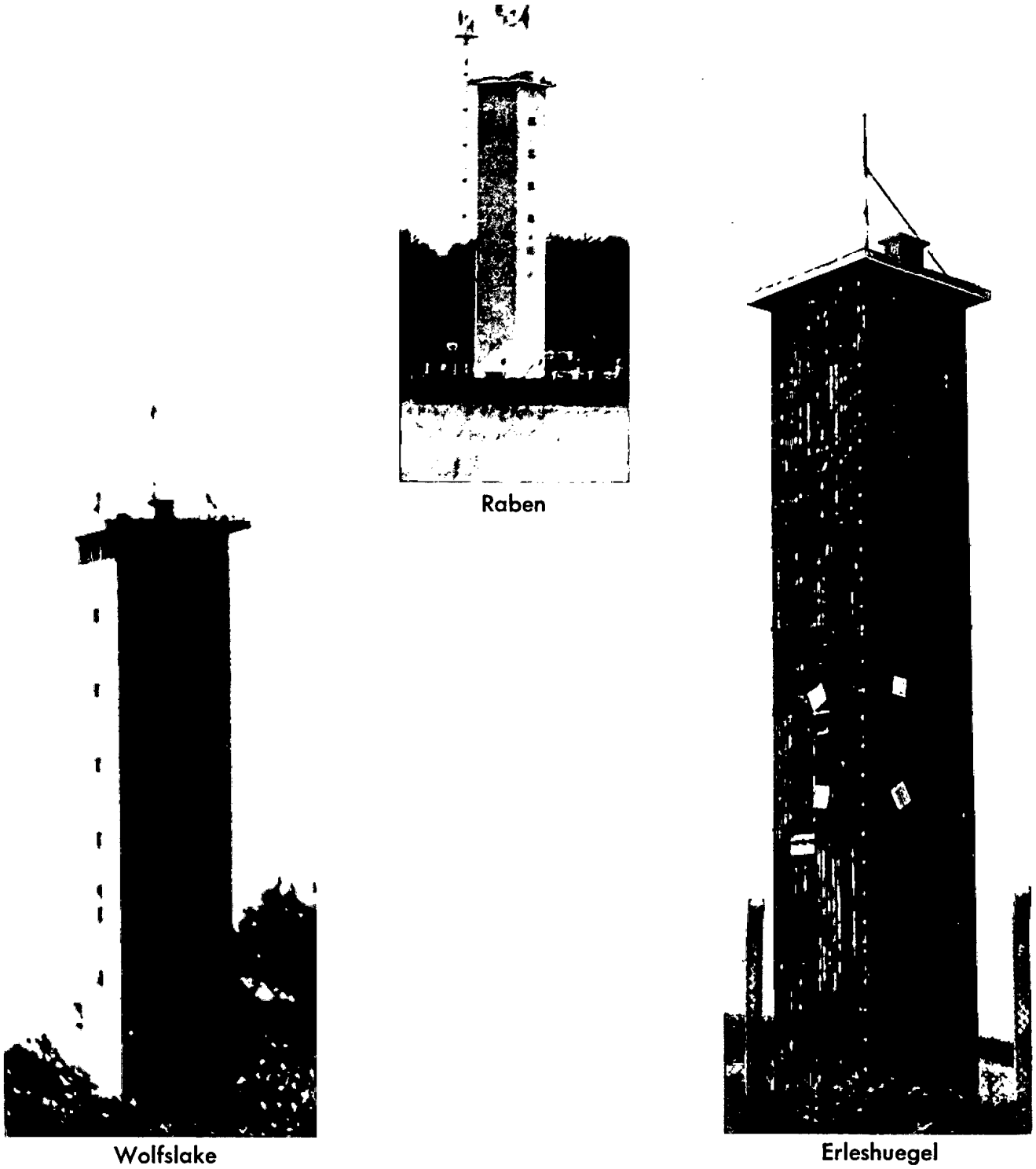

Figure 13. East Germany: Medium Masonry Communications Towers Observed at Raben, Wolfslake, and Erleshuegel, September 1960

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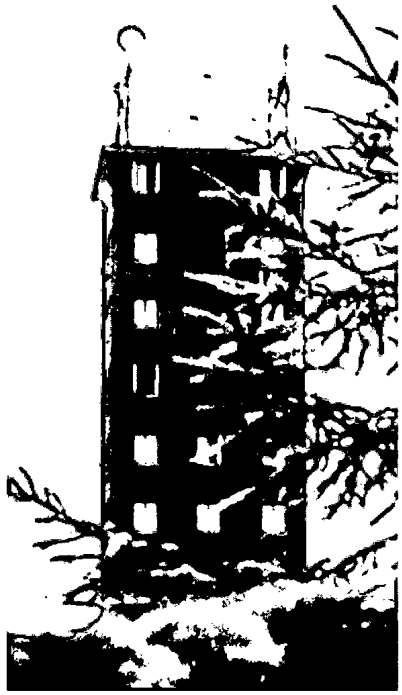
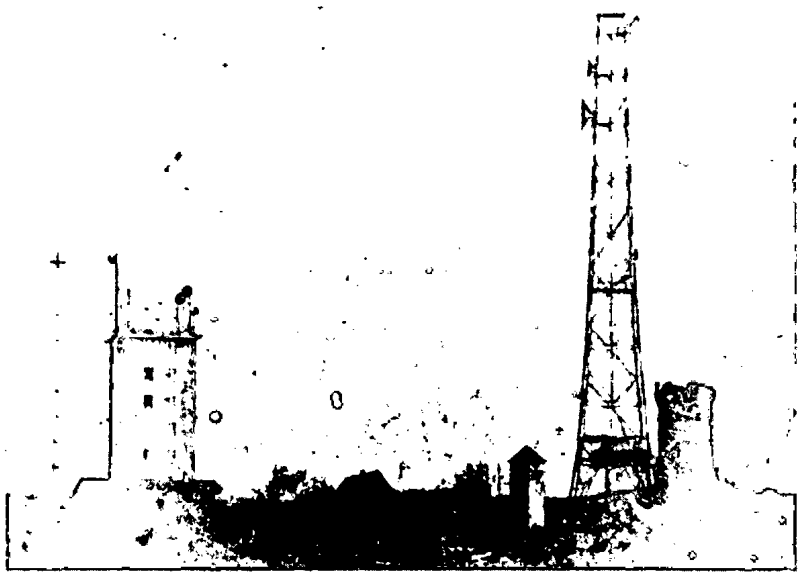


Schneekopf



Peters-Berg

Figure 14. East Germany: Short Masonry Communications Towers Observed on Peters-Berg and Schneekopf Mountains, November 1960

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be equipped with radar antennas, [redacted] 50X1
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Speculations on the use of the new SED network for military purposes may not be resolved until it is fully equipped and placed in operation. If, in fact, joint use by the Party and the MINAVE is intended, it should effect a major improvement in the military communications capability of East Germany.

2. Ministry of National Defense (MINAVE)

The MINAVE operates and maintains extensive wire and radio networks to direct and control the air, ground, and naval forces under its command. These networks, centered around Strausberg -- headquarters of the National Peoples Army (NVA)* -- provide services both to subordinate military commands in the country and to defense ministries of other countries of the Soviet Bloc. [redacted] 50X1
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During 1959-65 the communications resources of the MINAVE will be improved through the construction of new fixed facilities and the more extensive use of mobile facilities. The key project for improving fixed facilities is the enlargement of the main communications center at Strausberg. Initiated early in 1959, this project entails the relocation of the aboveground transmitting site at Strausberg to Kagel and the aboveground receiving site at Strausberg to Eggersdorf. Known as the "Strausberg Objekt," the transmitting station at Kagel, an elaborate underground facility, will be linked with the Strausberg control center by a multichannel microwave radio relay line and a 32-pair cable. Thus the Kagel station, containing about 20 shortwave transmitters with powers ranging from 300 watts to 4 kw, will be remotely controlled from Strausberg. At least Morse, telephone, teletype, and facsimile services will be available. 39/

The new receiving site at Eggersdorf, currently the headquarters of the Air Force as well as the alternate headquarters of the NVA, will be less elaborate than the Kagel installation. Nevertheless, it also will be an underground structure, housing at least

* Within the MINAVE the NVA is a single, unified service comprising air, ground, and naval forces.

[redacted] 50X1

18 receivers. Plans specify that a cable will be laid to connect the alternate NVA headquarters in Eggersdorf with the Kagel transmitting site.

Construction of these new "hardened" installations is nearing completion, and they should become operational early in 1961. Originally, completion was scheduled for mid-1960, but reports indicate that construction is still in progress. Inasmuch as they are high-priority projects, this delay may signify shortages of needed technical manpower and materials. The important features of the underground transmitting station at Kagel are shown in the sketch, Figure 18.*

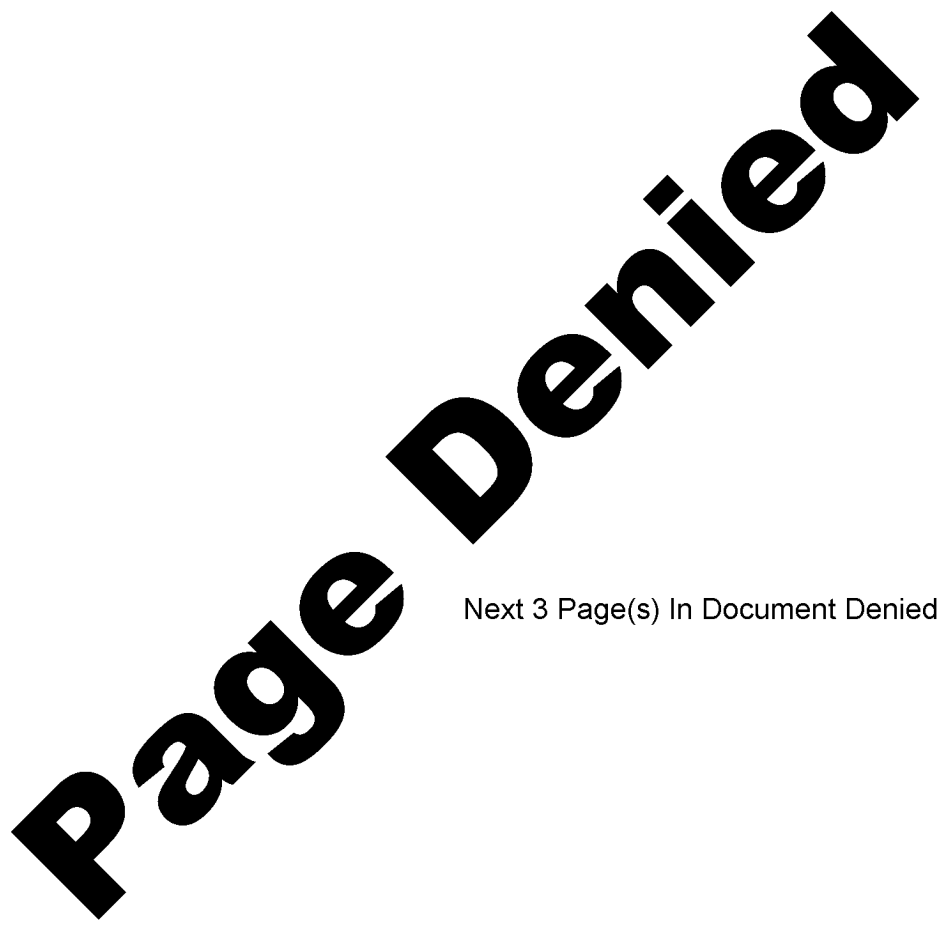
The most significant advancement in the communications capability of the MINAVE during 1959-65 probably will be the further use of mobile radio relay equipment for tactical communications. In addition to increasing the traffic capacity and security of the MINAVE network, the more extensive use of this equipment will afford a highly mobile and flexible long-distance communications structure. Very-high-frequency (VHF) and ultra-high-frequency (UHF) equipment will be used for mobile military communications. At present, some mobile VHF equipment, type R-401, which provides two voice and two teletype channels simultaneously, is used at army and division levels. In the near future this equipment will be used by nearly all military echelons.

The buildup of UHF military communications is directly tied to specially designed mobile microwave radio relay equipment of the RVG-924 and RVG-925 types. Still in the early stages of production, the RVG-924 can provide 8 telephone channels, whereas the RVG-925, still under development, can provide either 1 video channel or 12 telephone channels. The RVG-925 is being designed in conjunction with the FS-876A transportable television transmitter. In combination these types of equipment could be used to transmit either video signals from forward combat positions to a rear command post or radar-video signals from early-warning sites to air defense filter and command centers.

Interconnection between the MINAVE network and the SED network is suggested by the assignment of common equipment. The use of the RVG-924 on the MINAVE and the probable use of the RVG-925 on the SED network could mean that a substantial part of the MINAVE network will be compatible with that of the SED, thus permitting interconnected service, either normal or emergency.

The alternative communications capability of the MINAVE will be increased further by the planned expansion of MPT facilities. The requirements of the MINAVE probably affected the developmental

* Following p. 32.



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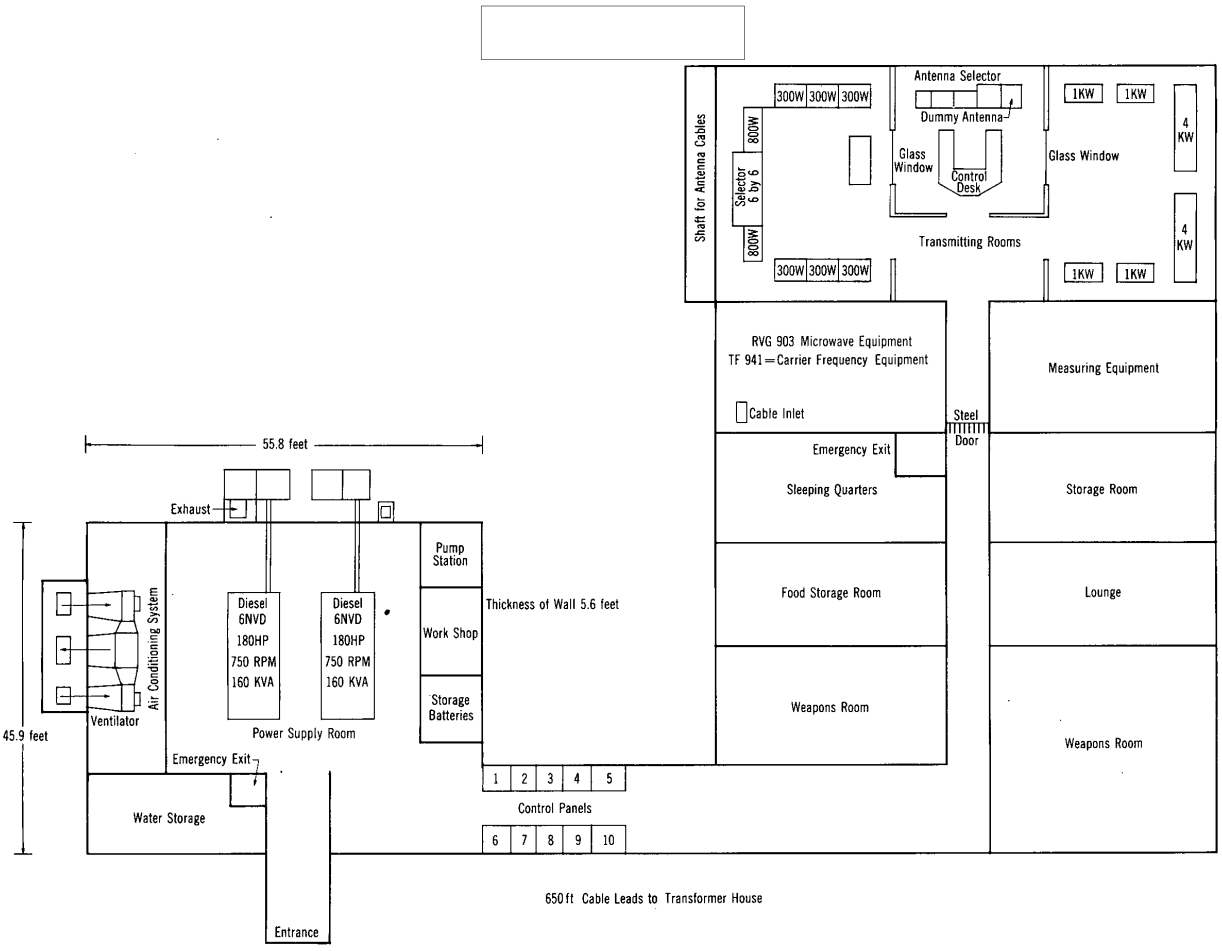

Figure 18. East Germany: "Hardened" Military Communications Center Under Construction at Kagel, January 1961

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planning of the MPT, especially on modern, new arterial lines, because the MINAVE is an important customer of the MPT. The MPT has plans to interconnect East Berlin with important military centers around the country. For this purpose, either microwave radio relay or coaxial cable lines or both will be used. For these and other planned cable lines, terminal and repeater stations will be placed underground in the interest of military hardening, if not economic cost.

No information is available on the planned expansion of the communications capability of the MINAVE for 1966-75. However, increased use of mobile communications facilities is expected. Furthermore, it is conjectured that scatter facilities will be developed, particularly for intra-Bloc circuits. Currently, East Germany is operating four experimental tropospheric scatter links, one of which serves between Kolberg (on the outskirts of East Berlin) and Prague.*

3. Group of Soviet Forces Germany (GSFG)

The telecommunications facilities of the Group of Soviet Forces Germany (GSFG) probably comprise one of the better communications systems within the Soviet Armed Forces. Consisting of integrated wireline and point-to-point radio (fixed and mobile) networks, these facilities, [redacted] give direct communications between the headquarters of the GSFG in Zossen-Wunsdorf and the six GSFG ground armies and between it and the Soviet Ministry of Defense in Moscow. For the most part the GSFG employs wireline as its primary medium and point-to-point radio as its secondary, or backup, medium. Information is lacking on the point-to-point radio network, but it probably comprises the same points of communications as the wireline network. 50X1

Installed by Soviet military personnel, the open wireline network is owned and operated by the USSR. The construction of this network began some time after the end of World War II with the installation of several lines running between the eastern and western borders of East Germany. During the ensuing years the network was extended so as to become the main communications artery of the GSFG. As such, its primary function is to support, independently of lines owned by the East German government, Soviet military forces in the country. For this important purpose, the use of aboveground lines, which are constantly patrolled by Soviet armed guards, rather than of underground lines may reveal Soviet communications doctrine. In this case, doctrine may trade off physical security for visual security. 40/

* The other three links are between Kolberg and Dresden, Kolberg and Fichtelberg, and Kolberg and Inselberg.

[redacted] 50X1

The GSFG also uses circuits of the wireline facilities of the MPT. These circuits are controlled by the GSFG for its exclusive use. Because the MPT cannot use these circuits for its own traffic requirements, their use by the GSFG constitutes a drain on the already overburdened resources of the MPT. In recent years the GSFG has offered to relinquish control of these circuits if its traffic is handled on a priority basis. Although some gain would accrue to the MPT by the reacquisition of these circuits, the major beneficiary would be the GSFG. In addition to expediting the flow of Soviet traffic, the security of this traffic would be improved because transmissions would be dispersed randomly over a large number of circuits rather than over a few readily identifiable circuits.

No information is available on plans to expand GSFG facilities during 1959-65, but it is believed that coverage of the wireline network will be extended as necessary. More extensive use probably will be made of mobile UHF and VHF radio relay equipment. At present, R-401 equipment is the primary mobile radio relay equipment used by the Soviet field armies, but the low capacity of this equipment and its short transmission range limit its usefulness. It is anticipated, therefore, that within the next 3 to 5 years this equipment will be replaced by more modern types featuring better range, capacity, and flexibility.

IV. Program for Development of International Telecommunications, 1959-75

East German plans for developing international telecommunications reflect the objectives of Bloc-wide organizations such as the Organization for Cooperation Among Socialist Countries in the Fields of Post and Communications (OSS) and the International Radiobroadcasting and Television Organization (OIRT). These organizations are attempting to integrate, standardize, and expand telecommunications in and among the countries of the Sino-Soviet Bloc. To achieve these goals, member countries are required to participate in establishing by 1965 or earlier a number of intra-Bloc facilities, including an automatic telegraph network known as GENTEX; a semiautomatic telephone network, which is to be fully automatic by 1975; and a television network known as Intervision.

The Seven Year Plan shows East Germany's intentions to meet those goals on a broad front. High-capacity microwave and 4-tube coaxial cable lines are to be installed between Berlin, Dresden, and Prague and between Berlin and Katowice. In addition to carrying telephone and telegraph traffic, these new lines will serve in the proposed Intervision network. In support of proposed GENTEX and semiautomatic telephone networks, a new central telegraph office is to be established

in East Berlin by 1961, and a new long-distance telephone exchange is to be constructed by 1963. Situated close to and associated with the existing long-distance telephone exchange located on Dottistrasse in East Berlin, this new exchange will be housed in a "hardened" site with at least two underground levels. The exchange will have 25 long-distance through lines for handling international calls to and from East Berlin. Reportedly the exchange equipment will be imported from Czechoslovakia.

Planned mainly for international services, these new facilities also will be used, at least until 1965, for domestic services. Overall investment involved in this program is not known, but the allocation of more than 22 million DME for installation of planned coaxial cable lines implies a sizable total outlay.

Although motivated primarily by the need to meet OSS and OIRT commitments, these programs to develop international telecommunications also reflect East Germany's attempts to establish itself as a main communications route for East-West traffic. As such, the political posture of the country would be enhanced in its drive for recognition as a sovereign power. Significantly, East Germany has made strong and repeated representations to OSS that East Berlin serve as the main trunk exchange in the planned intra-Bloc telephone and telegraph networks, maintaining, in view of East-West contentions over the status of East Germany, that it would be politically desirable to concentrate international transit communications traffic in that city.

The Seven Year Plan contains other programs for expanding international telecommunications. The most significant of these entail the expansion of the international radiobroadcasting facilities at Nauen and Koenigs Wusterhausen. Presently the Nauen site houses five 100-kw short-wave transmitters that give coverage to the Middle East. During 1959-65, five more 100-kw transmitters will be installed so as to extend coverage to all Latin America and perhaps parts of Africa. At Koenigs Wusterhausen, there are now three low-power short-wave transmitters that provide services to Europe and Africa. During the plan period these transmitters will be replaced by three new 100-kw transmitters so that services can be extended to include the Middle East, Latin America, Africa, and Southeast Asia. The new transmitters planned for Nauen will come from domestic production, but those at Koenigs Wusterhausen will be imported from the USSR at a cost of about 11 million DME. 41/

This enlargement of international radiobroadcasting will establish East Germany as a major world broadcaster. Furthermore, the extension of coverage to the underdeveloped areas of the world, which are emerging

as potent forces in international politics and which are susceptible to Communist propaganda, could facilitate East German attempts to win worldwide support and recognition for its Communist regime.

Plans for 1966-75 indicate a continuation of East Germany's drive to establish itself as a major international communicator. During this decade the growth of international services and facilities will continue at a rapid rate. In these efforts, compliance with the objectives of OSS and OIRT will continue to be the overriding consideration, but the desire of East Germany to foster world trade and to place its international telecommunications resources on a par with those of West Germany also will be contributing factors.

V. Prospects for Fulfilling the Program

Prospects for fulfilling current and long-range plans for expanding telecommunications in East Germany are dim. Although some targets will be met on schedule, especially those related to the expansion of functional facilities, these plans as a whole are considered to be overly ambitious and not in consonance with the true capabilities of the post and telecommunications sector of the economy. Past performance of this sector thus far has not shown the ability to sustain such a vast program. Although planned investment appears to be adequate, shortages of equipment and technical manpower will deter the attainment of plan goals.

A. Investment

Allocations of investment funds under the Seven Year Plan appear to be adequate to support the planned expansion. Investment during 1959-65 is expected to be about 2.2 billion DME, more than three times the figure of 700 million DME for the previous 7 years. Investment will increase from 203 million DME in 1959 to 398 million DME in 1965, or about 96 percent, but the average annual rate of growth,* as shown in the chart, Figure 20,** will be only 13.9 percent compared with 19.5 percent in 1952-58. 42/ The higher rate during 1952-58 reflects the low level of investment before 1952.

The over-all amount of investment funds to be allocated to the postal and the telecommunications subsectors is not known. With the exception of broadcasting, available information lumps investment in telecommunications with that in the postal subsector. During 1959-65,

* The average annual rates of growth in this report are computed at the compound interest rate for the stated period including the terminal years.

** Following p. 36.

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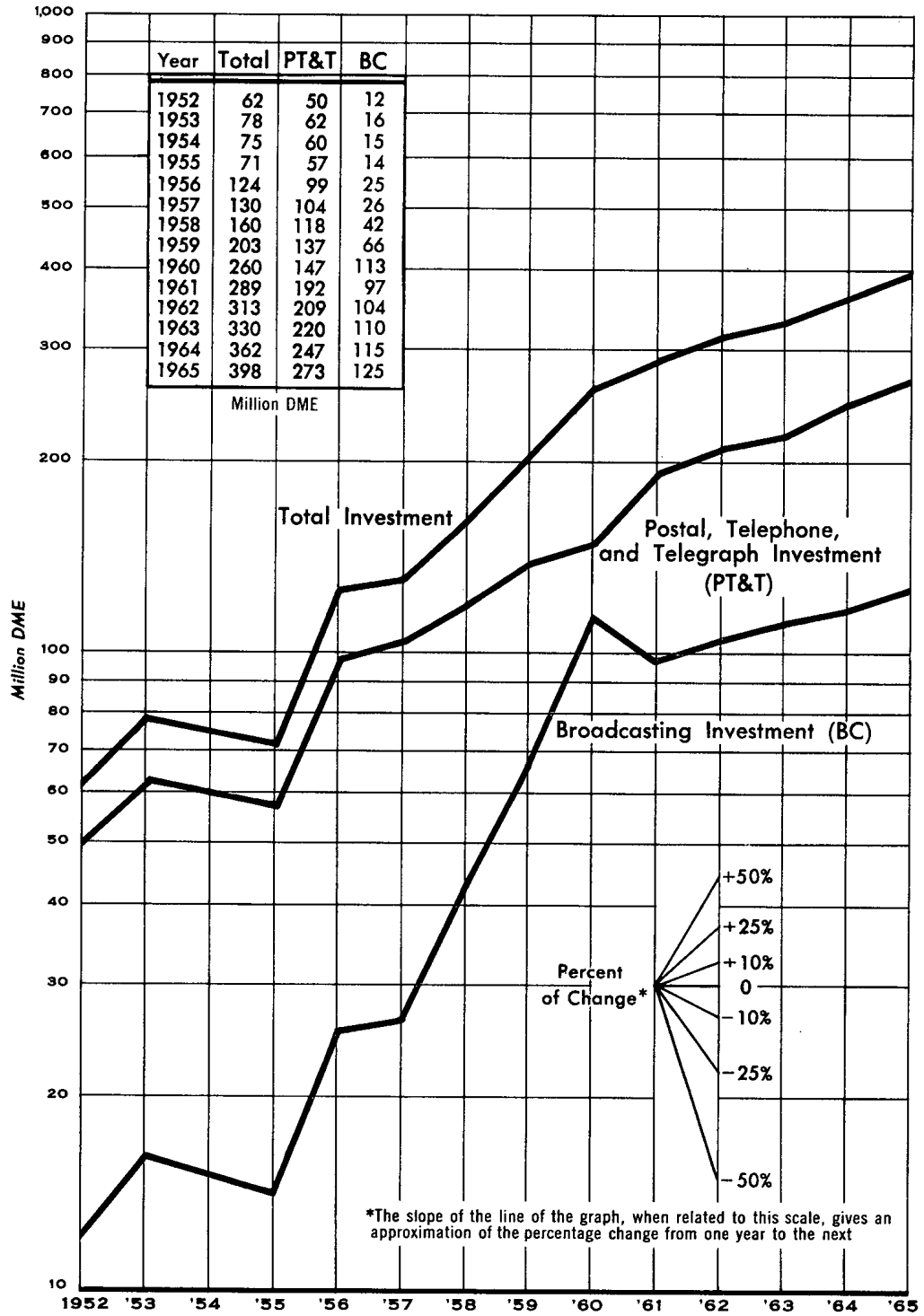
Figure 20

EAST GERMANY: RATE OF GROWTH OF INVESTMENT OF THE MINISTRY OF POST AND TELECOMMUNICATIONS, 1952–65



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investment in broadcasting is expected to be 730 million DME, or about 35 percent of the total planned for the period. This amount, which is greater than the total MPT investment for 1952-58, signifies the importance attached to the development of broadcasting. In the absence of better data, it is assumed that the major part of the remaining 1.4 billion DME of investment planned for 1959-65 will be in telecommunications, primarily high-cost multiconductor cable (including coaxial) and microwave radio relay lines. Sizable allocations of funds for these facilities are mandatory if the MPT is to extend domestic and international telephone, telegraph, and broadcasting services according to plan.

Investment data cited in Figure 20 do not include funds for the expansion of functional facilities as such. The MINAVE, the SED, and the GSFG as well as other ministries and agencies allocate funds directly to the MPT for the construction of facilities to meet their own needs. These contributions are made within separate and independent investment programs for which data are lacking. Nevertheless, the magnitude of plans suggests that such investment will be substantial but less than that in basic facilities.

Only limited and extremely tentative data are available on investment in telecommunications in East Germany during 1966-75. These data, nevertheless, suggest that East Germany will attempt to maintain its position as one of the foremost "communicators" of the Soviet Bloc and even of Western Europe. Accordingly, funds will be allocated so as to achieve these objectives by 1975. 43/

B. Equipment and Technical Manpower

Allocations of investment funds appear to be adequate, but prospects for fulfilling all major goals for expanding telecommunications during 1959-65 are poor. [redacted] the electronics industry is experiencing difficulties in developing and producing the required equipment in accordance with plan schedules. The same data show that the MPT is suffering from chronic shortages of technical personnel in the installation and operating groups. These deficiencies, appearing mildly in the past, will continue, during pursuit of the very ambitious Seven Year Plan, at aggravated levels.

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From its beginning the over-all program has moved slowly. The following major obstacles have been encountered:

1. Delays in the development and production of microwave radio relay equipment such as the RVG-924, the RVG-934, and the RVG-958. Quantity production of the RVG-924 and RVG-934 was to begin

in 1959, but shortages of component parts, developmental personnel, and plant capacity have delayed the start of series production of the RVG-934 until mid-1960 and of the RVG-924 until early in 1961. Because of this lag, it is now anticipated that the expansion of the SED microwave network, originally scheduled for completion in 1962, will not be achieved until the end of 1963. A prototype of the RVG-958 was to be available early in 1960, and full-scale production was to begin by 1961. Presently, development is more than 2 years behind schedule, and full-scale production probably will not begin until late in 1963 or early in 1964.

2. Shortages of 8-pair and 14-pair multiconductor cable and 17-pair and 4-tube coaxial cable. Stemming primarily from the inadequacy of existing facilities for production of cable, these shortages have already delayed installation of significant parts of the planned southern carrier frequency cable ring and of the projected 4-tube coaxial cable lines. To overcome these deficiencies, East Germany plans to import from the West additional coaxial cable-making machinery in 1962 and to expand existing facilities of the Oberspree Cable Plant (KWO) in 1963. Until these new production facilities are placed in operation, East Germany plans to import 4-tube coaxial cables from the USSR.

3. Delays in the development and production of 60-channel carrier-frequency telephone equipment. Although experimental models of this equipment have been produced by the Bautzen Telecommunications Plant, they did not function satisfactorily when tested on the new carrier-frequency cable line between Frankfurt-an-der-Oder and Cottbus. As a result, the MPT has refused to approve the equipment in its present form for series production. The major bottlenecks in the development and production of this equipment are a lack of filters, a lack of quality control of critical component parts, and a lack of skilled technical personnel to assemble and install the finished equipment. This equipment was to be available early in 1959, but installation reportedly will not begin until early in 1961. This delay has already prevented the maximum use of previously installed 8-pair, 14-pair, and 17-pair cable lines and also will impede work on the development and production of 120-channel and 240-channel carrier-frequency telephone equipment.

4. Delays in the development and production of crossbar switches for use in new automatic telephone exchanges. Essential for the planned automation of domestic and international telephone traffic, this equipment was to be available late in 1960. Shortages of plant space and technical manpower at the Arnstadt Telecommunications Plant, the producing plant, however, have delayed its development. Although experimental units have been produced, they did not function

satisfactorily under test conditions. Reports state that East Germany plans to import from West Germany a sizable quantity of this equipment to meet current needs.

5. Delays in the development of high-gain antennas for use in conjunction with all newly installed television transmitters. These antennas were to be available in 1959 but at present are still in the early stages of development. Unless East Germany is able to import sufficient numbers of these antennas from West Germany, plans to extend the coverage of television broadcasting will be hampered.

6. Confusions in planning, procurement, and allocation processes for needed raw materials.

All these impediments imply that the growth envisioned for telephone, telegraph, and broadcasting services in East Germany will not be reached during the plan period. Plan goals, especially those for enlarging the long-distance cable network and for extending local and interurban telephone services are believed, for the most part, to be "illusionary" in some quarters. Responsible authorities in East Germany, recognizing this fact, now anticipate plan fulfillment of between 70 to 80 percent. Nevertheless, even this level of performance for so extensive a program would broaden significantly the domestic and international telecommunications resource base of the country. These additional resources would meet a major part of the needs of the country and at the same time accommodate Soviet political and military interests in East Germany and in Western Europe. Finally, they would serve as a broad foundation on which to lay long-range plans for 1966-75.

APPENDIX A

GLOSSARY OF TECHNICAL TERMS

Amplitude modulation (AM): The process by which a selected carrier frequency is varied in magnitude (amplitude) by other frequencies that contain the information to be transmitted in telecommunications. (See Frequency modulation.)

Apparatus: Instruments, machines, appliances, and other assemblies used in providing a telecommunications facility.

Automatic (as an adjective): Of or pertaining to any process involved in producing telecommunications service that does not require direct, immediate human assistance.

Band (of frequencies): The entire range of frequencies between two numerically specified frequency limits. The magnitude of this range is a limiting factor on the amount of information that can be transmitted in telecommunications. With respect to frequencies of the radio spectrum as a whole, the International Telecommunication Union has for convenience divided the whole radio spectrum into eight major bands, as follows:

Frequency Bands

Range	Type	Corresponding Wave* Band
Up to 30 kc**	Very low frequencies (VLF)	Myriametric waves
30 to 300 kc	Low frequencies (LF)	Kilometric waves
300 to 3,000 kc	Medium frequencies (MF)	Hectometric waves
3,000 to 30,000 kc	High frequencies (HF)	Decametric waves
30,000 kc to 300 mc***	Very high frequencies (VHF)	Metric waves
300 to 3,000 mc	Ultra high frequencies (UHF)	Decimetric waves†
3,000 to 30,000 mc	Super high frequencies (SHF)	Centimetric waves†
30,000 to 300,000 mc	Extremely high frequencies (EHF)	Millimetric waves†

* Waves are undulating disturbances: a sound wave is a disturbance in the air, which is an elastic medium, and an electric wave is a disturbance in any medium whatever. The number of waves per second is the frequency of a given wave. Because the speed of wave propagation is considered to be constant, the length of a given wave is in inverse relation to its frequency: the longer the wave length, the lower the frequency; and the shorter the wave length, [footnote continued on p. 42]

Cable: A bundle of sheathed, insulated wires and/or coaxial tubes used as a telecommunications medium. It is sometimes referred to as "multiconductor cable."

Carrier (as an adjective): Of or pertaining to a technique for dividing a circuit, lane, supergroup, group, or channel into portions that can be used independently of and simultaneously with all other portions. Different frequencies or different pulses are selected for each portion to "carry" the information to be transmitted, after alteration by the information frequencies. The carrier itself need not be transmitted.

Channel: A portion, electrical or physical, of a telecommunications circuit, lane, supergroup, or group that can be used to transmit information independently of and simultaneously with all other portions. A channel may be used to provide two or more subchannels.

Circuit: A telecommunications connection between two or more distant points by a wire, cable, or radio medium facility used to carry information. The circuit is the fundamental telecommunications connection between distant points. By the application of appropriate techniques, a circuit may be arranged in many different combinations to meet the need for various kinds and quantities of telecommunications service. In its simplest form a circuit may carry only single telecommunications units in sequence. In its most complex form it may by apportionment carry simultaneously thousands of telephone channels and telegraph subchannels; a number of television programs; and other specialized kinds of service, such as high-fidelity broadcast programs, radar signals, and data-processing signals.

For the most complex application, a circuit is often arranged into lanes, each of which can carry, in one direction, 1 television program or up to 1,800 telephone channels. In turn, these 1,800 telephone channels are subdivided into 10 supergroups of 60 telephone channels each. Each supergroup is subdivided into 5 groups of 12 telephone channels each. One or more telephone channels may be further subdivided into 3 to 20 sixty-word-per minute teletype subchannels. Other specialized kinds of service may be accommodated by combining two or more telephone channels.

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the higher the frequency. Wave length usually is measured in linear units of the metric system.

** Kilocycles per second, or 1,000 cycles per second.

*** Megacycles per second, or 1 million cycles per second.

† It is becoming common usage to refer to waves (frequencies) in these three bands as "microwaves."

Coaxial (as an adjective): Of or pertaining to a modern telecommunications cable medium technique using one or more tubes (sometimes called "pipes"). Each metal tube surrounds a conducting wire supported concentrically by insulators. The space in the tube usually contains nitrogen gas under pressure. Generally, coaxial cable is used for the transmission of information in complex form, such as radar, computer data, or television signals, and/or for the transmission of telephone channels and telegraph subchannels. A single tube usually carries information in only one direction at a time. The capacity of a tube depends in part on the distance between repeater stations. In the standard facility, which may have from 2 to 8 tubes in the cable, a single tube carries a lane of up to 1,800 telephone channels or 1 television lane, for which the repeater station spacing is about 7 statute miles. In a new developmental coaxial cable facility, a single tube may carry 3 lanes of a total of 1,800 telephone channels or 3 television lanes, for which the repeater station spacing is expected to be about 3 statute miles.

Electronics: A general term used to identify that branch of electrical science and technology which treats of the behaviour of electrons in vacuums, gases, or solids. Today telecommunications makes extensive use of electronic technology.

Facility: An association of apparatus, material, and electrical energy required to furnish telecommunications service.

Facsimile (as an adjective): Of or pertaining to a telecommunications (telegraph) service in which photographs, drawings, handwriting, and printed matter are transmitted for graphically recorded reception. In one method (Type A), images are built up of lines or dots of constant intensity. In another method (Type B), images are built up of lines or dots of varying intensity, sometimes referred to as "telephoto" and "photoradio."

Feeder (as an adjective): Of or pertaining to telecommunications facilities of relatively low capacity that join facilities of relatively high capacity. (See Main.)

Frequency: The rate in cycles per second at which an electric current, voltage, wave, or field alternates in amplitude and/or direction. (See Band.)

Frequency modulation (FM): The process by which a selected carrier frequency is varied in frequency by other frequencies that contain the information to be transmitted in telecommunications. (See Amplitude modulation.)

Functional (as an adjective): Of, pertaining to, or connected with special, unique, or particular telecommunications facilities managed and operated by a single agency, organization, company, department, committee, ministry, or other entity, in contrast to the facilities of a basic system. (See Basic system.)

Group: A number of channels (usually 12) or subchannels combined (multiplexed) electrically in building up the total capacity of a telecommunications circuit, lane, or supergroup.

Ionosphere: Those layers of the earth's atmosphere occupying the space about 210 statute miles in thickness extending from about 30 statute miles above the earth's surface to the outer reaches (exosphere) of the atmosphere. Reflection from these layers makes possible long-distance transmission of radio signals. The layers, however, are responsible for fading of signals, skip distance, and differences between daytime and nighttime radio reception. The layers also are used as a scattering reflector for ionospheric scatter-transmission techniques to transmit to distances of about 1,000 to 1,500 statute miles.

Joint facility: A telecommunications facility owned, controlled, or operated by two or more agencies, organizations, companies, departments, committees, ministries, or other entities.

Lane: A one-way portion, electrical or physical, of a two-way telecommunications circuit that can be used independently of and simultaneously with all other portions. The largest lane today can handle 600 telephone channels or 1 television program. In some applications the direction of a lane may be reversed.

Leased (as an adjective): Of or pertaining to the direct operation by a user of a telecommunications facility owned by another agency.

Line: A general term used to delineate a telecommunications circuit facility (wire, cable, or radio).

Main (as an adjective): Of or pertaining to telecommunications facilities at and between principal cities and centers that have relatively high capacity compared with feeder facilities. (See Feeder.)

Medium: Any substance or space that can be used practically to transmit a form of electrical energy for the purpose of providing telecommunications service.

Microwave radio relay (as an adjective): Of or pertaining to a radio medium technique in modern telecommunications employing radio frequencies higher than 300 mc. These frequencies normally do not afford

practical direct transmission to great distances, principally because they do not bend well around the earth's surface and because they do not reflect well from the ionosphere. They are, however, capable of reliable transmission from horizon to horizon (line-of-sight) by the use of special antennas that concentrate the radio energy and give it desired direction. In consequence, great distances can be reached by this technique by the interposition of relay stations along the route of the line with a spacing interval of from 25 to 40 statute miles, depending on terrain conditions. This technique can be employed practically to carry from a small number of telephone channels and telegraph subchannels to thousands of such channels and subchannels through two or more lanes and to carry one of more television and other specialized lanes and channels. (See Band.)

Mobile (as an adjective): Of or pertaining to a telecommunications facility that is intended to be operational while in motion or during halts at unspecified points. (See Portable.)

Modulation: The process of altering a carrier frequency or carrier pulses by other frequencies or pulses representing the information being transmitted.

Multiplex (as an adjective): Of or pertaining to the combining of information signals, modulated or unmodulated, of two or more lanes, supergroups, groups, channels, or subchannels for transmission over the same circuit.

Network: An interconnection, electrical or physical, of two or more circuits or portions thereof for the purpose of facilitating telecommunications service.

Point-to-point (as an adjective): Of or pertaining to telecommunications service between fixed points, using the radio medium.

Portable (as an adjective): Of or pertaining to a telecommunications facility that can be readily moved from place to place but normally is not operational while in motion. (See Mobile.)

Private (as an adjective): Belonging to or concerning an individual person, organization, institution, or activity; not public or common.

Pulse: A spurt of electrical energy of extremely short duration (usually measured in millionths of a second) yet capable of being used in telecommunications to transmit information.

Quad: In a multiconductor telecommunications cable, the physical association of a group of four conductors in any one of various arrangements for the purpose of providing two-way multichannel operation.

Reception base: The aggregate telecommunications receiving facilities employed in providing a broadcast service.

Route: The geographical path followed by a wire, cable, or radio line.

Scatter (as an adjective): Of or pertaining to a radio medium technique in modern telecommunications by which energy in radio frequencies above 30 mc is deliberately scattered into one or the other of two reflecting portions of the atmosphere (troposphere and ionosphere) at such a predetermined angle that a usable portion of the energy arrives at the desired receiving location. This technique is especially applicable to regions in high latitudes (Arctic and Antarctic) where facilities of other media suffer from the rigors of weather and terrain and where the conventional long-distance radio media of the lower frequency bands (200 kc to 30 mc) are subject to serious disruptive propagational anomalies. (See Band.)

Subchannel: A portion, electrical or physical, of a telecommunications channel that can be used independently of and simultaneously with all other portions. An appreciable number of telephone channels usually can be subchanneled to carry from 3 to 20 sixty-word-per-minute teletype subchannels on each telephone channel so employed.

Subscriber: Any customer who directly operates telecommunications apparatus in obtaining telecommunications service.

Supergroup: A number of groups (often five) combined (multiplexed) electrically in building up the total capacity of a telecommunications circuit or lane.

System: All of the facilities and networks managed by a single agency, organization, company, department, committee, ministry, or other entity in rendering either functional or basic telecommunications service.

Telecommunications: Transmission, reception, or exchange of information between distant points by electrical energy over a wire, cable, or radio medium facility to produce telephone, telegraph, facsimile, broadcast (aural and visual), and other similar services.

Teletype (as an adjective): Of or pertaining to a technique for effecting telegraph service by the use of an apparatus similar to a typewriter in which information is transmitted by keyboard and received by type printer on a roll of paper or tape or by perforations on a roll of tape or both. The apparatus is sometimes called a "teleprinter" or a "teletypewriter."

Transmission base: The aggregate telecommunications transmitting facilities employed in providing broadcast service.

Transistor: A modern device that is capable of performing in a solid (germanium or silicon) many of the functions performed by the conventional electronic tube in a gas or vacuum.

Troposphere: The layer of the earth's atmosphere occupying the space from the earth's surface to a height of about 6 statute miles. This layer is used as a scattering reflector for tropospheric scatter-transmission techniques to distances of about 200 to 500 statute miles.

Wave guide (as an adjective): Of or pertaining to a telecommunications medium, now under development in several countries, that may be capable of transmitting extremely large amounts of conventional and complex information. It consists of a circular or rectangular hollow metallic tube in which electrical energy travels in the form of waves, much as do sound waves in a speaking tube.

Wire diffusion: Distribution of broadcast programs by a wire or cable medium to wired loudspeakers.

Wired loudspeaker: A telecommunications loudspeaker that receives from a distribution point one or more broadcast programs by a wire or cable medium.

Wireline: A general term used to identify a line consisting of either an aerial cable (and/or separate wires) or an underground cable used as a telecommunications medium.

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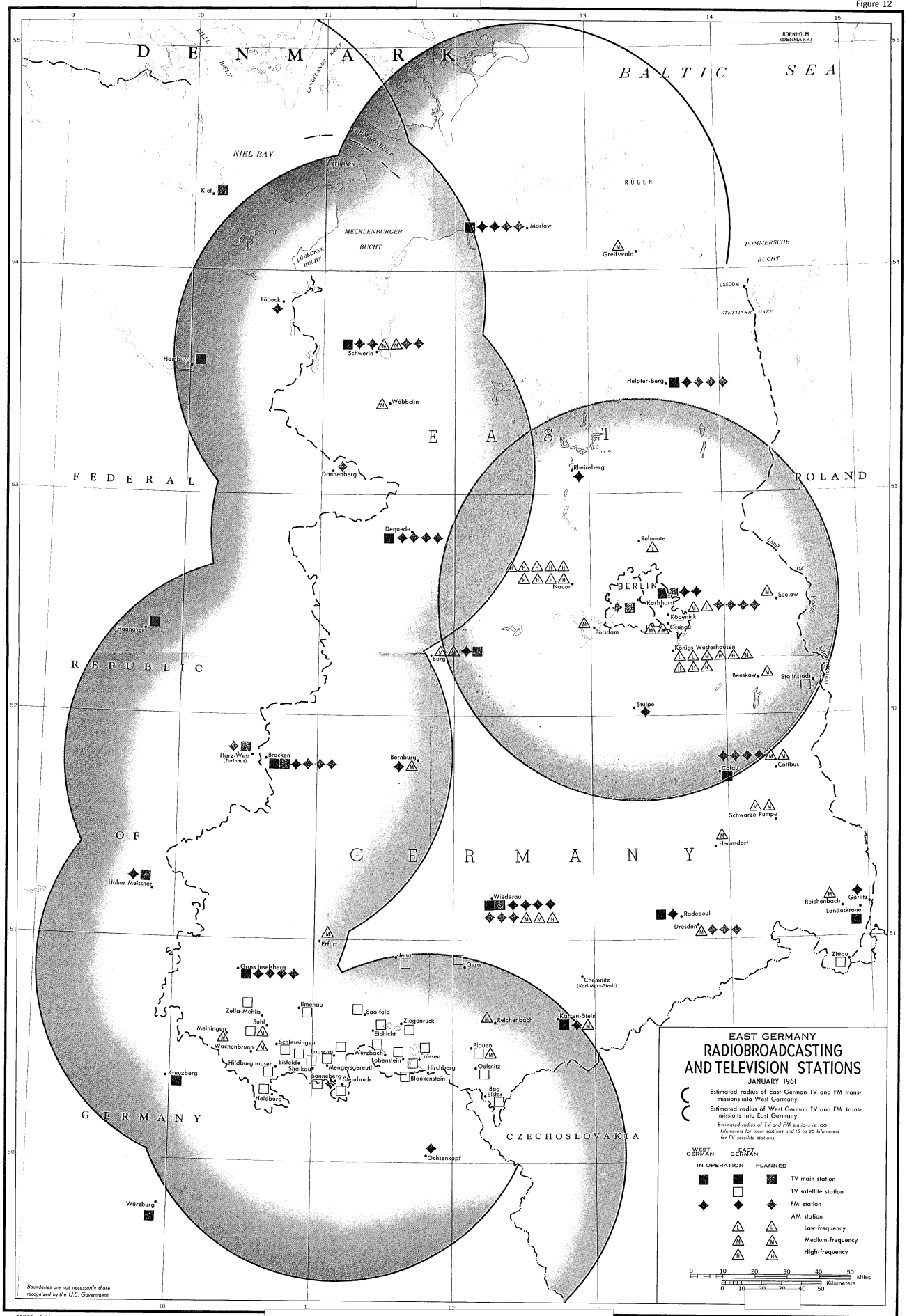
Figure 12



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