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MAIN FUNCTIONAL TELECOMMUNICATIONS SYSTEMS SERVING THE ECONOMY OF THE USSR

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FOREWORD

Surveyed in this report are the major telecommunications systems operated by various sectors of the Soviet economy independently of the basic telecommunications system of the Union-Republic Ministry of Communications. Also, the interrelationship between these functional independent systems and the basic system is examined. An economic survey of the basic system will be found in CIA/RR 138, Post and Telecommunications Services in the USSR, 1950-57, 21 July 1958, SECRET, which is now under revision.

Excluded from this report are military and quasi-military systems and many small systems operated by other sectors and subsectors of the economy, such as agriculture, mining, and manufacturing. Telecommunications systems internal to a plant or an enterprise also have been excluded.

Details on the radio facilities portion of the telecommunications systems covered in this report, as well as the radio facilities of all known telecommunications systems in the USSR, are given in the following reports of the National Security Agency:

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MAIN FUNCTIONAL TELECOMMUNICATIONS SYSTEMS SERVING THE ECONOMY OF THE USSR*

Summary and Conclusions

Functional telecommunications systems account for a significant part of the total civil telecommunications resources of the USSR.** At the end of 1961, identified functional systems consisted of nearly 4,000 radio circuits, more than 5,000 miles of microwave radio relay lines in operation or under construction, and a vast network of multiconductor cable and open wirelines. These facilities, the magnitude of which is understated in available statistics, provide large quantities of conventional telephone and telegraph services and a variety of specialized services to meet private needs. The most important functional systems are those operated by ministries and departments responsible for rail, pipeline, air, and water transport; the electric power and fishing industries; hydrometeorological and diplomatic services; and the sovnarkhozes.

Functional telecommunications systems have been developed over the years by individual civil ministries and departments in order to effect better control and coordination of related economic activities, including dispatching control over the movement of goods, fuels, and power. In most cases their communications requirements are specialized and entail the need for continuous, direct, and reliable communications service with widely dispersed points.

* The estimates and conclusions in this report represent the best judgment of this Office as of 1 October 1962. For a definition of technical terms, see Appendix A.

** The term functional telecommunications systems in this report refers to those telecommunications systems operated by and serving individual civil ministries and departments of the Soviet economy independently of the basic telecommunications system of common usage operated by the Ministry of Communications.

Functional systems have been developed largely independent of the Ministry of Communications,* which manages the basic telecommunications system in the USSR, even though many systems lease from or jointly own facilities with the Ministry. This independent development has come about in part because of the inability of the Ministry of Communications to meet specialized communications requirements and in part because of economic and bureaucratic pressures. Consumers of bulk communications traffic have found that they can operate and maintain their own facilities more economically than they can lease facilities from the Ministry of Communications. In instances where service requirements and economic factors fail to justify the operation and maintenance of an independent telecommunications system, the prestige and convenience afforded Soviet officialdom by such a system outweigh practical considerations.

Functional systems of the railroad system, gas and oil pipelines, and the electric power industry operate the largest networks of open wire, multiconductor cable, and microwave radio relay lines. One or more of these media parallel the 78,800 route miles of rail line, the 28,900 miles of gas and oil pipelines, and much of the more than 90,000 circuit miles of main electric power transmission lines. At present, open wireline is the predominant medium used by these systems, but most of the mainline facilities constructed since 1958 employ the more modern multiconductor cable and microwave radio relay media.

In contrast to other functional systems, those serving water and air transport, the fishing industry, and diplomatic and hydrometeorological services rely on radio as the primary medium of communications. This reliance on radio is dictated by the need to communicate with airborne and waterborne craft and with stations in foreign countries and by economic considerations that restrict the construction of other types of telecommunications facilities in remote areas of the USSR.

In the past the telecommunications facilities used by the functional systems have adequately met service requirements. At present, however, in addition to the normal increments in demand for the communications services that accompany a growing economy, functional systems

* The term Ministry of Communications includes both the Ministry of Communications of the USSR and the ministries of communications of the various republics of the USSR.

are faced with sharply rising requirements for new as well as conventional services. These additional requirements are an outgrowth of the current Soviet program of automation, mechanization, and modernization, including plans for the establishment of centralized telecomputer centers at many points around the country. To meet these demands in the most economical manner, the functional systems are introducing modern communications media and terminal equipment to supplement and replace existing facilities. Among the modern facilities being introduced are microwave and very-high-frequency (VHF) radio relay, cable, single-sideband and tropospheric scatter radio, automatic switching equipment, high-capacity carrier apparatus, and teledata equipment.

In the light of these developments and the advancing state of telecommunications technology in the USSR, the Ministry of Communications is now attempting to act as the focal point for coordinating the development of functional systems. The Ministry views this need for coordination as especially critical in the planning, construction, and operation of high-capacity multiconductor cable and microwave radio relay lines. There is evidence that the economic advantages of such coordination are slowly overcoming the reluctance of many users of functional systems to cooperate with the Ministry of Communications in this regard.

In contradistinction to its attitude toward other functional systems, the Ministry of Communications seeks to assert direct and absolute control of systems operated by individual sovnarkhozes so that they may be integrated into the common usage system. Most of the sovnarkhozes in the RSFSR, the Ukrainian SSR, and Kazakh SSR continue to resist integration. It is likely, however, that the fulfillment of the Seven Year Plan (1959-65) of the Ministry of Communications, which includes great expansion of service capacity employing the most modern technology, will result in the eventual dissolution of the redundant, aged, and uneconomical sovnarkhoz systems.

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I. Transportation

Ministries and departments responsible for rail, pipeline, air, and water transport in the USSR have established functional telecommunications systems to maximize the utilization of their available transport resources. Although all have a common need for direct and continuous communications between administrative and operational units, the unique aspects of each transportation system have necessitated the establishment of independent telecommunications networks.

A. Rail

In the USSR the railroad system, managed by the All-Union Ministry of Railroad Transportation, functions as the backbone of the transportation network. In 1961 the railroad system handled nearly 85 percent of the total domestic freight traffic in ton-kilometers. The system consists of 31 railroad regions and about 180 subordinate operating divisions and at the end of 1961 covered about 78,800 route miles.

1. Facilities

The Ministry of Railroad Transportation through its subordinate unit, the Chief Directorate of Signals and Communications, installs, operates, and maintains an integrated network of telecommunications facilities. This network provides a variety of conventional and specialized communications and signals services. 1/*

a. Open Wireline

The open wireline network is the major medium used for local and long-distance railroad communications, tying Ministry

headquarters in Moscow to the various railroad regions and their subordinate operating divisions. With the exception of those rail lines that have been electrified with alternating current (AC) and a few other main lines, the open wireline network serves all rail lines. It provides circuits of varying capacity for the transmission of telephone, telegraph, and signaling traffic. As is the case for other communications media, open wire facilities are well maintained and, with few exceptions, are separate from those of the Ministry of Communications.* 2/

The wireline network runs adjacent to track facilities. Whereas the local part of the network uses wires of zinc-coated steel, the long-distance part uses copper-covered steel. In order to increase the circuit capacity of long-distance lines, extensive use is made of 3-channel and 12-channel telephone carrier equipment. Some use is made of 24-channel equipment, but the quality of voice transmission is poor. 4/

b. Multiconductor Cable and Microwave Radio Relay

At the end of 1961, there were about 4,600 miles of multiconductor cable and microwave radio relay lines in operation or under construction along rail lines.** These media (see the map***) are used on some main routes and on all AC electrified sections of the railroad system and provide both communications and signaling circuits. Because of electrical interference, open wirelines had to be replaced with underground cable or microwave radio relay lines on all AC traction systems.

The first multiconductor cable lines installed by the railroads were of the lead-covered, paper-insulated type. In recent years the use of polystyrene insulated cable has been emphasized. One such cable has been installed on the Mariinsk-Zima section of the Trans-Siberian Railroad. Imported from France, it is a 14 star-quad cable with a potential capacity of about 160 telephone channels.

* The railroads spend annually more than 40 million (old) rubles to maintain their open wireline facilities. 3/

** Of this total, 800 miles of cable lines and 1,600 miles of microwave radio relay lines were in operation, and 2,200 miles of microwave radio relay lines were under construction.

*** Inside back cover.

d. Other Facilities

The use of television and radar facilities in rail operations is still in the developmental stage. Television is used in classification yards on a few selected rail lines to enable the dispatcher to observe the status of track utilization and the disposition of rail cars in the yard. Radar is used in a few yards to measure the speed of cars coming off the hump into the classification tracks for assistance in the proper application of pressure by the car speed retarders.

2. Services

The telecommunications system of the railroads provides domestic and international telephone and telegraph services. International services have been improved appreciably in recent years. These gains have been achieved in the Sino-Soviet Bloc under the auspices of the Organization for the Cooperation of Socialist Railroads (OSShD). Formed in September 1957, its main objective is to unify rail operations, including communications and signaling, of all member countries. In 1958 a plan was drafted to establish an automatic telephone and telegraph system that would provide direct connections between the railroads of all member countries. This Bloc system was to be formed in two rings, an "East Ring" and a "West Ring," with Moscow serving as the hub. Details on the execution of the plan are not available, but at present the system provides manual telephone and telegraph connections on a 24-hour basis between all rail headquarters located in the Bloc capitals. 9/

a. Telephone

Telephone service is available on a system-wide basis. Local telephone service enables stationmasters to be in constant communication with dispatchers, other stations, and switch and signal tenders so that train movements and other operational activities can be controlled. Long-distance telephone service is quite extensive, affording connections between the headquarters of the Ministry in Moscow and all regional and divisional headquarters.

Both automatic and manual exchanges are employed to provide telephone service. Fully automatic and semiautomatic exchanges are used on all long-distance circuits as well as on circuits serving large rail centers and important junction and marshaling yards. Since 1957, all newly installed exchanges with a capacity of 200 lines or more have been automatic. 10/

The over-all performance of the telephone system, in both qualitative and quantitative terms, is good. Some delays occur in the completion of local calls, but these generally are confined to secondary areas equipped with obsolete manual exchanges. The use of automatic and semiautomatic exchanges not only has speeded long-distance service but also has significantly lowered operating and maintenance costs and reduced manpower requirements. Automatic equipment probably will eventually replace all manual equipment. 11/

b. Telegraph

The telegraph network of the railroads provides regular telegraph service and a limited amount of facsimile service. Manual and automatic Morse equipment and teletype equipment are used on the telegraph network. Teletype equipment has been used extensively since 1958, when the Ministry directed that page printing equipment be the principal telegraph apparatus. Recent reports state that teletype equipment is to be converted to conform to international standards. This action undoubtedly reflects the efforts of OSShD to standardize the railroad telegraph services and facilities of member countries.

Although the telegraph network offers relatively good service, its operating efficiency suffers somewhat from an insufficiency of direct circuits. Such circuits generally are available between Ministry headquarters and regional and divisional headquarters but are in short supply for communications between regional headquarters and their operating divisions and between divisions. This shortage necessitates the multiple relaying of large quantities of traffic through intermediate points. To overcome this deficiency, the Ministry intends to establish a substantial number of strategically placed railroad telegraph centers so as to insure direct service between regional headquarters and their

operating divisions. Service between divisions in the same railroad region either will be direct or will be relayed through no more than one intermediate point. Along with these developments the Ministry also plans to introduce subscriber telegraph service (TELEX) between points exchanging large volumes of traffic.

c. Signaling

The signaling facilities of the railroads are largely of the manual or semiautomatic variety. Of the 78,800 route miles of railroad in operation, 61,700 miles are equipped with manual or semiautomatic systems, 14,100 miles are equipped with automatic block signal (ABS) systems, and 3,000 miles are equipped with centralized traffic control (CTC) systems.

Control of train movements on sections equipped with manual or semiautomatic block systems requires the use of direct telephone or telegraph communications between the stationmaster, the dispatcher, the switch and signal tenders,* and the adjoining stations. Sections of line where ABS systems are installed employ coded track circuits (signals are transmitted along the track) to control the three aspect searchlight signals as well as for wayside and cab signaling purposes. The signaling and communications circuits on the CTC system are carried by underground cable. Besides using the basic features of the ABS system, the CTC system permits the CTC operator, who is constantly aware of the track conditions and the status of track circuits, to control remotely the routing of trains throughout his territory.

B. Pipeline

The Main Administration of the Gas Industry, Council of Ministers of the USSR, is responsible for the construction and operation of gas and oil pipelines in the USSR. Its pipeline network at the end of 1961 consisted of 15,900 miles of gas and 13,000 miles of oil pipelines.**

* On some sections of line equipped with semiautomatic block systems the switch is controlled remotely.

** This network is to be expanded to 26,500 miles of gas and 28,100 miles of oil pipelines by the end of 1965. Included in this plan are oil pipelines that will link the Urals-Volga oilfields in the USSR with refineries in Poland, East Germany, Hungary, and Czechoslovakia. 12/

Telecommunications facilities running parallel to this pipeline network provide the telephone, telegraph, telemetric, and telecontrol services necessary for the control and supervision of pipeline performance.

Most telecommunications facilities used by the gas industry are jointly owned and operated with the Ministry of Communications. Some facilities are leased from the Ministry of Communications, and a few are believed to be owned wholly by the gas industry. The economic advantage of joint ownership is apparent from Soviet estimates that, by sharing construction costs with other organizations, the cost of installing telecommunications facilities can be reduced from about 2.7 percent of the total investment cost for a pipeline to about 0.4 to 0.5 percent. 13/

Before 1959, open wireline and multiconductor cable were the main media paralleling pipelines. During the 10-year period 1949-58, 1,400 miles of open wireline and 600 miles of cable were installed along main pipelines by the construction trusts of the Ministry of Communications. 14/

The first microwave radio relay line was introduced in 1959 along the Aksay (near Rostov) to Moscow section of the Stavropol'-Moscow gas pipeline (see the map*). This microwave line, which is owned jointly with the Ministry of Communications, employs 24-telephone-channel equipment (Strela-M) and equipment for the relay of television broadcasts (Strela-T). 15/ The gas industry, in conjunction with the Ministry of Communications, has planned an additional microwave radio relay line to parallel the gas pipeline being constructed from Gazli to Sverdlovsk, a distance of about 1,300 miles. 16/ This microwave radio relay line is now under construction south from Gazli to Tashkent, along an existing pipeline route, as shown on the map. R-60/120 equipment probably will be used along the entire route from Sverdlovsk to Tashkent, as specifications call for the transmission of television broadcasts as well as telephone and telegraph traffic and telemetric and telecontrol signals.

Available information is insufficient to identify additional pipeline routes that will employ microwave radio relay, nor have operational

* Inside back cover.

or planned multiconductor cable routes been identified. The extensiveness of plans for the use of cable, however, are apparent from a statement by the gas industry that, starting in 1960, the electronics industry must produce annually 1,900 miles of polyethylene insulated cable having four and five conductor pairs for pipeline use. 17/ It is probable that multiconductor cable of this type will be laid along the oil pipelines that will link the USSR with Bloc countries, for these pipelines are being buried and camouflaged to reduce their vulnerability in time of war.

Telephone and/or telegraph service is available at all manned points along pipelines for operational control and at producing areas and terminal points for administrative and operational purposes. Telemetry service is employed extensively by the gas industry for remote monitoring of the operational status of equipment and pipelines, but only limited application is made of telecontrol service for the remote control of valves and for pressure-boosting and pumping stations. Planned technological developments in automation, however, will greatly increase the use of telecontrol service in the next few years.

C. Air

Domestic and international civil air transport in the USSR is controlled by the Main Administration of the Civil Air Fleet, Council of Ministers of the USSR.* The Civil Air Fleet (AEROFLOT) is divided into 29 Territorial Directorates and Regional Air Groups, each having Regional Controllers and subordinate airfields.** This organizational structure is closely paralleled by an administrative telecommunications system with Moscow as its focal point. In addition, AEROFLOT operates a navigational telecommunications system consisting of navigational stations located along air routes and at principal airfields.

Radio, operating in the HF and VHF spectrums, is the predominant communications medium used by AEROFLOT.

* Beginning in 1959, Polar Aviation was resubordinated from the Chief Directorate of the Northern Sea Route, Ministry of the Merchant Fleet, to the Civil Air Fleet. 18/

** International operations are controlled from the Moscow Territorial Directorate. This directorate has communications with both Bloc and non-Bloc countries.

This network is the most extensive nonmilitary network of radio facilities in the USSR. In some remote areas of the USSR the radio facilities of AEROFLOT are shared with other organizations. Moreover, AEROFLOT provides communications support to military aircraft in areas where military facilities are not available.

Open wireline, multiconductor cable, and microwave radio relay facilities that are owned and operated by AEROFLOT are believed to be confined to relatively short routes for connecting air traffic control centers with peripheral communications installations. 19/ Although evidence is lacking, it is possible that AEROFLOT leases some open wireline, cable, or microwave radio relay circuits from the Ministry of Communications for long-distance communications.

Radio facilities of AEROFLOT provide telephone and Morse and teletype telegraph services

Most ground-to-ground radio circuits in the administrative telecommunications system offer Morse service, and a few offer both Morse and telephone service. Teletype service is confined to those administrative circuits that have a high traffic density. Both Morse and telephone services are available on radio circuits of the navigational telecommunications system for ground-to-ground and ground-to-air communications. 20/

D. Water

Commercial shipping in the USSR is largely the responsibility of two Ministries, the All-Union Ministry of the Merchant Fleet and the Ministry of the River Fleet of the RSFSR. The Ministry of the Merchant Fleet controls commercial ocean and Caspian Sea shipping. A subordinate unit, the Chief Directorate of the Northern Sea Route, coordinates

* The sum of the transmission modes does not equal the total number of radio circuits of AEROFLOT, as more than one transmission mode may be employed on any circuit.

shipping along the Arctic coast. Most inland water transport is managed by the Ministry of the River Fleet of the RSFSR.

Both the Ministry of the Merchant Fleet and the Ministry of the River Fleet own and operate autonomous telecommunications systems. HF and VHF radio is the dominant medium for point-to-point, shore-to-ship, and ship-to-shore communications.* Open wire and multiconductor cable lines operated by the Ministry of the Merchant Fleet are confined to urban areas and to short interurban routes. The Ministry of the River Fleet operates similar facilities in urban areas and, in addition, has a network of open wireline facilities that parallel most main inland waterways in the European part of the RSFSR. None of the open wire or cable lines operated by these ministries is known to be jointly owned with the Ministry of Communications. 21/

Radio circuits, furnish telephone and Morse, teletype, and facsimile telegraph services. As shown in the table, Morse service is the most widely used, and only a limited number of circuits offer telephone service. Although, generally, teletype service is confined to main radio circuits,

* Low-frequency and medium-frequency radio is used on some point-to-point circuits in the Far North because of adverse conditions for radio propagation.

** P. 8, above.

*** Some radio circuits of the Ministry of the Merchant Fleet are used to support military activities.

-- at least with respect to the Ministry of the Merchant Fleet -- that teletype service will be standardized and greatly expanded on main and secondary radio circuits during 1962. Facsimile service for the transmission of weather data is broadcast by three meteorological centers of the Chief Directorate of the Northern Sea Route to about 20 land stations and to an unidentified number of ships. 23/

The Ministries of the Merchant and of the River Fleets operate a large number of low-powered VHF radio facilities

Such facilities are available at ports and on most ships for short-range telephone communications. Commercial shipping organizations also are known to employ fixed VHF radio relay facilities, which have a capacity of two telephone and two telegraph channels (Soviet equipment designation RRS-1), for communications over distances of less than 200 miles. This equipment is known to be present at six installations of the Ministry of the Merchant Fleet in the Far North and a comparable number of installations of the Ministry of the River Fleet in the RSFSR. Operational use of VHF radio relay probably far exceeds these fragmentary data. 24/

II. Electric Power Industry

Control of the electric power industry in the USSR is exercised by individual sovnarkhozes and is coordinated at the All-Union level by Gosplan. This industry generates electric power at thermal electric and hydroelectric powerplants and distributes it through more than 90,000 circuit miles of 35, 110, 220, 330, and 500 kilovolt (kv) transmission lines.*

The electric power industry owns and operates an independent telecommunications system to interconnect dispatching points, powerplants, and substations. This system employs power transmission lines, open wirelines, multiconductor cable, and microwave radio relay lines to

* The 500-kv transmission lines, which distribute power from the largest powerplants in the USSR, will act eventually as the backbone for intersystem ties and for the transmission of bulk power over long distances.

provide telephone, telegraph, telemetric, and telemechanical services. To augment its communications system in the event of outages, the facilities of the electric power industry tie in at selected points with communications centers of the Ministry of Communications.

Most communications of the electric power industry are carried over their own power transmission lines. The economic advantages of using these lines have proved so favorable that their exploitation has been emphasized, and multichannel carrier equipment has been especially designed to increase their capacity. The number of installations using this communications medium has increased from 300 in 1949 to 2,200 in 1959. 25/

The extensiveness of the open wireline and multiconductor cable networks is not clear. The electric power industry is known to own and operate at least one wireline, consisting of three wires, paralleling the 500-kv power transmission lines, Kuybyshev-Moscow and Kuybyshev-Sverdlovsk. Open wirelines probably parallel other main power lines, but, because of excessive construction and maintenance costs in comparison with alternative media, it is doubtful that additional wirelines have been constructed since 1958. Multiconductor cable lines are largely confined to urban areas and are used to connect substations with control points. Two such cable lines have been reported in the Moscow area. 26/

The first microwave radio relay line of the electric power industry was completed in 1960. This line parallels the 500-kv transmission line between Moscow and the Volzhskaya Hydroelectric Station near Kuybyshev (see the map*) and was constructed jointly by the electric power industry and the Ministry of Communications. The capacity of this line, which uses Strela-M equipment, is 24 telephone channels, and each organization has the exclusive use of 12 channels. The Ministry of Communications also has installed Strela-T equipment on this line for the transmission of television broadcasts.

The electric power industry plans to expand its use of 24-channel microwave radio relay equipment along main power lines and within urban areas, but exact routes have not been identified. Plans also

* Inside back cover.

call for the testing of new microwave radio relay equipment with capacities of 6 and 12 telephone channels. 27/

Telephone and/or telegraph services are available at powerplants, at manned points along power transmission lines, and at control and administrative centers. In addition, substations on 500-kv transmission lines are equipped with 100-line and 200-line telephone exchanges for internal substation service and for service with industrial consumers. These exchanges also connect with telephone systems of the Ministry of Communications. 28/

Telemetric and telemechanical services have found widespread application in the electric power industry. These services are used for monitoring the operations of power lines and for the remote control and supervision of unattended powerplants and substations. 29/

III. Hydrometeorological Service

The Main Administration of the Hydrometeorological Service, Council of Ministers of the USSR, has the primary responsibility for civil meteorological activities in the USSR and for the international exchange of meteorological information. In the Soviet Far North the Hydrometeorological Service relies on the Chief Directorate of the Northern Sea Route, Ministry of the Merchant Fleet, for most of its meteorological information. 30/

All types of telecommunications facilities are employed in the collection of data from thousands of meteorological stations located throughout the USSR and in the dissemination of these data to civil and military recipients.* For reasons of security and reliability, open wirelines, cable, and microwave radio relay facilities are preferred and are used predominantly in areas where they are available. Most, if not all, such

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* there are about 3,000 active meteorological stations in the USSR. This figure includes stations subordinate to the Chief Directorate of the Northern Sea Route
d automatic weather stations. 31/

facilities used by the Hydrometeorological Service are leased from the Ministry of Communications. The telephone and telegraph terminal equipment associated with these facilities, however, is believed to be owned and operated by the Hydrometeorological Service.

In areas of the USSR not served by open wire, cable, or microwave radio relay lines, the Hydrometeorological Service relies on HF and VHF radio. radio circuits [illegible] are operated by the Hydrometeorological Service, a part of the facilities used probably are shared with other organizations.

Telecommunications facilities used by the Hydrometeorological Service provide telephone and Morse, teletype, and facsimile telegraph services. Morse telegraph is the more prevalent service observed on radio circuits. Telephone, teletype, and facsimile services generally are confined to main radio circuits connecting major meteorological centers.

IV. Diplomatic

Soviet diplomatic posts throughout the world communicate with Moscow via international commercial facilities and/or Soviet diplomatic facilities. As of 1 July 1962 a total of 78 diplomatic posts outside the USSR had been identified in communication with Moscow. Of these, 12 were served exclusively by Soviet diplomatic facilities, 47 were served both by Soviet diplomatic facilities and international commercial facilities, and 19 were served exclusively by international commercial facilities.**

All diplomatic posts that have their own communications use HF radio, and all diplomatic radio circuits are administered by either the Committee for State Security (KGB) or the Chief Intelligence Directorate

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* P. 8, above.

** Permission for Soviet diplomatic posts to operate an overt radio facility from a host country is normally a subject of bilateral agreement.

of the Armed Forces (GRU). The reason for the administration of diplomatic radio circuits by two separate organizations is not clear. In no instance, however, do circuits administered by these organizations duplicate one another. 32/

V. Other

A. Fishing Industry

The fishing industry, administered at the All-Union level by the State Committee for the Fishing Industry, Council of Ministers of the USSR, owns and operates an independent telecommunications system. Available intelligence indicates that the facilities of this system are largely HF radio and provide Morse telegraph service for point-to-point and shore-to-ship communications* (see the table**). There is no evidence that the fishing industry operates open wire, cable, or microwave radio relay lines, nor is there any evidence that channels on such facilities are leased from the Ministry of Communications. 33/

B. Sovnarkhozes

Before the economic reorganization in 1957, there existed a large number of functional telecommunications systems owned and operated by industrial ministries. When these ministries were abolished in 1957, their telecommunications systems were to be transferred to the Ministry of Communications. The responsibility for resolving orderly transfers was left to the Council of Ministries of each republic. By 1961, transfers in 12 of the 15 republics had been accomplished, but in the three largest republics -- the RSFSR, the Ukrainian SSR, and Kazakh SSR -- the newly created sovnarkhozes acquired control of these functional systems.

* Ships of the fishing industry are known to support military activities

** P. 8, above.

As a result of their fragmentation among the sovnarkhozes, these functional telecommunications facilities no longer represent a homogeneous system of any nationwide significance. Collectively, however, they represent substantial communication capacities, thus explaining why the Ministry of Communications is continuing its efforts to gain control of them. 34/

VI. Relationship of Functional Systems to the Ministry of Communications

In addition to its primary responsibilities of providing domestic and international telephone, telegraph, and broadcasting services through an integrated telecommunications system, the Ministry of Communications has the responsibility for the control of telecommunications facilities of all other ministries and departments. This control, in accordance with the "Statute of Communications for the USSR," involves the establishment, by the Ministry of Communications, of uniform standards and rules for the construction and operation of telecommunications facilities. Theoretically these statutory provisions should enable the Ministry to play a dominant role in coordinating the development and operation of national telecommunications resources. In practice, however, the Ministry has been only moderately successful in this regard.

Although the Ministry of Communications has no interest in acquiring direct control of functional systems owned and operated by organizations other than the sovnarkhozes, it has been attempting, in recent years, to effect the coordination of their development. This effort has been especially true with respect to the construction of high-capacity multiconductor cable and microwave radio relay lines. The Ministry believes that coordination and cooperation in the planning, construction, and operation of these lines can eliminate needless duplication of facilities. Moreover, because of shortages of telecommunications equipment, coordination and cooperation in this area can permit a more rational allocation of resources.

There are signs that some of the efforts exerted by the Ministry of Communications are slowly becoming effective. Official publications of various ministries and departments are now making reference to the

economic advantages of some joint undertaking with the Ministry of Communications. Even the Ministry of Railroad Transportation, which has been extremely proud and jealous of its independent communications system, has stated:

> The material benefit from construction of the railroad radio relay lines is further enhanced by the fact that other ministries and departments bear part of the expenses. The Ministry of Communications is interested in construction of radio relay lines of individual railroad branches for the purpose of transmission of television programs and intensification of telephone communications. 35/

Furthermore, by taking a new approach to the establishment of more realistic rates for the lease of channels and service to other organizations, the Ministry of Communications is enlisting greater support for its program of coordination and cooperation.

The Ministry of Communications has taken an aggressive stand in its relationship with the functional telecommunications systems of the sovnarkhozes in the RSFSR, the Ukrainian SSR, and Kazakh SSR. The Ministry is not seeking cooperation and coordination, but complete control and ownership of these systems. Harsh words have been exchanged on this subject, but there has been evidence of some inroads by the Ministry of Communications in its efforts to gain control. Three large sovnarkhozes in the RSFSR -- Moscow, Leningrad, and Sverdlovsk -- have relinquished control of their telecommunications systems, and a fourth, Perm, is making preparations for a similar transfer. Others may follow suit, but this problem will not be resolved until the Ministry can demonstrate, beyond doubt, that it can provide the desired communications services both better and more cheaply than the existing functional systems. The Ministry should be in such a position by the end of 1965. Once this has been accomplished, the functional systems of the sovnarkhozes will dissolve rapidly. 36/

VII. Trends

Although the functional telecommunications systems described in this report have been developed to meet the specialized communications requirements of their respective area of economic activity, there are clearly discernible trends in services and facilities that are common to all functional systems. Two factors that have had the greatest influence on these common trends are Soviet efforts to accelerate economic development by the application of automated and mechanized techniques to production processes, and plans that are being formulated to establish centralized telecomputer centers to effect better coordination, control, and planning of economic activity.

These national actions are beginning to have a forceful impact on the services provided by each of the functional telecommunications systems, as they are generating requirements for more as well as for new kinds of communication services. Demands for conventional telephone and telegraph services are steadily rising, and demands are being created for sophisticated transmission systems to supply inputs to computers and to control, operate, and monitor production processes.

To meet these service requirements, functional telecommunications systems must have facilities that offer not only more circuits but also circuits with more reliability, higher quality, and, in some instances, greater band-width. This development is currently being accomplished by increasing the capacities of many existing facilities and by introducing new, more modern facilities. Among the more modern media being introduced are microwave and VHF radio relay, cable, and single-sideband and tropospheric scatter radio equipment. To complement these media, modern terminal facilities are being introduced, such as automatic switching equipment, high-capacity carrier apparatus, and teledata equipment. Not all functional systems will use all of these modern facilities. Rather, their selection will be determined by individual operational requirements and economic considerations.

Functional telecommunications systems, with the exception of those operated by sovnarkhozes, probably will continue to retain their autonomy. There will be a greater degree of cooperation, however, between ministries

and departments operating functional systems and the Ministry of Communications in the planning, construction, and operation of facilities, especially those with high capacity. This cooperation will increase the flexibility of individual functional systems and at the same time will weld all civil telecommunications resources into a more cohesive form.

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		Corresponding Wave* Band
Range	Type	
30 kc** and below	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. [footnote continued on p. 26]

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 parts that can be used independently of and simultaneously with all other parts. Different frequencies or different pulses are selected for each part to "carry" the information to be transmitted, after alteration by the information frequencies. The carrier itself need not be transmitted.

Channel: A part, 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 parts. 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

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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, the higher the frequency. Wave length is usually 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."

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 1 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 three to twenty 60-word-per-minute teletype subchannels. Other specialized kinds of service may be accommodated by combining two or more telephone channels.

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 upon 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 600 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 that treats of the behavior 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.)

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. They also are used as a scattering reflector for ionosphere 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 1-way part, electrical or physical, of a 2-way telecommunications circuit that can be used independently of and simultaneously with all other parts. 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 do not normally 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. Great distances can, in consequence, 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 upon 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 2 or more lanes and to carry 1 or 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 parts thereof for the purpose of facilitating telecommunications service.

Point-to-point (as an adjective): Generally, 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 is not normally 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 4 conductors in any one of various arrangements for the purpose of providing 2-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 a predetermined angle such 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 part, electrical or physical, of a telecommunications channel that can be used independently of and simultaneously with all other parts. An appreciable number of telephone channels can usually be subchanneled to carry from three to twenty 60-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.

Telecomputer centers: Computer centers that receive data for processing and transmit processed data by means of telecommunications media.

Telecontrol: Automatic control of an action at a distance by wire, radio, or light.

Teledata: Information in any symbolized notation (language, code, or other artificial symbols) transmitted in the form of signals by a person or machine at one point to a person or machine at a distant point by wire, radio, or light.

Telemechanics: Telecontrol of an electromechanical action at a distance by wire, radio, or light.

Telemetry: The automatic process by which the reading of a measuring instrument or the indication of a condition is recorded or otherwise indicated at a distance by wire, radio, or light.

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, on a roll of tape, or by perforations on a roll of tape, or both. (Sometimes called a "teleprinter" or "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, which 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 loudspeakers: 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 underground cable, used as a telecommunications medium.

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APPENDIX B

GAPS IN INTELLIGENCE

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APPENDIX C

SOURCE REFERENCES

Evaluations, following the classification entry and designated "Eval.," have the following significance:

Source of Information	Information
Doc. - Documentary	1 - Confirmed by other sources
A - Completely reliable	2 - Probably true
B - Usually reliable	3 - Possibly true
C - Fairly reliable	4 - Doubtful
D - Not usually reliable	5 - Probably false
E - Not reliable	6 - Cannot be judged
F - Cannot be judged	

"Documentary" refers to original documents of foreign governments and organizations; copies or translations of such documents by a staff officer; or information extracted from such documents by a staff officer, all of which may carry the field evaluation "Documentary."

Evaluations not otherwise designated are those appearing on the cited document; those designated "RR" are by the author of this report. No "RR" evaluation is given when the author agrees with the evaluation on the cited document.

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2.
3. CIA. FDD Summary no 14, 23 Mar 59, p. 30-31. U.
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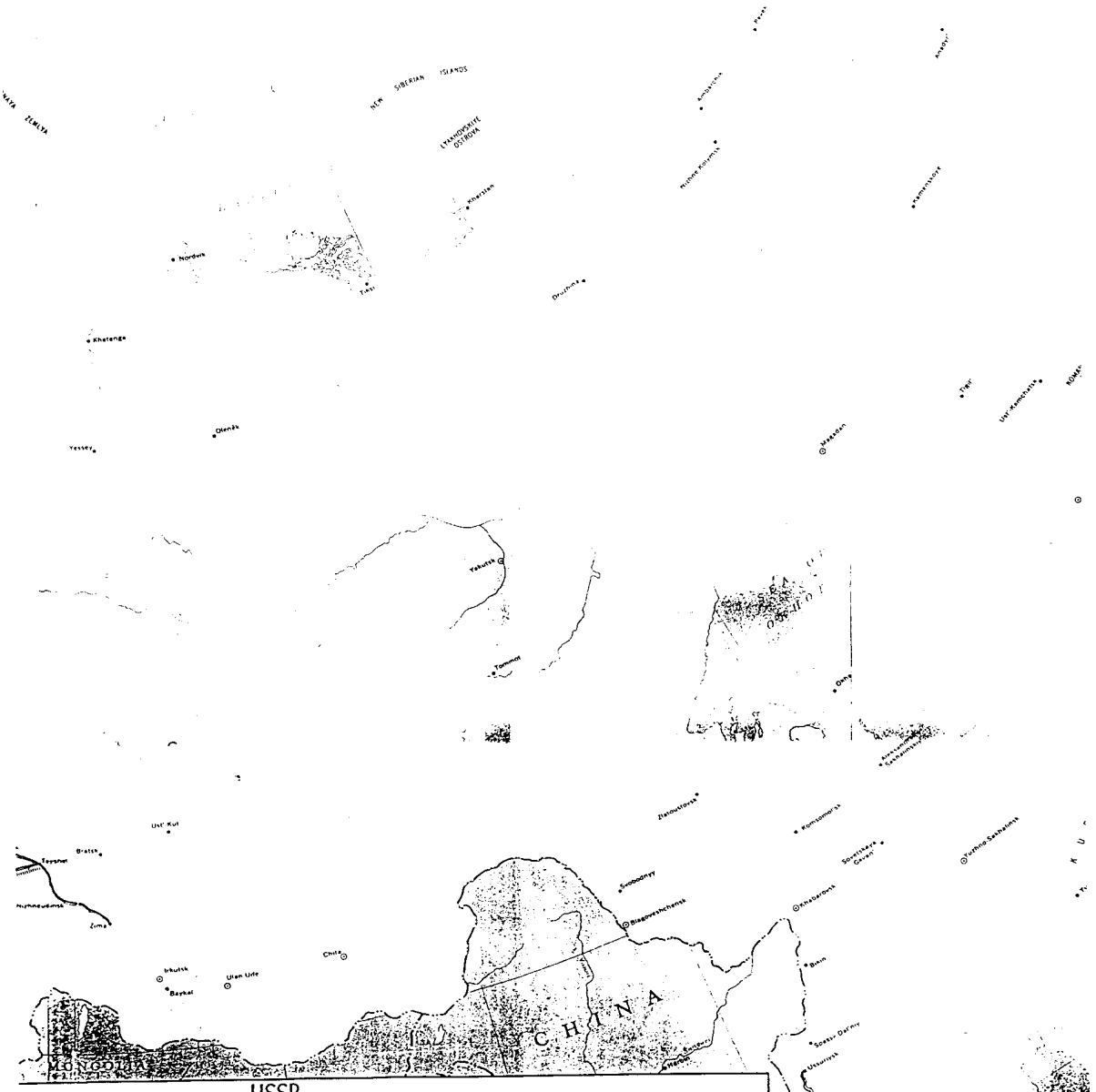
33.
34. JPRS. 11568, 12 Dec 61, p. 1-5. U.
35. JPRS. 11667, 13 Dec 61, p. 5-6. U.
36. JPRS. 4731, 27 Jun 61, p. 1-11. U.
JPRS. 11568, 12 Dec 61, p. 1-5. U.



USSR

Cable and Microwave Radio Relay Lines of the Railroads, Gas Industry, and Electric Power Industry, 1 August 1962*

ROUTES

	MULTICONDUCTOR CABLE	MICROWAVE RADIO RELAY
In Operation	———	———
Under Construction	———	———
Planned	———	———

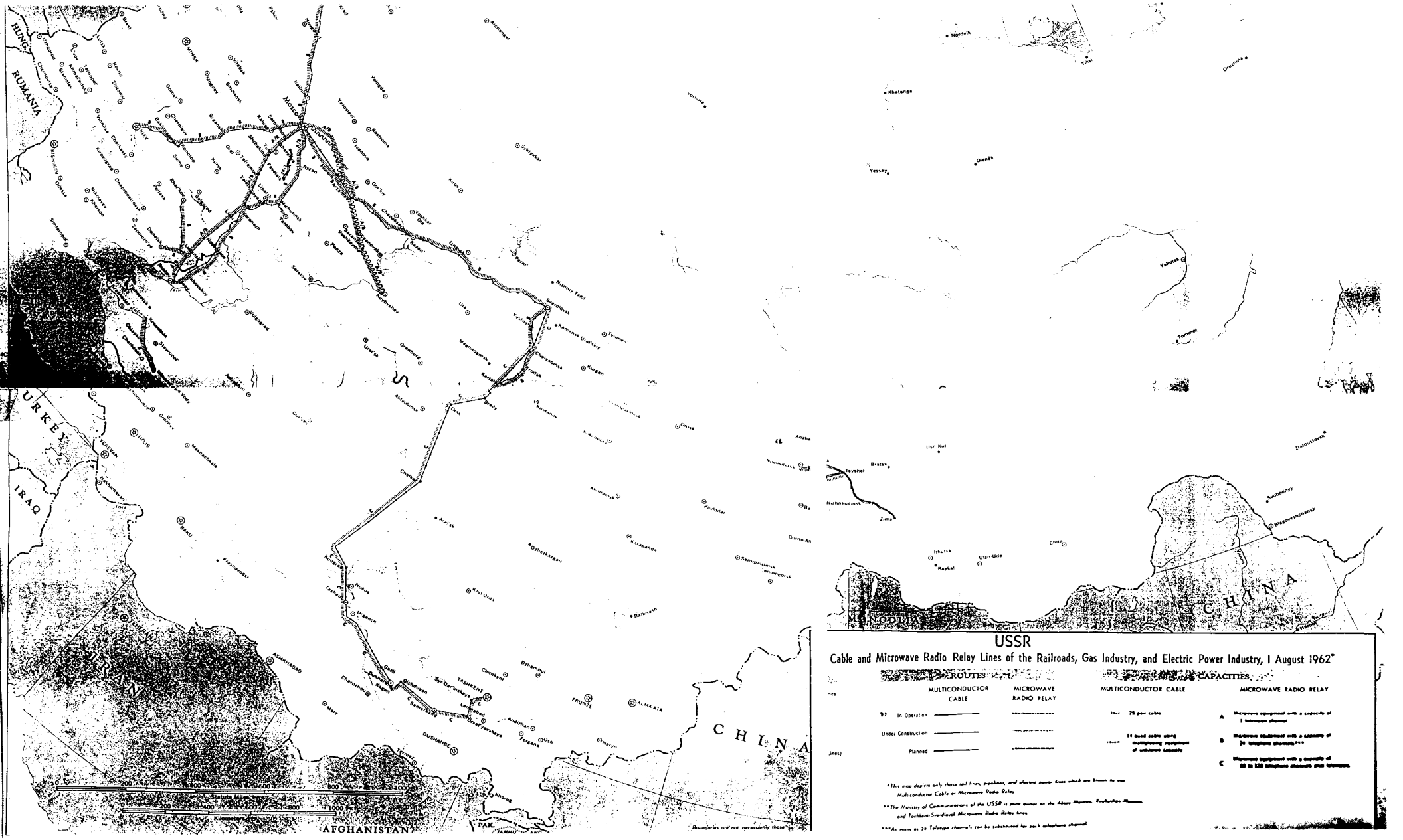
CAPACITIES

MULTICONDUCTOR CABLE		MICROWAVE RADIO RELAY	
10×2	28 pair cable	A	Microwave equipment with a capacity of 1 television channel
14 quad	14 quad cable using multiplexing equipment of unknown capacity	B	Microwave equipment with a capacity of 24 telephone channels**
		C	Microwave equipment with a capacity of 60 to 120 telephone channels plus television.

*This map depicts only those rail lines, pipelines, and electric power lines which are known to use Multiconductor Cable or Microwave Radio Relay.

**The Ministry of Communications of the USSR is joint owner on the Aksay-Moscow, Kuybyshev-Moscow, and Tashkent-Sverdlovsk Microwave Radio Relay lines.

***As many as 24 Teletype channels can be substituted for each telephone channel.


HUNGARY
RUMANIA
TURKEY
IRAQ
AFGHANISTAN
CHINA
MONGOLIA
MOSCOW
BAKU
TASHKENT
FRUNZE
ALMA ATA
DUSHANBE
ASHKHABAD
Boundaries are not necessarily those of
USSR
Cable and Microwave Radio Relay Lines of the Railroads, Gas Industry, and Electric Power Industry, 1 August 1962*
ROUTES
MULTICONDUCTOR CABLE
MICROWAVE RADIO RELAY
In Operation
Under Construction
Planned
CAPACITIES
MULTICONDUCTOR CABLE
MICROWAVE RADIO RELAY
A
B
C
*This map depicts only those rail lines, pipelines, and electric power lines which are known to use Multiconductor Cable or Microwave Radio Relay
**The Ministry of Communications of the USSR is more precise on the Adler-Sochi, Kuybyshev-Moscow, and Tashkent-Sverdlovsk Microwave Radio Relay lines
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