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# ***JPRS Report***

## **Telecommunications**

***Eastern Europe Telecommunications Conference***

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# Telecommunications

## Eastern Europe Telecommunications Conference

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**Development of GDR Telecommunications**

91AN0020 London CONFERENCE PROCEEDINGS:  
TELECOMMUNICATIONS IN EASTERN EUROPE  
in English 25-26 Sep 90 pp 1-17

[Paper by Detlef Haase, of the Deutsche Post's General Directorate of Telecommunications, Strategy, and Research Division, Berlin, GDR]

[Text]

**1. Current Situation**

For the GDR it is one of the most decisive conditions of economic and political development to have available up-to-date communications means. Compared with industrialized countries, however, there are considerable deficiencies in supplying telecommunications services. The situation may be characterized particularly when comparing the supply levels of telephone subscriber lines (main lines) in selected European countries (see table 1).

**Table 1. Supply of Main Lines in European Countries (as per 1 January 1989)\***

Country	Main Lines per 100 Inhabitants
Sweden	66.36
Switzerland	55.04
Denmark	54.42
Finland	49.90
FRG	46.43
France	45.56
UK	42.75
Austria	39.52
Italy	34.98
Yugoslavia	13.87
CSFR	13.60
GDR	10.57
Poland	7.80

The following facts typically describe the current infra-structural situation:

- At present, the demand of the public and particularly of business for existing telecommunications services as well as for new ones cannot be met, neither [as published] in quantity nor in quality.
- The telecommunications equipment of almost the whole network is outdated and in a desperate technical condition (see table 2).

- The outdated equipment and the lack of circuits and satellite channels are significant handicaps for the GDR's international telephone service.
- The actual provision of text and data communications services as well as facsimile does not meet the requests.
- Until now the Deutsche Post does not operate broadband distribution networks for radio and television.

**Table 2. Technological Level of Local Telephone Exchanges (as per 31 December 1990)**

Type	Technological Level	Number of Access Lines	Share (%)
Step-by-step	1922-1934	410,325	19.7
	1950	827,816	39.8
	1953-1958	99,008	4.8
Crossbar	1963-1965	741,027	35.7
Total		2,078,176	100.0-

Table 3. Telephone Services

	GDR (1990)	FRG (1988)	Industrialized Countries
Main lines (per 100 inhabitants)	11	44	35-63
Telephone lines (per 100 inhabitants)	25	64	70-90
Residential telephone lines (per 100 dwellings)	16	99	70-110

The current situation as described enforces a profound updating of the existing telecommunications infrastructure. The general objective with that is to achieve the services level of the Deutsche Bundespost Telekom by the year 1997, with respect to all significant service characteristics.

## 2. Objectives

### Telephone Services

Demand for main lines:

—Number of requests submitted: 1.2 million—  
Necessary increase for achieving the services level of the Deutsche Bundespost Telekom: 7.1 million

Schedule:

1991: 300,000 main lines 1992: 500,000 main lines  
1993: 800,000 main lines 1994/97: 5,500,000 main lines

### Telefax Services

Demand:

—Number of requests submitted: 1,200—Demand estimated by 1997: 360,000

Schedule:

1990/91: 10,000 subscriber lines 1992/93: 90,000 subscriber lines 1994/97: 260,000 subscriber lines

### Data Services

Demand:

—Number of requests submitted: 13,000—Demand estimated by 1997: 96,000

Schedule:

1990/91: 5,000 subscriber lines (incl. 4,500 Datex-P)  
1992/93: 17,000 subscriber lines (incl. 11,000 Datex-P)  
1994/97: 74,000 subscriber lines (incl. 34,000 Datex-P)

### Telex Services

Demand:

—Number of requests submitted: 3,000—Demand estimated by 1997: 6,000

Schedule:

1990/91: 2,000 subscriber lines 1992/93: 2,000 subscriber lines 1994/97: 2,000 subscriber lines

### Videotex Services

Demand:

—Number of requests submitted: 200—Demand estimated by 1997: 100,000

Schedule:

1990/91: 1,000 subscriber lines 1992/93: 20,000 subscriber lines 1994/97: 79,000 subscriber lines

### Cellular Mobile Telephone Services

Demand:

Establishment of a cellular mobile telephone network designed for a capacity of approximately 300,000 subscribers by 1997.

Schedule:

1990/91: network capacity for 40,000 subscribers 1992/93: enhancement of network capacity for additional 50,000 subscribers 1994/97: enhancement of network capacity for additional 210,000 subscribers

### Broadband Distribution Services for Radio and Television

In the future the Deutsche Post will operate under its own responsibility broadband distribution networks/community aerial equipment for radio and television in local areas covering more than 10,000 potential subscribers.

Schedule:

1990/91: 500,000 subscriber lines 1992/93: 600,000 subscriber lines 1994/97: 1,100,000 subscriber lines

At present, the demand for further telecommunications services like teletext, electronic mail, and Cityruf [German paging system] cannot be assessed.

## 3. Development Programme

The long-term target network of the Deutsche Post is the integrated services digital network (ISDN). Short-term measures have to be taken, however, to overcome existing deficiencies. These measures must not contradict the final ISDN goal.

To this end, the Deutsche Post decided to establish a digital network overlaying the existing analogue one, the

former being grown continually and at highest priority. The old fashioned analogue network will not be further extended.

In the period from 1990 to 1997, three phases of network development are defined:

***Phase 1 (1990/91)***

For the improved handling of telephone traffic between the networks of the Deutsche Post and the Deutsche Bundespost Telekom, the number of circuits is increased up to the end of 1990 as follows:

GDR-FRG: from 111 to 1,249 circuits GDR-West Berlin: from 95 to 429 circuits FRG-GDR: from 690 to 1,494 circuits West Berlin-GDR: from 565 to 1,076 circuits

A new international exchange is being installed in East Berlin for the improved handling of the growing international telephone traffic. This exchange is based on up-to-date digital equipment and will replace the existing analogue exchange.

Trunk exchanges based on digital equipment will be installed in the regions of Dresden, Chemnitz, Leipzig, Neubrandenburg, Berlin, Rostock, and Erfurt. They will form a skeleton of the upper network layer of the overlay network and will include approximately 67,000 circuit access points. These exchanges will also handle directly routed traffic between the GDR and the FRG.

As a rule, all new nodal exchanges have to be installed on the basis of up-to-date digital switching equipment.

Locations with new digital trunk exchanges have to be completed simultaneously by digital local exchanges. This includes a number of approximately 52,000 access lines.

The existing coaxial cable main route in the south of the GDR originally prepared for carrier frequency transmission will be reconstructed to create PCM [pulse code modulation] connections between the new digital trunk exchanges.

The extension of digital transmission channels between the regional capitals by means of glass fiber will be started.

As a first step of extension of the packet switched data network, switching nodes will be installed in Berlin, Dresden, Chemnitz, and Leipzig.

As a rule, new telecommunications buildings will be adapted to the use of digital equipment.

The local telephone networks will be developed according to the scheduled objectives.

Mobile telephone services (C-Netz) will be extended over the whole country by the end of 1991 on the basis of a macrocell structure for covering approximately 60 percent of the area and 80 percent of inhabitants. By doing so, Berlin as well as industrialized areas and traffic routes of greater importance are covered.

Having started in Leipzig, the Cityruf will be introduced in another 11 places.

***Phase 2 (1992/93)***

Up to the end of 1993, digital trunk exchanges and the related local exchanges will be installed in the remaining regional capitals as well as in selected district towns.

All new local and trunk exchanges will be established exclusively on the basis of digital equipment. Analogue switching equipment will only be used for the completion of existing exchanges and for adaptation purposes.

The national digital transmission channels will mainly be developed on the basis of glass fiber cables and broadband radio relay systems. Digital transmission facilities will be installed to handle connections to CSFR, Poland, and Scandinavia.

Switching nodes of the packet switched data network will be installed in 11 regional capitals.

The telex network will be reconstructed on the basis of up-to-date digital equipment.

For the mobile telephone services, the C-Netz will be upgraded by means of a microcell structure in regions originating high traffic load. The establishment of the D1 network as part of the pan-European cellular mobile telephone network will be started early in 1992.

***Phase 3 (1994/97)***

All trunk exchanges will be operated digitally. The introduction of ISDN features is started.

With the exception of crossbar devices, the analogue switching equipment is completely taken out of service.

The long-distance transmission network (glass fiber) will essentially arrive at its long-term structure.

In local networks, the employment of glass fibers for subscriber lines will be started.

The digital mobile telephone network is extended to cover the whole country.

Concerning telephone services, text and data communications services, and other services, all user requests will be handled fairly comfortable. The services standard of the Deutsche Bundespost Telekom will be achieved.

**Table 4. Telecommunications Upgrading Towards the Services Level of The DBP-Telekom up to 1997**

	Number of Subscriber Lines in 1990	Number of New Installations
Telephone	1,800,000	7,100,000
Public phones	25,000	60,000
Telefax	1,100	360,000
Data	5,000	100,000
Datex-P		50,000
Telex	17,500	6,000
Videotex		100,000
Cellular mobile telephone (C-Netz, D-Netz)		300,000
Broadband distribution		2,200,000

Annual investment: DM 8 to 9 billion

#### 4. Summary

At present, requests by the public and especially by business for telecommunications services cannot be handled properly in the GDR because of serious deficiencies both in capacity and in technical condition of equipment available. For the period from 1990 to 1997, a development programme has been defined providing the approach towards the services standard of the Deutsche Bundespost Telekom as far as possible. The phases planned to handle this programme are described.

#### Footnote

\* Internationale Fernmeldestatistik. Stand 1. January 1989. Muenchen: Siemens AG 1990.

#### Hungarian Telecommunications Plan Outlined

91AN0021 London CONFERENCE PROCEEDINGS: TELECOMMUNICATIONS IN EASTERN EUROPE in English 25-26 Sep 90 pp 1-7

[Paper by Pal Horvath, deputy director general of the Hungarian Telecommunications Company]

[Excerpts]

#### General Overview of the Situation

If we try to characterize the situation and trends in East Europe's telecommunications, we should not forget about the way the countries have reached their present state. The last 45 years caused a strong divergence between courses of development in East and West Europe. The single-party regimes neglected the basic principles of market economies and held under control the flow of information both in the economy and in the entire society. This has led to the reduction of claims in telecommunications services. As the obsolescence of the political and economic regimes became evident in the 1980s in some countries of the region—e.g., in the Soviet

Union, Poland, and Hungary—attempts to vitalize the economy were followed by attempts to accelerate the development of the telecommunications infrastructure. As these trials could not bring the necessary breakthrough due to the keeping of the outdated management, planning, and financing methods, the backwardness of telecommunications can be identified as one of the most typical characteristics of the countries of this region.

The historic year of 1989 has changed the situation of power, and the elections of 1990 strengthen the new political course in these countries, but the consolidation of telecommunications needs many years. It is clear that national resources are not sufficient to make a major leap forward in telecommunications, so the countries need to access in some form of immediate foreign participation or partnership:

- Modern technology;
- Management support;
- Hard currency;
- Know-how;
- Training.

The desire for foreign participation in financing in the form of joint ventures is available in the different countries with varying degrees of understanding and interest. The countries are considering, implementing, or have already implemented (e.g., Hungary) new laws and regulations for joint ventures. In varying degrees, laws on privatization, tax restructuring, and foreign investments are in process or, as in Hungary, have already been adopted. The countries insist on joint ventures with local manufacturers for two reasons:

- Need for modern telecommunications equipment (soft currency);
- Combining the development of telecommunications and industry.

Repatriation of profits in the short term is either impossible or very difficult. In Hungary, repatriation is guaranteed by the force of the law, but in practice, reinvestment of profits for the initial years is considered as a major advantage for those who really want a joint venture. One of the major duties of the new government is to define a new telecommunications policy to be supported by new legislation and tax policy. The latter is currently of confiscatory nature: The telecommunications services profit is taxed in Czechoslovakia up to 87 percent; in Hungary, 58 percent. Centralization and redistribution of the resources by the state is still very high in these countries. In most of them (except Hungary), telecommunications is still cross-subsidizing its traditional debt-generating partner, the postal service.

#### Telephones, Waiting Lists, Investments

During the next 15 years, the number of telephones will grow in the region as shown below:

1988: 58.8 million 1995: 67.5 million 2000: 76.7 million  
2005: 87.2 million

The average waiting time for telephones is between 8-14 years. In the Soviet Union alone, there are 15.5 million claims on the waiting lists (1988).

Waiting Lists in Other Countries		
Poland	1.85 million	1987
GDR	217,000	1987
Czechoslovakia	370,000	1989
Romania	800,000	1989
Hungary	525,000	1988

Due to the long waiting time, customers are almost hopeless about getting a phone, so many consider it unreasonable to apply for one. For this reason, the real claim can be considered essentially higher.

Market analysts forecast telecommunications expenditure in the region as follows:

	1990 (\$ billion)	1995 (\$ billion)
Switching	5.3	8.2
Transmission	3.3	5.0
Cables	1.8	2.8
Satellites	0.46	0.71

As expenditure on switching amounts usually to about 25-30 percent of the investment budget, the market potential of the region can be estimated as triple to quadruple the switching expenditure. This statement is justified by other estimates forecasting the worth of East European market:

1986: \$9.7 billion 1990: \$16.0 billion 1995: \$24.2 billion  
2000: \$31.5 billion

The share of countries is shown in the following table:

Country	Population (million)	GDP/Capita (\$)	Inflation (%)	Number of Lines		Telecom Investment (\$ million)	
				Telephone	Telex	1990	2000
	1988	1988	1988	1988		1990	2000
USSR	287.3	3,602	-	34.5	1.7	13,700	27,300
Poland	37.6	1,231	60	3.0	33.5	521	742
GDR	16.6	9,108	1.5	1.7	16.7	640	864
Czechoslovakia	15.6	7,115	0.3	2.0	12.0	370	790
Hungary	10.7	2,159	17	0.9	13.0	343	810
Yugoslavia	23.5	1,030	180	3.0	13.0	290	670
Romania	23.1	2,139	0	2.3	-	-	-
Bulgaria	8.9	4,049	0.8	2.1	7.1	138	264
Albania	3.2	844	-	-	-	-	-
East Europe	426.6	3,500	-	49.5	97.0	16,029	31,479
UK (comparison)	56.9	14,130	4.9	23.0	116.0	-	-

Source of all data shown above: "Eastern European Telecommunications"

[passage omitted]

### Telecommunications

It is just a coincidence that the economic modelling of the 10-year (1991-2000) telecommunications development program forecasts an essential rise—after massive investment—in the profit-generating capability of the telecommunications services business just for the same time—e.g., mid 1990s—when the general economic boom is also expected. So telecommunications can even more contribute to the improvement of the Hungarian economy.

The investment policy of the Hungarian Telecommunications Company (successor of PTT) has two main targets:

- To serve, by 1993, all business claims by putting into operation a telephone capacity of 0.5 million lines,

the absolute majority of which to be operated on a new digital overlay network;

- To reach, by 2000, the present West European services level by putting into operation a total telephone capacity of 3.0 million lines during the decade.

In order to be able to carry out the program, the following measures are to be carried out:

- Splitting of telecommunications authority and services provider roles (done in 1989);
- Splitting of the Hungarian PTT into three companies, independent of each other, under state control (done 1 January 1990);
- Privatization of the Hungarian Telecommunications Company—expected to be a step-by-step program

with a deadline for issuing the privatization guidelines by end of June 1990;

- Incorporating network development initiatives of local authorities into the development program.

The realization of the 10-year development program needs from the government not as much financial resources, but rather a beneficial [as published] for the development policy and more stable economic conditions.

The Hungarian Telecommunications Company on the other hand should and will carry out the following measures:

- Elaboration and maintenance of a complex strategy defining long-term targets;
- Initialize a rapid reform of the company for reaching the following main targets (in accordance with the strategy):
  - reduction of number of levels of the management hierarchy;—reduction of headquarter's role (and staff as well) to strategic control;—delegate resources and responsibility to the single lower layer;—ensuring the accountability of the whole management hierarchy;—clear but not rigid definition of goals, interests, responsibility of organizational units and individuals;—strengthening of economic aspects in market research, project financing, introducing strong cost control;—introduction of new scrolling planning method;—modifying the assessment of quality of service.
- Taking more care about human resources, namely:
  - handling of overstaffing;—introduction of a modular training system;—straightforward career management of capable people;—keeping necessary people working for our company in conditions of competition;
- Establishment of a Telecommunications Investment Bank for acquiring and handling of necessary investment resources;
- Reshaping of the entire statistical system and introduction of a computer-based management information system (MIS);
- Rising the efficiency of operation and maintenance work by introducing computer-based operational support (DSS) serving at the same time as information source for MIS;

Depending on the kind of the service, some level of foreign participation is necessary in financing, operating, or marketing of the services further in training and banking.

This kind of reshaped company has to be an effective service provider capable to play a defining role on the Hungarian telecommunications scene.

Competition has already been introduced in the terminal equipment and PABX market and in mobile telephony; full liberalization is expected in value added services; and limited competition in mobile telephony [as published] and data communications. Our company has already established two limited companies: one in the mobile, the other in the PABX business.

The new Telecommunications Act has to define the roles of the customer, services provider, and [telecommunications] authority, with clear distinction between the three main functions of the services provider, e.g.:

- Owner of telecommunications assets;
- Operator of equipment and network;
- Provider of services to customers.

This distinction is to make it possible to involve foreign resources where they are needed.

For being able to plan the future, declaration of the concessional and tariffation policy is necessary [as published]. These questions are still being discussed. The flexibility of the authority is shown by the issue of concessional documents to two companies in the mobile business. This can be considered as the beginning of the age of controlled competition in the Hungarian telecommunications business.

#### Development of Telecommunications in Poland

91AN0022 London CONFERENCE PROCEEDINGS: TELECOMMUNICATIONS IN EASTERN EUROPE in English 25-26 Sep 90 pp 1-8

[Paper by A. Ksiezny, director at the Polish Ministry of Post and Telecommunications: "The Existing Situation and the Trends of Development of Telecommunications in Poland"]

[Text]

#### 1. Introduction

Telecommunications in Poland operate under the auspices of the Ministry of Post and Telecommunications. This ministry is a governmental administrative and regulatory organ, which determines the general policy lines of development of telecommunications in Poland. It is responsible for supervising and coordinating all activities in that field in the country and represents the interests of Polish Posts and Telecommunications abroad within the appropriate international organizations and within the framework of bilateral and multilateral contacts with foreign telecommunications administrations.

For the operation and development of the telecommunications network, the Polish Post, Telegraph and Telephone (PPTT) organization is acting as a state enterprise and is ruled by a PPTT General Directorate.

The liberalization of the telecommunications law is pending in the Parliament. This law should also allow

other operators, private or public, domestic or foreign (including joint-ventures with participation of foreign capital), to take over some existing or to establish new telecommunications services under the licence of the Ministry of Posts and Telecommunications.

## **2. The Existing Situation of the Telecommunications Network in Poland**

### ***Telephony***

Currently there are in Poland about 6,200 local telephone exchanges with the total capacity of 3,277,600 lines, including 345,900 lines in the rural areas.

The number of telephone subscribers is about 3,100,000, including over 340,000 of subscribers in the rural areas.

The telephone density is 7.84 subscribers per 100 inhabitants.

Ninety-one percent of the exchanges are automatic. The total number of automatic trunk circuits exceeds 50,000.

The trunk teletransmission network is 99 percent analogue. Through the local urban networks digital transmission systems are utilized. There is a strong demand for a higher-transmission-speed fiber-optic system.

The international traffic is realized via an automatic electronic E-10 digital exchange in Warsaw of domestic manufacture based on the licence of CIT-Alcatel (France).

Poland has at its disposal some state-of-the-art satellite communications systems cooperating with an earth-stations teleport in Psary in the central part of Poland. In the Intelsat system, telephone conversations and television transmissions are realized via satellites, located over the Atlantic and Indian Oceans, belonging to this organization. In the Inmarsat system, telephone conversations are realized with ships at sea via satellites belonging to or hired by this organization, located over the Atlantic and Indian Oceans. In the Intersputnik system, telephone conversations and television transmissions with various countries in Europe, Near East, Africa, and America are realised via a Soviet satellite located over the Atlantic Ocean.

### ***Telex***

The telex network is fully automatic and is equipped with the exchanges of domestic manufacture, recently fully digitized and fitted with stored program control. The total capacity of these exchanges is about 47,000 lines. The total number of telex subscribers is about 33,500.

### ***Telefax***

This service has developed quickly in Poland over about the last 2 years and is available without any limitations for all telephone subscribers, utilizing the type of equipment which obtained an approval certificate from the Institute of Telecommunications. The quality of the

Polish telephone network does not meet the requirements of fourth-generation telefax equipment.

### ***Data Transmission***

For data transmission, leased circuits and the existing switched telephone network may be used. Many local area networks within banks and other bigger commercial and industrial enterprises, in the scientific research institutions and administrative entities already operate or are being developed.

Some large-scale undertakings in that domain are under way. One of them is the establishment of the special wide area network embracing the whole country for banking purposes based on leased circuits.

The establishment of the first experimental packet switching public data transmission network called Polpak is currently under way.

### ***Mobile Radio***

Currently there are about 20,000 mobile radios for various emergency service mobile radio networks. These networks operate mainly in the 30-MHz and 150-MHz frequency bands and they operate under licence from the Ministry of Post and Telecommunications.

For about 3 years, mobile radio subscribers have been admitted to a manual/semi-automatic public mobile radio network. The service area of this network covers several of the more important cities in Poland (Warsaw, Katowice, Lodz, Gdansk-Gdynia) and some parts of interconnecting roads between these cities. This network is based on the noncellular principle and is equipped with large-coverage base stations. Its total capacity may reach 10,000 subscribers, but currently the number of subscribers only slightly exceeds 1,000 subscribers.

### ***Radio and Television***

There are four sound broadcasting transmitter networks practically covering the whole country: one on longwave (well received throughout almost all of Europe), two on VHF-FM frequency band (66-73 MHz), and one mixed—partially on MF and VHF-FM bands (also 66-73 MHz). In 1987 a new frequency assignment plan for VHF-FM transmitters was adopted by the regional Administrative Radio Conference for ITU region 1 (Europe, Northern Asia, and Africa) and for some countries in Region 3 (Middle East). This opened for audio-broadcasting the whole 87.5-108 MHz band, part of which (87.5-100 MHz) was already utilized for VHF-FM audiobroadcasting in Western Europe (including the GDR). Now the elaboration of the detailed plans concerning the development of the transmitter network on the 87.5-108 MHz band in Poland is under way. The possible introduction of digital instead of frequency modulation to this frequency band is under consideration.

The programs of Radio Polonia intended for listeners abroad, including Poles living in various parts of the world, are transmitted on HF.

The television transmitters network of the Program I covers about 98 percent of the country's population; the network of Program II, about 70 percent of the population.

### 3. Development Trends

#### 3.1. General

The existing condition of the Polish telecommunications network is highly unsatisfactory, mainly because of the underdevelopment of the basic telephone network. The quality of the service is low.

The main problems to be solved are:

- The fundamental improvement of the quality of the service;
- The reduction of the waiting time for the installation of a telephone;
- The preference for the rural areas;
- The development of the trunk and international networks.

The realization of these targets will be achieved in the first case by:

- The increase of the number of connection circuits and automation and development of the trunk and international traffic;
- The digitization of the network;
- Telephone installation in new residential areas in the cities and in rural areas;
- The introduction, on a broad scale, of data transmission and other new services.

Aiming at the improvement of the existing disastrous situation, we are undertaking a number of immediate and some long-term actions. We consider the liquidation of the waiting list and the provision of high-quality services as quickly as possible to be a target of particular importance.

The existing 12-year average waiting time for the installation of a new telephone should be reduced to about 12 months in 1992 and to about 2 weeks maximum by 2000; the quality of night service shall also be assured.

A more strategic aim our projects is the establishment of a state-of-the-art telecommunications network in the form of ISDN, by means of digitization of the switching and transmission systems and terminal equipment.

#### 3.2. Immediate Actions

The immediate actions will concern in the first case the telephone network. The primary goals of these actions will be the following:

- The improvement of local telecommunications in Warsaw.

- The purchase, installation and putting into operation of: (1) the already mentioned special international exchange in Warsaw serving, under special conditions, a selected group of privileged subscribers in other cities; (2) of the submarine fiber-optic cable Bornholm-Koszalin (realized as a joint-venture with the Danish PTT administration and with the PTTs of other Scandinavian countries); (3) a digital microwave radio-relay link between Koszalin and Warsaw as an extension of the link From Denmark to Warsaw; (4) the already mentioned packet switching data transmission network Polpak; (5) the big modern digital electronic international exchange in Warsaw and a similar international exchange and a new trunk exchange in Katowice; (6) eight digital transit exchanges in the local network in Warsaw; and (7) a cellular mobile radiocommunications network covering, in the first stage of development, Warsaw, then several principal cities in Poland and the interconnecting routes between them, and, finally, the whole of Poland. The last undertaking will be the first large-scale undertaking concerning the development of a telecommunications network in Poland realized with substantial participation of foreign capital.

- The demonopolization of the telecommunications services in Poland.

- The legal and organizational preparation of activities in the field of telecommunications under conditions of demonopolization.

- The cancellation of the official (imposed by the government) prices for telecommunications services.

Because of the urgent need for evaluation of our assumptions concerning the future development of the telecommunications network in Poland, a feasibility study will be prepared. It will be realized within the framework of the assistance of the United States Government according to the Grant Agreement between that Government and the Government of Poland signed recently in Warsaw.

In any case, the development of the domestic production of digital electronic telephone exchanges is already considered indispensable and the most effective realization of this task will require cooperation with the most experienced foreign manufacturers of that kind of equipment.

Currently well advanced are the discussions and preparatory works on cooperation in the manufacture of following exchange systems, two of which have been finalized:

- Modernized E-10 between CIT-Alcatel (France) and Teletra (Poznan),
- EWSD between Siemens (FRG) and ZWUT (Warsaw),

The cooperation plans also include the manufacture of state-of-the-art transmission equipment.

In regard to organisational changes, the modification of the legal regulations should be oriented toward demopolisation of the telecommunications services; the appropriate structural changes will be realized.

Appropriate conditions will be created for development of mobile communications in the frequency band about 450 MHz, allocated for the cellular communications network, the establishment of which should start shortly after settlement of the international request for bids.

### 3.3. Long-Term Actions

The immediate actions were designed mainly to improve the quality of services and to prepare the telecommunications network for the revolutionary acceleration of its development.

The participation of entities other than the PTT, including the private sector, will also be possible on the basis of new telecommunications legislation pending in the Parliament.

We consider also as very important the proper preparation of the technical staff for the installation and operation of modern switching and transmission equipment. It requires well-equipped laboratories and modern teaching aids in the schools and qualified teaching personnel. In the teaching process, most up-to-date teaching methods well-tested in the highly developed countries should be implemented.

The project organizations will realize services preparing the plans of new telecommunications undertakings based on computer-aided design methods including the computerized methods of preparation of the geodesic base.

These tasks also include the implementation of computer-aided methods of radio frequency management, particularly important, taking into account the perspectives of privatisation of some part of audiobroadcasting and TV transmitter networks and the development of cellular mobile radio networks.

The realization of the program will require undertaking a number of scientific research and construction projects in connection with software and hardware adaptation to the local situation, social measurement apparatus, and modern network management and traffic control methods.

## 4. Conclusions

The realization of the immediate and long-term undertakings should result in the achievement, by the year 2000, of about 10 to 12 million telephone subscribers and a telephone density of about 30 subscribers per 100 inhabitants.

In the data transmission network the total number of terminals (various types) should exceed 100,000. At least part of them should be connected to ISDN "islands"

which should be established in the most important business and administrative centres in Poland.

The development of electronic mail has already started and the systems will be in the future transformed into a real videotex system with similar functions as the French Minitel giving its subscribers access to various data banks.

The number of subscribers to cellular communications networks should also exceed 100,000.

The introduction of many other new telecommunications services such as the 800 service (sale by telephone) or even the videoconference service should also be taken into account.

There is, however, one important condition for realizing these ambitious plans. To achieve the planned telephone subscriber number, about \$12 to 15 billion in capital investment will be needed. The pending new telecommunications law will open the way for all national foreign investors to participate in the development of Polish telecommunications on very favourable terms. But the problem is to find the investors willing to participate in the realization of this enormous task.

### Service, Network Objectives in Czechoslovakia

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[Paper by Miroslav Antonu, director of telecommunications at the Czechoslovak Federal Ministry of Post and Telecommunications]

[Text] The purpose of this paper is to report on the basic approach that the Czech and Slovak Federative Republic (CSFR) is adopting in establishing a telecommunications infrastructure that meets the preliminary conditions for Czechoslovakia's joining the European Community countries.

One of the basic steps in the presently much discussed scenario of economic reform belong is, most of all, the change in proprietary relations, which should diminish the role and influence of the state and lead to privatizations, liberalization of the market, reconstitution of the present structures of manufacturing and services companies primarily in the form of stock companies or companies with limited availability [as published]—including those with participation of foreign capital—and to the transition to the domestic convertibility of the Czech crown. These trends will be supported by appropriate legislative provisions with the aim of creating, as of 1991, adequate prerequisites for the realization of a market economy. It will not be an easy process because Czechoslovakia has for 40 years been under the influence of a rigid centralized control applied to society as well as to the national economy.

### Present State

Our telecommunications provide a poor standard of service. According to the conclusions of an evaluation made by a World Bank mission which visited Czechoslovakia this summer, the extent of telecommunications services is larger than in the neighboring countries of Eastern Europe. However, they still do not manage to meet the demand of society. We permanently fail to satisfy 400,000 applicants for telephones. There is a serious lag in the technical level of telecommunications equipment as well as in installed capacities. Networks are underrated and worn out, expensive to maintain, difficult to expand, and do not lend themselves readily to adaptation to new telecommunications services.

Full automation of the public switched telephone network is not yet completed. We do not satisfy more than one-third of applicants for the data transmission service. The signal for the second TV channel covers only about 77 percent of the country's territory. That generates a permanent tension which has a negative impact upon the quality of provided services.

The Czechoslovak basic telecommunications network is an analogue network. Approximately 50 percent of public exchanges are of the step-by-step selector type, 47 percent are crossbar exchanges, and 3 percent are stored program control (SPC) exchanges.

The penetration of digital transmission techniques and optoelectronics is slow. The most extensive service is the telephone, reaching about 4 million sets, of which 2.2 million are main telephone sets so that the telephone density is about 14.25 telephone sets per 100 inhabitants. The percentage of residential telephones (flats with a telephone) exceeds 27 percent. The telex network is stunted, its density is only 7.5 receivers per 10,000 inhabitants. Since 1988, the facsimile services telefax and bureaufax (in the CSFR "POSTFAX") are provided. We have no public data network and no public radio-telephone network.

The Czechoslovak PTT Administration procures the propagation of the signals from the Czechoslovak State of Broadcasting and Television. The quality of radio-communications services does not yet meet society's needs, neither by coverage of the country's territory with a stereophonic broadcasting signal, nor by the number of programmes of Czechoslovak Television propagated via the terrestrial TV network (three TV programmes and five broadcasting programmes [sic]). Additional radio-communications services (teletext, two accompanying sound channels) are propagated only locally. Paging is not yet used. Cable television systems (CATV) are negligible in extent.

In the fixed satellite services the Czechoslovak radio-communications administration secures operation within the international organization Interkosmos via the Stationare 4 satellite above the Atlantic and Stationare 13 in the Indochinese zone.

The development of telecommunications has been distorted by two relevant facts:

- It was based upon the allocation of very small investment resources (about 1.6 percent of the overall volume of investments flowing into national economy) rather than upon objective needs. The dislocation of investments gave very little consideration to the need to secure a sufficient rate of profit as a prerequisite for development continuity.
- The loss of technical and technological contacts with advanced countries. The background to this loss can be seen in the embargo on deliveries from advanced countries. Under these conditions, the development of the technological base was limited to the deliveries from the domestic electrotechnical industry and to imports from Eastern European countries whose technical level was considerably lower than the West European standard.

### Plans for the Future

The development objectives for the period up to the year 2000 in the new environment of a market economy will be focused on the removal of both distortions mentioned above and to securing the technological and service-oriented concatenation of the Czechoslovak telecommunications network to pan-European processes. As to short-term objectives, it will be necessary to establish basic technological structures ensuring transparency of the Czechoslovak telecommunications network for international terminal and transit traffic. These structures will, on the one hand, be sources for profit for further development and, on the other, a necessary prerequisite for reaching further goals.

In this framework:

- a. We shall secure correspondence with the most important telecommunications services in current use and—as of 1993—with those which are envisaged in Europe and in the rest of the world for the domain of business and industry. The European and global correspondence with the services provided will be, on the one hand, a source for further profit and, on the other, eliminate surplus costs which would arise at network interfaces by changes in media or protocols;
- b. We shall establish the basic structures, meeting the needs of information interchange for the newly arising entrepreneurial atmosphere. This part of the structure will bring in profits to be used for further network development, play the role of a catalyzer in the transition to a market economy, and forestall the build-up of private networks which would cause a loss of the most important subscribers as well as financial losses;
- c. We shall eliminate the most critical operational insufficiencies of the network, most of all the low connectivity and poor communication quality;

d. We shall make modifications to basic laws and legal provisions in the domain of telecommunications in the spirit of Europe-wide deregulation trends and tariff rules and promote the psychological preparation of the public for these changes (see "Green Paper");

c. We shall bring about structural changes in the PTT sector as a precondition for the necessary economic manoeuvres and the corresponding training of management staff and personnel;

f. We shall implement investment activities to an extent securing a full self-financing of telecommunications development according to society-wide needs in the current and generally valid economic environment;

g. We shall master basic knowledge in projecting, installation, operation, and management of new technologies and services.

The fulfillment of these short-term objectives, which can be attained in a period of about 2 to 3 years, will require structural funding (hard currency versus domestic currency) and, to an extent, will for an interim period be unrecoverable by the profit from the existing network. In the transition period of fulfillment of short-term objectives, we believe that it is necessary to provide, on the one hand, financial aid, best of all in the form of foreign participation in telecommunications undertakings, and, on the other hand, a modification of basic economic parameters, e.g., the abolishment of rigid deliveries into the State budget. The foreign participation will also guarantee the transfer of know-how.

Long-term objectives are:

a. Country-wide coverage of the territory by basic telecommunications services with "European" parameters of quality, availability, and price;

b. Country-wide digitization of the telecommunications network, ISDN backbone, and broadband communications, in particular:

—The build-up of the interurban network of optical monomode fibre cables, especially in industrial centres and metropolitan agglomerations with the provision of detour routes (optical ring structure);

—The build-up of local networks on a digital basis;

—The build-up of digital exchanges with ISDN functions in all large towns, cities, and industrial centres;

—The introduction of IN (Intelligent Network) functions into all digital transit exchanges;

—The build-up of the public digital cellular mobile telephone network according to the GSM [Special Mobile Group] standard and the build-up of the personal communications network (PCN);

c. The country-wide proliferation of mobile communications in compliance with pan-European standards, including personal communications;

d. A full transition to the European regulatory policy and competitive entrepreneurial environment in telecommunications with such an economic firmness of PTT organizations as to guarantee their survival.

The development of telecommunications in this second period will be primarily determined by the requirements for the services provided and technology will become a natural means of attaining objectives.

#### Survey of Specific Short-Term Objectives

Short-term objectives can be specified as follows:

a. Establishment of international digital centres in Prague and Bratislava;

b. Establishment of digital microwave routes and optical cables interconnected with the trans-European north-south and east-west optical highways;

c. Establishment of the packet switched public data network with a capacity of 2,000 ports in 1992, 8,000 ports in 1995, and 70,000 ports in 2000;

d. Introduction of the public videotex service;

e. Introduction of the paging service;

f. Introduction of the electronic mail service;

g. Establishment of digital tandem exchanges with basic subscriber capacities in Prague, Brno and Bratislava, especially for the entrepreneurial domain;

h. Extension of subscriber networks and local area networks in Prague, Brno, and Bratislava.

#### Development Strategies

For the period 1991-2000, two basic alternatives of development strategy are proposed which assume an essentially faster modernization and renewal most of all of the telecommunications network in comparison with the preceding periods and an accelerated introduction of new services. Alternative A is characterized by attaining a 71-percent integration rate of telephones in flats, with an additional requirement that 75 percent of the connection lines will be implemented in digital form; whereas alternative B aims at a 85-percent digitization of the network by 2000. Alternative B is given preference as it is economically more effective.

#### Romania Upgrades Communications Services

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[Paper prepared by Virgil Popescu, undersecretary of state of the Romanian Ministry of Communications, read by Emilia Dimitriu, chief of the International Relations Department of the Ministry of External Affairs]

[Text]

### 1. The Current Situation of the Telecommunications Networks and Services in Romania

The implementation of automatic telephone exchanges in Romania began at the end of the third decade of this century, more exactly in 1927 when the first Rotary 7A2 telephone exchange was installed in Bucharest with an initial capacity of 2,000 lines and an almost poor [sic] cable network.

The development of automatic telephony has continued by 7A2 and 7D Rotary switching equipment, while operator switchboards are being kept in operation in order to assure the necessary capacity to respond to increasing demands, also with regard to geographical distribution, while taking into account the poor technical possibilities to install new lines until the appearance of the first local supplies for telephone switching equipment.

Beginning with the year 1968, under Bell Telephone licence, the manufacturing of the automatic telephone exchanges from the Pentaconta family was begun, enabling local and trunk traffic automation.

By steady development the whole country was covered in 1990 by a telephone network consisting of three generations of different switching equipment and with the following numbers of subscribers and telephone sets:

- 2,321,868 subscribers, representing 9.85 percent of the total population;
- 2,903,312 telephone sets, representing 12.62 percent.

Of the total number of subscribers, 89 percent are operating on the automatic system, the rest are still linked to the manual switching system (by operator).

All Romanian towns and a number of villages are already connected to the national telephone network, but there are about 3,300 small villages which have no telephone lines at all.

The following public phone services are provided:

- 22,310 local coin telephone sets (i.e., 0.97 per 1,000 inhabitants);
- 6,993 trunk coin telephone sets (i.e., 0.3 per 1,000 inhabitants).

Sometimes, the coin sets for local and trunk communications, which are both operational, are used.

Actually, one of the main targets for national network upgrading consists of studies and the quick implementation of a new hierarchy in the numbering system, which is going to be implemented on 82 trunk exchanges that ensure links distribution in accordance with the traffic requirements. A uniform signaling system—R-2 analog—according to CCITT recommendation has been adopted for the whole country.

Domestic industry has developed the production of PABXs with a capacity of 1,000 lines.

Concerning telegraphy, there is a network with a 100-percent automation degree with a hierarchy based on zone, primary, and terminal distribution of the traffic using mainly TW-55 type equipment and for Bucharest, ELTEX and CROSSBAR type exchanges. The related network has 2,600 lines and 5,500 telex subscribers, and provides the telex, gentex, and point-to-point services.

The trunk connections use mainly the following transmission supports, all of them of the analog type:

- coaxial cables and related multiplex equipment up to 10,800 channels;
- balanced cables up to 120 channels;
- pupin [as published] loaded low-frequency cables for 12-channel systems;
- high-capacity analog microwave equipment up to 900 and 1,000 channels;
- low- and medium-capacity microwave systems: with 60-channel analog and also 30- and 120- channel digital equipment.

At present, international traffic is handled by an international telephone exchange of the Crossbar type with a capacity of 340 access points, implemented in 1974 using the CCITT codes No 4, No 5, and R2 for its operation.

The traffic volume is continuously increasing and in order to respond to these requirements, a new EWSD international gateway exchange with a 3,000-access-point capacity is to be installed by the end of this year. This is one of the major priorities of telecommunications upgrading since the revolution. The contract for this equipment was concluded with Siemens company of West Germany.

Briefly, the current network comprises 2.3 million analog lines (89 percent automatic). The population is 23 million with a national average penetration rate of 10 percent; urban, 15 percent; rural 2.5, percent; Bucharest, 30 percent.

Estimated network lines must increase to reach a normal European level, to eliminate a 10-year back order of 800,000 requests for telephone services (the actual waiting list from urban areas) and a foreseeable demand of more than 2.5 million lines to meet rural requirements and to replace the very old rotary exchanges.

To carry out this project and to assure the required service quality, the target is the implementation of 400,000 lines yearly, all digital equipment which is to be manufactured in Romania by a joint-venture with a foreign partner. Consequently, a PABX of up to 1,000 lines, local exchanges of 10,000-20,000 lines or even more, and also transit-trunk exchanges will be provided.

The achievement of a 50-percent telephony penetration rate is desired in the next 15-20 years.

As for radio broadcasting, this is operating on four programs scheduled nationally through the facilities of PTT administration both on long and medium-wave AM and FM.

The national TV broadcasting system consists of microwave links, TV transmitters, and TV relays by means of which the TV programs reach the users.

As of February 1990, this network is distributing two TV programs:

The first program is disseminated to the whole country, while the second one covers only 13 percent of the population. The area of the second program is to be extended steadily by installing new TV transmitters, microwave systems, and TV relays.

In accordance with the rights granted to Romania by the international frequency plans, the TV broadcasting network may be extended up to three national programs. For each national TV program are needed:

- 57 main TV transmitters with an output power of between 10 and 50 kW;
- about 900 TV relays with an output power of between 1 and 100 W;
- the related microwave links.

The number of radio subscribers exceeds 2.5 million and that of TV subscribers is about 3.8 million.

The Romanian PTT intends to open to privatization the following telecommunications sectors:

- cellular mobile radio;
- packet switching;
- cable television;
- radio and TV broadcasting;
- terminal equipment for value-added services.

A project of particular interest is the rapid establishment of a cellular mobile telephone network. Initially, cellular services are to be offered in major cities operating at 450 MHz.

Coverage will be expanded nationally in the future and the frequency switched to 900 MHz once the other services relinquish this band.

Romania's packet-switched data network, ROMPAK, will also be open to rapid upgrading. The studies are already made and 24 modes based on domestic technology have been installed, but the shortage of high-level technical equipment is a problem to be solved by cooperation with a foreign supplier.

## **2. Priorities and Plans Already Made To Bring the Network and Services up to a Higher Standard**

From the beginning of 1990, immediately after the revolution in December 1989, Romanian telecommunications faced a lot of major factors in its development and modernization.

In May, Romania joined both the Intelsat and Eutelsat organisations (on the basis of the applications submitted in February 1990); it is going to join Inmarsat in the near future.

Romania's two existing Intelsat earth stations are located in Cheia (15 and 11 years old). The addition of an Eutelsat earth station in the same site is planned for 1991, (the contract was concluded in August 1990 with the American suppliers STS and Hughes Network Systems and Japanese financing by Nissho Iwai).

Topping the list of priorities is the expansion in international switching capacity to be carried out by the end of this year by putting into operation a new digital EWSD-type international exchange already delivered by Siemens company.

The brief list of the main Romanian priorities is given below (any of these projects could be a subject of further discussion if necessary):

1. The electronic telephone exchanges—city, trunk, and rural type: The choosing of a new switching system for Romania (No 12, EWSD, E10B, AXE, etc.) and the local manufacturing of 400,000 channels/year on a joint-venture basis with the Electromagnetica plant.
2. Extension of television programmes: The delivery of television transmitters and antenna systems of 10, 20, and 40 kW power in the UHF band; joint-venture for manufacturing relays with 1, 10, 100 W in power.
3. Digital microwave links for phone communications (2, 8, 34, and 140 Megabit/s) in the 4, 6, 8, 11 GHz bands including guides and antenna; joint-venture for the production of this equipment in Romania.
4. Digital multiplex systems of high order 34 and 140 Mbit/s according to CCITT recommendations.
5. Fiber-optic cables for urban (multimode) and inter-urban (monomode) communications, too; joint-venture for making the cables with optical fibres.
6. The implementation of a high-speed packet-switched data transmission network.
7. Analog transmission systems in order to complete the existing trunk networks (primary group of 12-channel R2 system, secondary groups and blocks of 960 channels).
8. Transportable microwave systems for ensuring urgent communications (34 Mbit/s).
9. The billing system for telecommunications services and their adjustment to the electromechanical exchanges.
10. Implementation of the cellular mobile telephone network.

### 3. Foreseeable Opportunities for the Telecommunications Industry of Western Europe

Taking into account the large spectrum of the long-term projects mentioned, it is clear that there are many opportunities offered to the West European telecommunications industry for participation in Romania's telecommunications upgrading.

To outline, some of the most important projects could be:

- the cooperation, on a joint-venture basis, in the local manufacturing of the digital telephone exchanges (of medium and high capacity);
- digital microwave systems of 34- and 140-Mbit/s capacity;
- high-speed data transmission network,
- fiber-optic cable network for local (inter-exchanges) and trunk communications;
- mobile cellular radio-telephony;
- TV transmitters and TV relays;
- FM radio broadcasting equipment;
- cable television.

There are in Romanian industry some appropriate units able to participate in such production, but they are experienced only in the field of analog equipment.

In accordance with the principles recently promoted by Romania in view of the integration with the European economy, the Ministry of Communications has to overcome the lag in the field of telecommunications and has issued to this purpose a long-term program for network and services development giving particular attention to the coherent and well-harmonized upgrading of all integrated telecommunications branches.

Due to the keen national interest concerning this field of activity, the modern rules and regulations are expected to be applied so that a liberalization and a quick modernization can be implemented in the shortest possible period of time.

In this way, new Romanian investment law has established an initial framework attractive enough for foreign investors and assuring the conditions necessary for good cooperation between local and foreign partners.

The Ministry of Communications is authorized to elaborate the development strategy and specific rules and regulations; to coordinate all cooperation projects between local and foreign companies, and to encourage and supervise Romania's international relations in the field of posts and telecommunications.

The final purpose of the policy promoted by the Romanian Ministry of Communications is that of upgrading and steadily improving the telecommunications services quality, so that these services can meet the requirements of an up-to-date economy and be a component of a civilized level of life, becoming at the same time a large, open gate for Romania's integration with Western economy.

### Soviet Communications Projects Reviewed

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[Paper prepared by Erlen Pervyshin, Soviet minister of communications, read by P. Kurakov of the Ministry of Post and Telecommunications]

[Text]

#### Telecommunications in Eastern Europe—New Perspectives and Opportunities

The origin in Western Europe of the European Economic Community (EEC), currently comprising 12 countries (FRG, France, Italy, Belgium, Netherlands, Luxembourg, Great Britain, Denmark, Ireland, Greece, Portugal, and Spain) with a population of more than 300 million, points to a stable tendency in the economic development of both these countries and world economy as a whole. This is a tendency towards strengthening interdependency, maximum use of the advantages of international labour division, and extensive economic integration.

"Perestroika" currently taking place in the Soviet Union has its own roots and foundations, while, as a policy, it is closely and organically interconnected with the strategy of European economic integration. The transfer of the Soviet economy to a market-based footing enables a broad and effective cooperation with West European countries thus incorporating vast material resources into the general European processes. The agreement of December 1989 concluded by the Soviet Union and the EC on trade, commercial, and economic cooperation lays a constructive foundation for the development of relationships between the above countries.

The transition to a market-oriented economy entails a revision of the existing concepts of scientific, technical, cultural, and artistic development in the USSR; the same is true for the scientific, technical, and economic policies in posts and telecommunications.

The USSR Ministry of Posts and Telecommunications (MPT) is the biggest telecoms company in the world providing a full range of telecommunications and postal services, delivery of periodicals to the subscribers, transmission of TV and radio programmes.

The MPT has its own operational and scientific research organizations, industrial, commissioning-adjusting, construction, and installation enterprises. Thus, beside being an operator, the MPT carries out developments and mass production of a wide range of products including: communications equipment of all kinds of application, consumer electronics, general-purpose measuring instruments, radioelectronic medical equipment, computers, and special technological equipment.

The following figures testify to the scope of activities in the communications field in the Soviet Union: 92,000

enterprises and post offices provide communications services throughout the country, 8 billion letters and 55 billion copies of newspapers and magazines are delivered to the population per year, the number of telephone lines exceeds 40 million (ranking third in the world). The telecommunications system is operated today not only through a diversified network of ground lines, but also through 19 communications satellites and a wide network of earth stations of three types: "Orbita," including nearly 100 class "B" stations; "Moskva," around 3,000 stations; and "Ekran," amounting to 5,000 stations. Twenty-five national newspapers are distributed in 61 towns by electronic means. The Soviet Union participates in the activities of such international satcom organizations as "Intersputnik," "Inmarsat," and "Cospar-Sarsat" and it utilizes "Intelsat" and "Eutelsat."

Over 100 scientific research institutes and R&D bureaus conduct research and development work creating new means of communication. With a view to the early introduction of the results of fundamental research into industry, the MPT closely cooperates with the institutes of the USSR Academy of Sciences and with higher educational establishments through joint laboratories and agreed plans.

The industrial part of telecommunications mainly consists of assembly facilities producing finished end-products. Besides, there are specialized enterprises manufacturing OEM products, special materials, units, assemblies, and technological equipment. The annual growth rate of communication aids production is about 20 percent.

The MPT has six higher educational establishments to train specialists for operation, development, and production in all areas of modern communications technology.

At present, the USSR is living through a process of rapid informatization of society. This process aims to eliminate the mismatch of economic management and gives broad strata of the population access to data and knowledge bases and enables them to actively participate in international information exchange.

Recently, the MPT has elaborated and submitted for consideration of the Supreme Soviet and the Governments of the USSR a draft national programme of telecommunications development. The programme covers a period of 10 years, i.e., up to the year 2000, and provides for a swift growth rate of the telecommunications infrastructure development as a technical basis for informatization of society. The programme specifies the main areas in which scientific and industrial efforts should be concentrated to reach the objectives. They are:

- Extension of the public telephone network bringing the network density (the number of telephones per 100 families) up from 30 in 1990 to 48 by 1995 and to 86-90 by the year 2000, which would require equipment for 70 million lines to be manufactured and installed;

- Expanded coverage of the country's territory by television and stereo radio broadcasting, with national TV programmes to be received throughout the country; creation of conditions for TV and radio broadcasting in each republic;
- Development of the mobile radiocommunications network compatible with the Pan-European cellular mobile radiocommunications system, whereby the number of mobile telephones would reach 3 million by 2000 to cover practically the whole country;
- Establishment of commercial satcom systems, TV and Radio broadcasting services, and an environmental monitoring service using various types of spacecraft, including big unified space platforms put into orbit by superpowerful "Energiya" launchers;
- Construction of fiber-optic telecommunications links, including the Trans-Soviet line which would become part of the global loop of digital fiber-optic lines.

The programme implementation calls for a great deal of investments and production capacities.

The orientation of major technical projects integrated into the national programme of communications development makes advisable a wide-scale international cooperation in the organization of mass production of communications and data processing equipment. Thus, favorable conditions exist for joint ventures, investments in the Soviet economy, and development of other forms of cooperation.

Allow me to dwell in more detail on the contents and scales of some major communications projects in my country. We have begun to carry out a programme of telephone provision which sets the target of 100 million telephones in this country by 2000, i.e., one telephone for each family.

Only the 60 million new telephones to be installed and the 20 million additional lines to come into operation to replace technologically and physically obsolete exchanges—this should be done by the year 2000 according to the plan—would require heavy investments. The production capacity to manufacture around 25 million lines in 1991-95 and another 55 million in 1996-2000 will also be needed. Obviously, this task is hard enough for any country to solve.

To fulfill the task, a great number of scientists and production engineers have been involved, not only from the MPT but also from the USSR Academy of Sciences, other ministries, and higher schools. An important role is assigned here to enterprises undergoing conversion.

The issue of developing new switching systems has top priority under the national programme of telephone provision. At present, crossbar and electronic exchanges are used in the networks, a unified switching system is being developed.

The necessity to drastically increase the telephone line capacity, the uneven density of the country's telephone network, and the national geographical features have been considered when developing a new- technology digital electronic exchange named ESS-DSN.

The new switching system enabled a new approach toward the design of the DN-32 telephone network, which is a 32 Kbit/s digital homogeneous network.

The network is supposed to offer all the modern services of digital telecommunications services, such as digital data transmission channels, interfacing personal computers, telefax, and other digital terminals. The new exchange is more cost-effective than the existing ones and spares a great deal of subscriber cable; it is also compatible with all types of switching centres. The ESS-DSN exchange is designed for operation in areas with low telephone density, primarily where economic factors (cost per line) count for much. A transmission rate of 64 Kbit/s is possible through combining two channels.

Presently, the preparation of CCITT draft recommendations is under way for DN-32-based national networks and their interfacing with international networks.

The mobile radiocommunications system is to contribute to the solution of the telephone provision issue. We build up this system with due account of the uneven distribution of the population across the country as well as economic factors. Obviously, this system could be established completely in the 1.7-2 GHz range.

The development programme for a public radiocommunications system stipulates bringing the total number of radiotelephones up to 3 million by the year 2000.

The conversion in rocket and space technology and the orientation to new achievements in space engineering make it possible to develop commercial satcom systems based on heavy-weight unified space platforms which are put into geostationary orbit by the "Energiya" launcher.

A comprehensive approach towards the issues and the possibility of using heavy payloads and significant on-board power supply enable a considerable expansion of existing satellite communications, specifically the development of direct TV broadcasting, creation of a high-quality direct stereo radio broadcasting system, further extension of the telephone network, and the use of satellite communications channels instead of building up extensive trunk circuits in taiga and tundra areas.

The use of such platforms will make possible the application of multibeam antennas with narrow, electronically controlled patterns, on-board signal processing repeaters, the establishment of some 1.5 million digital simplex trunk circuits (64 Kbit/s), and about 1 million satcom points in remote and sparsely populated areas. "Molniya"-type man-made satellites placed in high elliptical orbit are available to provide communications services to the Extreme North Region.

Heavy-weight platform-based comsats will enable an early introduction of high-definition TV (HDTV), currently being developed by our specialists. At the initial stage, the system will be used for the general public view of TV films and afterwards for individual use.

A pilot space platform is scheduled to be launched in 1993.

The scope of work aimed at setting up a commercial satellite system creates good opportunities for scientific-technical cooperation with many companies and organizations from abroad.

The USSR telecoms administration pays much attention to international cooperation both in the traditional international exchange and in the establishment of joint ventures for rendering communications services and manufacture of communications equipment.

The Trans-Soviet fiber-optic-line telecommunications project (TSL project) is an example of intensive international cooperation.

The parties to the project are: the USSR MPT, U.S. West (USA), British Telecom (UK), Telecom Denmark and GNTC (Denmark), Bundespost (FRG), STET (Italy), KDD (Japan), OTC (Australia), France Telecom (France), and KTA (Republic of Korea).

The membership will hopefully extend in the future.

TSL will cross the USSR from the western to the eastern borders of the country to link up Western Europe with Japan, the Pacific countries, and Australia. The Soviet segment alone will extend over 14,000 km whereas the total TSL length will exceed 18,000 km. The transmission rate will be 565 Mbit/s; the wavelength, 1.55 microns; the international part's telephone capacity, 8,000 circuits; the repeater spacing, 100 km; and the lifetime, 25 years. At present, a consortium on building up TSL is being formed. This will really be the project of the century.

However, the participation by our foreign partners in the project implementation has been brought into question for lack of a COCOM decision permitting equipment supplies for TSL. The absence of permission from the COCOM will have no influence on our decision to construct TSL, although it may cause delays in its accomplishment. Therefore, we consider we should intensify our activities still hoping for a positive decision from the COCOM.

TSL implementation would allow the world community to set up a global communications loop transiting three continents and three oceans.

According to foreign experts, TSL is a major international project at the close of the 20th century. It is of great political, socio-economic, and technical importance for the world community. The accomplishment of TSL would contribute to the consolidation of peace and trust among the nations. We are well aware that time and effort will be needed for us to enter to the full extent into the system of trade and economic relations forming the essence of West European and world integration. Anyway, we believe that in telecommunications, this can be done soon enough.