


**BASIC DESIGN STUDY REPORT
ON
THE IMPROVEMENT PROJECT
OF
THE SATELLITE COMMUNICATIONS
IN
THE MONGOLIAN PEOPLE'S REPUBLIC**

June 1991

JAPAN INTERNATIONAL COOPERATION AGENCY

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JAPAN INTERNATIONAL COOPERATION AGENCY

International Cooperation Association
No. 22695
Tokyo, Japan



International Cooperation Association

PREFACE

In response to a request from the Government of the Mongolian People's Republic, the Government of Japan decided to conduct a basic design study on the Improvement Project of the Satellite Communications and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to the Mongolian People's Republic a study team headed by Mr. Takuo Kidokoro, Assistant Director, Grant Aid Division, Economic Cooperation Bureau, Ministry of Foreign Affairs, from 10th February to 4th March, 1991.

The team held discussions with the officials concerned of the Government of the Mongolian People's Republic, and conducted a field study at the study area. After the team returned to Japan, further studies were made. Then, a mission was sent to the Mongolian People's Republic in order to discuss a draft report and the present report was prepared.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

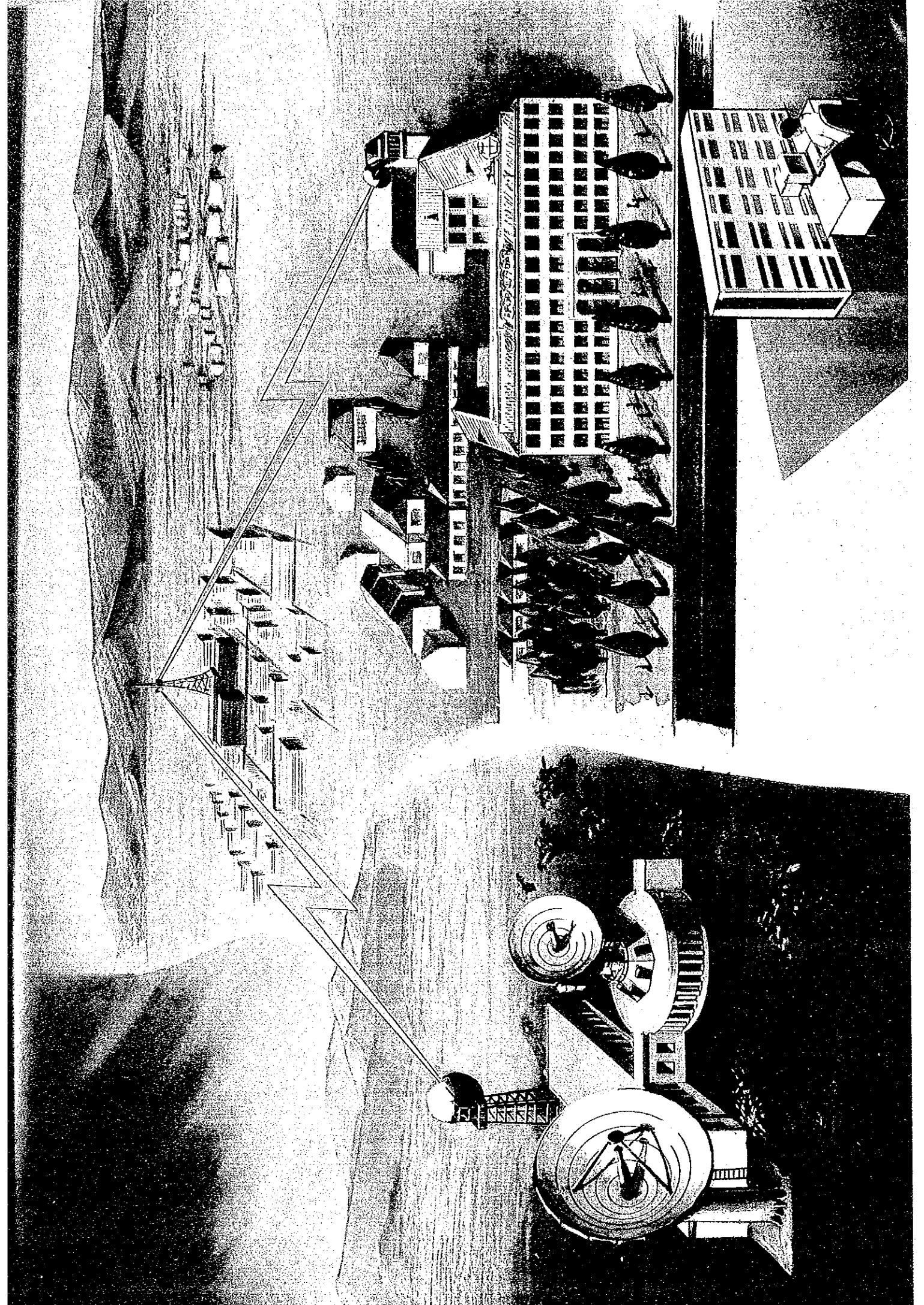
I wish to express my sincere appreciation to the officials concerned of the Government of the Mongolian People's Republic for their close cooperation extended to the teams.

June 1991

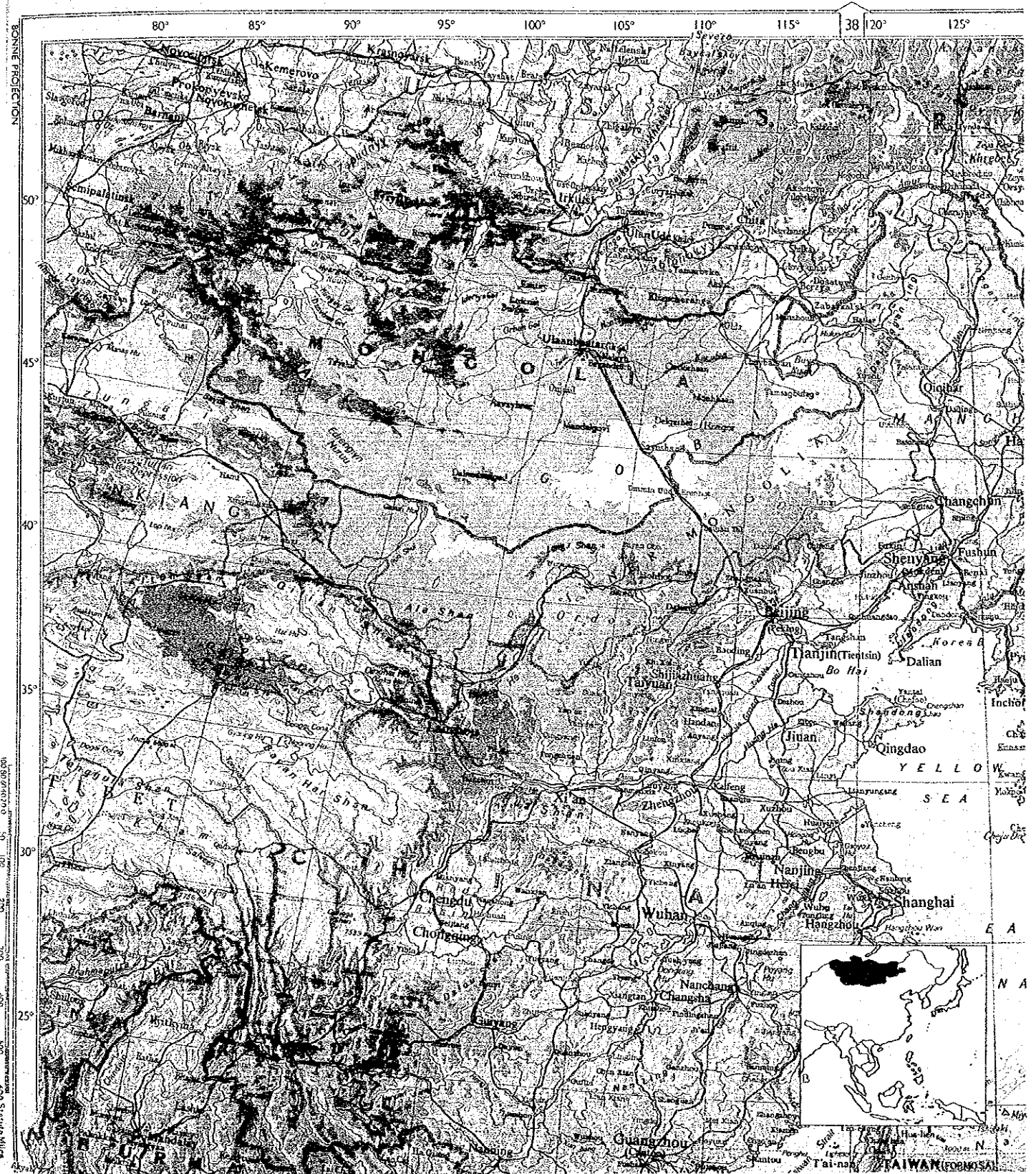


Kensuke Yanagiya
President

Japan International Cooperation Agency

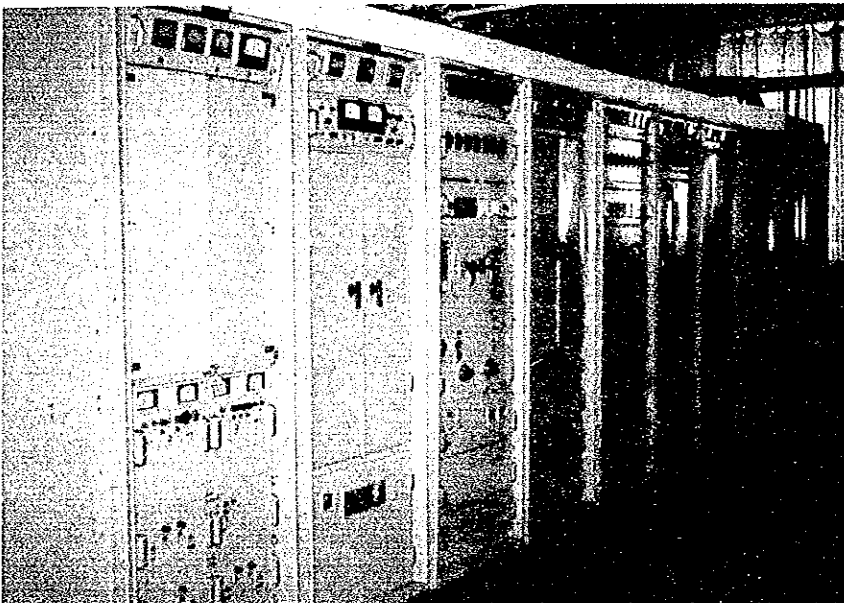


The Mongolian People's Republic

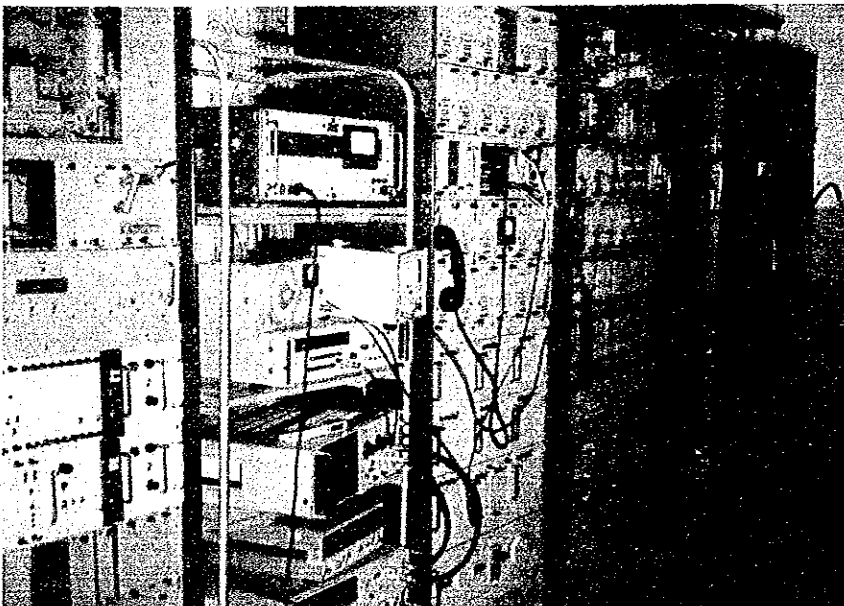




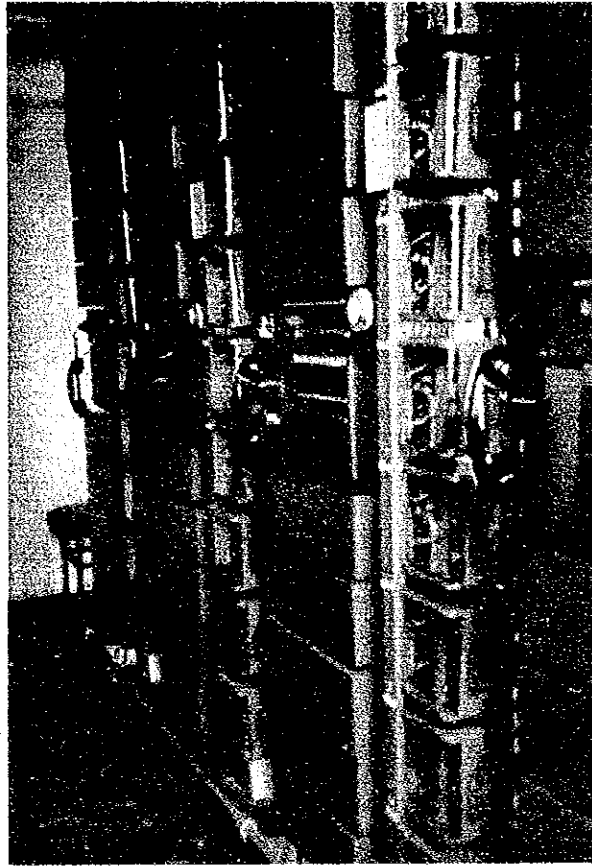
Site for the INTELSAT earth station



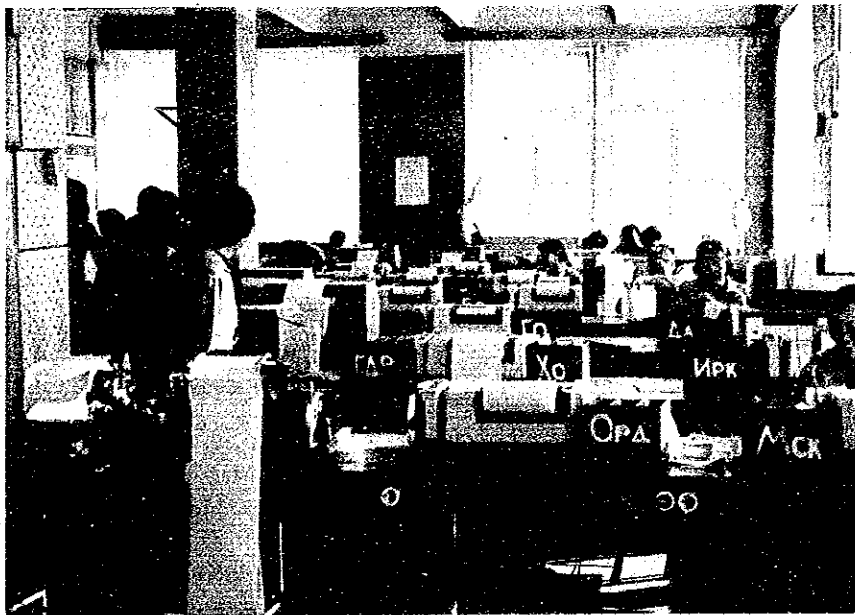
INTERSPUTNIK earth station
High Power Amplifiers



INTERSPUTNIK earth station
Ground Communication Equipment



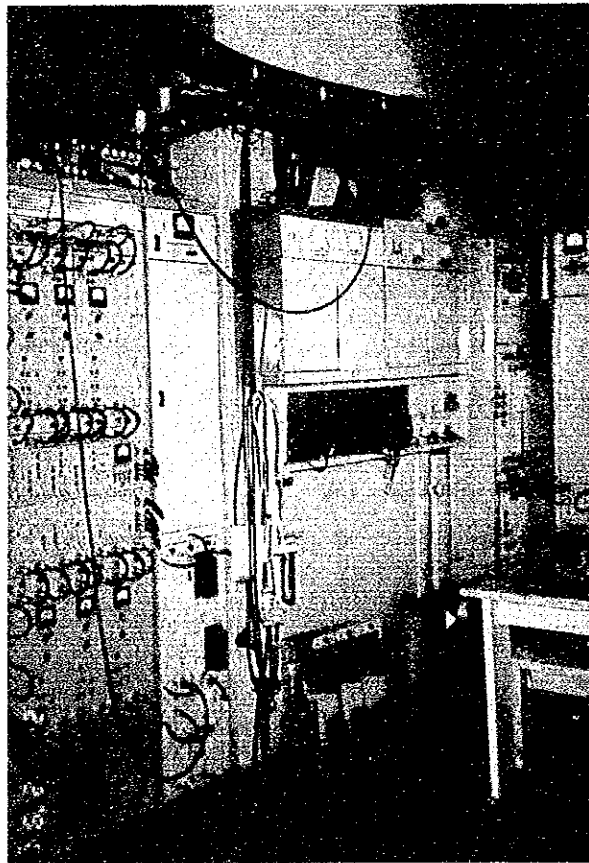
International/National Telephone Exchange



Telegraph Operation Room



Telephone Operation Room



TV Center
Analog Microwave Transmission Equipment

SUMMARY

SUMMARY

The Mongolian People's Republic is a landlocked country which borders on the Union of Soviet Socialist Republics (USSR) on the north, and the People's Republic of China on its south, east, and west. The country's territory is 1.56 million sq.km, four times as large as the size of Japan, and its population is about 2.09 million.

Since Mongolia obtained independence in 1921, its national economy has been developed under the great influence and economic cooperation by the USSR. The results of the 7th Five-Year National Development Plan, which started in 1981, with the goals of improving labor productivity, promotion of science and technology, and enhancement of the national standard of living, produced 6.3% growth in national income, 7% in agricultural total production, and 8.9% in industrial total production. In the current 8th Five-Year National Development Plan, which commenced in 1986, the objectives of the five years' achievement are a 28.8% increase in national income, a 20% increase in agricultural total production, and a 33.7% increase in industrial total production. However, the country's economy is still based mainly on agricultural production by means of traditional ways of farming and cattle-breeding.

Mongolia is a landlocked country with no harbor for trade. Accordingly, the improvement and expansion of overland transportation and communication is placed as the key policy of the country to promote socioeconomic development and to expand foreign trade and interchange. It is also the key factor of the Five-Year National Development Plan.

The administration of the country's telecommunications services, together with broadcasting and mail service, had been under the Ministry of Telecommunications. However, in accordance with the reorganization of the national system in October of 1990, it was also reorganized into a public corporation named the Mongolian Telecommunications Authority or MTA, on the basis of the old system. Since then the authority has managed all of the Mongolian telecommunications activities. Their income was 23,000 million Tugriks and expenditures were 14,000 Tugriks in 1989, representing a successful achievement (One Tugrik is equivalent to about 25 yen with the public exchange rate as of February 1991.).

The country's international telephone networks are composed of 4 circuits through INTERSPUTNIK, 4 circuits through microwave link and 9 circuits through cables with the USSR, and 3 circuits through open wire with Beijing.

In other words, the country's direct destinations are only the USSR and China; international telecommunications for other destinations are carried

through Moscow. International telecommunications via Moscow, where facilities are deteriorating with age, are operated through manual switching by operators and it sometimes takes 3 to 4 hours for a connection. Therefore, such degraded circuits now becomes a bottle neck to the social and economical development and international communication of the country. In terms of international traffic in the past, that with the USSR accounted for about 95% of the total. Along with the economic market shifts toward Western countries, the weight of traffic demand with Western countries is increasing. However, telecommunications via the USSR, for which a long queuing time is needed before connection, prevents speedy communication. To overcome this inconvenience, the MTA has opened 2 telephone circuits through the AsiaSat with Hong Kong.

Most of all telecommunication facilities and equipment are now aged exceedingly because they were built by the USSR ten to twenty year ago. It is difficult to procure the units and parts for extension and repair, as well as to obtain instruments and materials for maintenance.

In light of the above, the Government of the Mongolian People's Republic has projected a new plan for the improvement and expansion of the international telecommunications system with Western countries by means of direct circuits through the INTELSAT satellite, and has requested of the Government of Japan for a Grant Aid.

To respond to the request, the Government of Japan decided to pre-study the feasibility and scope of the cooperation. The study was performed by the Japan International Cooperation Agency (JICA) in September of 1990, and the necessity of improvement in the international telecommunications by means of the INTELSAT earth station was affirmed. As a result, the JICA also made a Basic Design Study from February 10 to March 4, in 1991.

The items requested of the Government of Japan are as follows: construction of an INTELSAT New Standard A earth station, installation of electronic switching system for both international and national transit, and digital transmission link to relay between the earth station and the Ulan Bator telephone office.

The INTELSAT earth station is essential for establishing reliable direct circuit with Western countries through the INTELSAT. In addition, it enables reception of international television program.

Because the current exchange used in international telecommunications are also aged, connections are still performed by manual operation and are not able to meet requirements for automatic dialing and new services. The introduction of new electronic exchange for both international and national transit will

improve traffic quality and service grade and meet the requirement for new services.

The digital transmission link between the earth station and the Ulan Bator telephone office will be realized by means of a digital microwave link. This will also serve to improve circuit quality in its relay route.

The survey of Study Team on the sites and the discussions with the Government of Mongolia reveals that Mongolia's international telecommunication facilities and equipment are even older than expected. The improvement of facilities and/or equipment and the implementation of direct circuits with Western countries are considered as an urgent necessity. The scope of the project discussed and negotiated was that the project will consist of the construction of an INTELSAT New Standard A earth station, the installation of an electronic exchange for both international and national transit, and the construction of a digital microwave link between the earth station and telephone office. The team also surveyed the projective site and visited relevant facilities to gather the information and data necessary for the Basic Design.

After returning to Japan, the team worked on the results of field survey to examine the feasibility of the Project, the scale of the Project, and the basic design of equipment, implementation schedule and estimation of Project cost. The results were compiled as the Draft Final Report.

The Japan International Cooperation Agency (JICA) sent a team to Mongolia to explain to the Government the results of a survey and the Draft Final Report on the Project from May 20 to 28, 1991, and the present report was prepared based on the results of the discussions.

The outline of facilities and equipment to be introduced in the Project are as follows, and the Project will be divided into two periods as described below.

First period	Construction of the INTELSAT New Standard A earth station
--------------	---

Second period	Installation of an electronic exchange for both international and national transit. Construction of a digital microwave transmission link to relay between the earth station and the Ulan Bator telephone office.
---------------	--

The service is assumed to be commenced in 1993. Assuming the first expansion is done five year later than the commencement, the initial capacity should meet the increase in traffic up to 1998. The destinations of the direct circuits through the INTELSAT are to be England and Japan. To other

destinations, the traffic is communicated via these two countries, except for the USSR and China, which are communicated through the conventional circuits.

The first construction includes:

INTELSAT New Standard A earth station:

Antenna system	one set
Ground Communication Equipment	one set
Monitoring system	one set
Power supply system	one set
Measuring instruments for maintenance	one set
Repair parts and consumable parts	one set

The second construction covers:

Electronic exchange system for international and national transit

Exchange system	one set
Switchboard	one set
Power supply	one set
Measuring instruments for maintenance	one set
Repair parts and consumable parts	one set

Digital transmission link

Antenna system	one set
Radio equipment	one set
Digital multiplexed terminal equipment	one set
Voice frequency telegraph equipment	one set
Measuring instruments for maintenance	one set
Repair parts and consumable parts	one set

In the implementation, the MTA, which is under direct control by the Mongolian Government, will be concerned with the Project. The MTA is managed on a self-supporting basis, and all administrations and operations during construction and after completion are subject to them. Because the MTA has proved its competence to control skillfully the existing system, it is believable that they will be able to manage the new system as well. Since the INTELSAT earth station and exchange are to be built near the existing facilities, there is not a great need to increase operators and maintenance personnel. As the annual maintenance cost is estimated at about 4.2 million Tugrik, it is considered to be within the range of MTA's competence.

Because the MTA has no experience in the operation of the INTELSAT earth station and has little knowledge of digital communication technology at present, Technical Cooperation including international group training held by the JICA and the delegation of special engineers who are able to transfer operation and maintenance skill are considered desirable. With this Technical Cooperation, the Project will be effectively promoted.

The first period is broken down as follows; 3 months for consultation contract and detail design, 2 months for the work relating to tender, 8 months for fabrication of equipment, 4 months for transportation and installation, and 3 months for test on the site.

The second period consists of 9 months for the fabrication of equipment, 3.5 month for transportation and installation and 2.5 month for test on the site.

Total Project cost funded by Mongolia is estimated to be about 1.2 million Tugrik.

With implementation of this Project, the country's direct telecommunications with Western countries through the INTELSAT become possible; thus the international telecommunications of Mongolia are improved greatly in terms of efficiency and reliability. International telephone circuits will be increased to 111 circuits from the existing 20 circuits. This will solve the pending problem of circuit capacity. In addition, international traffic is connected automatically without telephone operators and the queuing time of 3 or 4 hours that was required in the past will be improved. This means that the international telecommunications will be greatly improved in quality and connectivity.

The Project is expected to greatly contribute to advancing the international telecommunications services of Mongolia, as well as to promoting diplomatic, economic and social development of the country. The Project is considered to be valuable if it is promoted by the Japan's Grant Aid.

**PREFACE
PERSPECTIVE
MAP
PHOTOGRAPHS
SUMMARY**

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ABBREVIATION LIST

---- A ----

ADPCM	Adaptive Differential PCM
AIR CON	Air Conditioner
ANT	Antenna
ASIASAT	Asia Satellite Telecommunications
AZ, Az	Azimuth Angles

---- B ----

BATT	Battery
------	---------

---- C ----

CCIR	International Radio Consultative Committee
CCITT	International Telegraph and Telephone Consultative Committee
CFDM/FM	Companded Frequency Division Multiplex Access/Frequency Modulation
CFM	Companded Frequency Modulation
CHILL	CCITT High Level Programming Language
COMB	Combiner
CONT	Controller

---- D ----

D/C	Down-Converter
DCME	Digital Circuit Multiplexing Equipment
D/D	Detail Design
DE-ICE	De-Icing
DEM	Demodulator
DISP	Display
DIV	Divider

---- E ----

E/C	Echo Cancellor
EL, El	Elevation Angles
E/N	Exchange of Notes
ESC	Engineering Service Circuit

---- F ----

FDMA	Frequency Division Multiple Access
FEED	Feeder
FET	Field Effect Transistor
FMTV	Frequency Modulation Television

---- G ----

GCE	Ground Communication Equipment
GL	Ground Level
GNP	Gross National Product
G/T	Gain to Noise Temperature Ratio

---- H ----

HF	High Frequency
HPA	High Power Amplifier

---- I ----

IBS	INTELSAT Business Service
ICT	Incoming Trunk
IDF	Intermediate Distributing Frame
IDR	Intermediate Data Rate
IESS	INTELSAT Earth Station Standard
IF	Intermediate Frequency
ICM	INTELSAT Intersystem Coordination Manual
INTELSAT	International Telecommunication Satellite Organization
INTERSPUTNIK	International Organization of Space Communications
INTS/TS	International Transit Switch/Tool Switch
IPL	Initial Program Loading

---- J ----

JICA	Japan International Cooperation Agency
------	--

---- L ----

L, LHCP Left Hand Circular Polarization
LNA Low Noise Amplifier
LRE Low Rate Encoding
LS Local Switch

---- M ----

MAS Multiple Access System
MDF Main Distributing Frame
MML Man-Machine Language
MOD Modulator
MODEM Modulator Demodulator
MON Monitor
MOT Ministry of Telecommunications
MTA Mongolian Telecommunications Authority
MUX Multiplex Demultiplex Equipment

---- O ----

OGT Outgoing Trunk
OJT On the Job Training
OW Order Wire

---- P ----

PAL Phase Alternation Line
PCM Pulse Code Modulation
PDB Power Distributing Board
PSK Phase Shift Keying

---- R ----

RF Radio Frequency
R, RHCP Right Hand Circular Polarization
RX Receive, Receiver

---- S ----

SCPC Single Channel Per Carrier
SD Sound Diplexer
SDL Specification and Description Language
SECAM Sequential Color Television System
SSPA Solid State Power Amplifier

---- T ----

TDM Time Division Multiplex System
TDMA Time Division Multiple Access
TEL, TP Telephone
TG Telegraph
TRACK Tracking
TS Toll Switch
TVRO Television Receive Only
TWT Traveling Wave Tube
TX Transmit, Transmitter

---- U ----

U/C Up-Converter
UPS Uninterruptible Power Supply

---- V ----

VDF Voice Frequency Distributing Frame
VDU Visual Display Unit
VFT Voice Frequency Telegraph
VRC Variable Ratio Combiner
VSAT Very Small Aperture Terminal

CHAPTER 1

INTRODUCTION

1 INTRODUCTION

In the Mongolian People's Republic, international telecommunications are divided into three categories: international telecommunications through the INTERSPUTNIK satellite, interterritorial telecommunications with the USSR through a microwave route, and interterritorial telecommunications with China through a cable route. In other words, the country has only two direct telecommunications routes with the USSR and China, and the traffic for other destinations are carried through the USSR. Thus, dependence of telecommunication on the USSR is unavoidable. Most traffic has been destined for the USSR and East European in the past. Along with the recent shifts to the market economy and approaches toward Western countries, traffic demand for international telecommunications with the Western World is increasing at a rapid pace. However the existing aged facilities cannot handle the increasing traffic, and cause deterioration of the service quality in international telecommunications.

As Mongolia is located in the middle of the Asian Continent and surrounded by the USSR and China, it is situated in a quite unfavorable location for trading with foreign countries. The Government of Mongolia has considered it quite important that the improvement and expansion of telecommunications with Western countries though the INTELSAT catch social and economic trends in the world for the economic future of the country.

In light of the above, the Government of Mongolia has positioned the international telecommunications improvement and expansion plan as one of the most important policies for its economic development plan and requested the Government of Japan for a Grant Aid for its implementation.

Responding to the request, the Government of Japan decided to investigate the feasibility of the Project and the scope of cooperation. The pre-study by the JICA was thus implemented in September of 1990.

As a result, the Government of Japan decided to carry out Basic Design on the satellite telecommunications project of Mongolia. Along those lines, the JICA delegated a study team headed by Mr. Takuo Kidokoro, Assistant Director, Grant Aid Division, Economic Cooperation Bureau, the Ministry of Foreign Affairs, from February 10 to March 4, 1991.

The team worked to study the background of the request and the feasibility and effects of the Project as the object of a Grant Aid, and discussed with the officials concerned with the Government of Mongolia in order to determine the scope and scale of the cooperation and to carry out a Basic Design. They also gathered necessary information and data and made a field survey on the construction site of the earth station facilities and of the international exchange as well as of the relevant facilities in the Project.

The minutes of the basic agreement reached through the discussions with the personnel from the Government of Mongolia were documented, and executed on February 16, 1991, with signatures from Mr. Kidokoro, the team head; Mr. B. Baatar, director of the MTA; and Ms. Nasanbuyan, assistant director of the Ministry of Trade and Industry.

After returning to Japan, the team compiled a report of Basic Design on the basis of the field survey. This included a feasibility study of the Project, the desirable form of the economic grant by the Government of Japan, the appropriate scale of the Basic Design, the operation and maintenance plan, and the appropriate project cost.

The JICA delegated a team headed by Mr. Yutaka Yokoi, Deputy Director, Grant Aid Division, Economic Cooperation Bureau, Ministry of Foreign Affairs to explain the Draft Final Report and to discuss the Project with the officials concerned with the Government of Mongolia from May 20 to 28, 1991.

The present report contains the results of the Basic Design made by the team. The members of the team, date of the field survey, list of gathered data, list of the parties concerned, and the Minutes of Discussions with the Government of the Mongolia are attached as reference in the appendix.

CHAPTER 2
BACKGROUND OF PROJECT

2 BACKGROUND OF PROJECT

2-1 Outlook of the Mongolian People's Republic

2-1-1 Territory and Population

(1) Territory

In the center of the Asian Continent, the Mongolian People's Republic is landlocked between China to the east and south and the Soviet Union to the north. It is over four times as large as Japan, with an area of 1.65 million square meters and a border length reaching 8,158 kilometers. Mongolia is located in a highland with an average elevation from sea level of 1,598 meters, from the lowest area by 560 meters to the highest area of the Altai Mountains by 4,374 meters.

Mongolia has geographical features full of mountain chains with virgin forests, huge lakes and rapid streams in the northern area, and the Gobi Desert and vast grasslands in the southern area. Particularly, the undulating vast steppe with pasture is the typical Mongolian landscape. Its weather is typical for the continental climate, with the winter lows hitting minus 49 degrees centigrade and the summer highs, 30 degrees Centigrade. The average temperature comes to minus 3.6 degrees centigrade. Fine weather days in the year number 220-260 days, with a long spell of fine and dry weather in the winter and a small amount of rain in the hot summer which is cooler in the nighttime.

(2) Population

Population is approximately 2.05 million as of the end of 1989, among which are about 550 thousand in the Capital of Ulan Bator. Main cities are Darhan, Choibalsan, Ulusa and Erdenet. The nation's population density is extremely as low as 1.31 persons per square kilometer.

The main ethnic group consists of a single Mongol race that speaks Mongolian and has common moral customs. Minorities are Cazakhstan in western Mongolia and Chinese in Ulan Bator.

The official language is Mongolian and in some parts Russian is popular; however, English is scarce. The popular religion is Buddhism and Lamanism.

2-1-2 Politics and Economy

(1) Politics

The nation's supreme authority is in the Congress of People's Deputies and administration organs are in the Cabinet Council. At the 19th Congress of 1988, basic policies were decided for new economic policy, intensified freedom of information, corporate autonomy and the introduction of an independent profit system, taking into consideration of the political changes of the Soviet Union, creatively adopting them into the nation. Following this decision, administrative reform took a place by unification of five executive organizations regarding the economy into the National Planned Economy Committee and the National Committee of Science, Technology and Education, with the aim of further economic development. Being active in the movement to democratize, the Government introduced a system of plural political parties as well as a much desired information medium to change its one-sided information.

Mongolia has improved its diplomatic relations with China in 1989 and forwarded steps toward positive diplomacy, reflecting its remarkable and swift movement approaching Western nations.

Since 1989 this positive diplomacy has become active particularly in frequent interchange with Western governmental high officials such as Japan's Foreign Minister, Sousuke Uno and U.S. Secretary of the Treasury, James Baker.

As a result, Mongolia signed and concluded a cultural convention with the U.S.A. and decided to promote education of the English language and accept resident students as well as dispatch experts to investigate mining resources. In 1972 Mongolia established diplomatic relations with Japan, organizing Embassies in both countries. Delegation of Diet members has been exchanging every other year, at the request of Mongolia, an air route between the two countries was opened in 1990, even though chartered-flights in the summer. This will be an epoch-making event, because the air route was used just via Moscow or Beijing.

(2) Economy

By the planned economy with five year intervals, the national economy has been operating within the framework of the National Development Plan. The followings are brief economic changes of the past 10 years.

The 7th five-year Plan, from 1981 through 1985, resulted in economic expansion with a 7% increase in Gross Domestic Product growth in the area of agriculture and stock farming, compared with its budget of 4.2%. There was also

an 8.9% increase against a budget of 8.9% in industrial GDP growth and in National Incomes, with increases of 6.3% and 7.1%, respectively.

In the 8th five-year Plan, from 1986 to 1990, a target was set at a 28.8% increase in National Income and a 20% growth in GDP for agriculture and stock farming, and at 33.7% for GDP growth during this period, and no announcement of its results has been made yet. However, according to the announcement made by The Central Statistics Bureau, the economic figures for 1989 indicated a 6.3% increase in National Income, compared with the previous year, and a 16.4% average increase in GDP growth in agriculture and stock farming, compared with the last term of 1981/1985. Industrial GDP growth increased by 6.9% and Per Capita Gross Income increased by 2.6%, compared with the previous year.

Exports from Mongolia are headed by raw materials (including unfinished products, wool, hides and furs), followed by meat (livestock, flesh and canned meat), mining minerals (copper ore, molybdenum and coal), lumber, and cement. Especially, mining resources are much expected to be a major export item, with a rich store of the reserves.

In the trade results for 1989, the Soviet Union were the country's largest counterparts, with over a 90% share of total export/import activity, following by Czechoslovakia, East Germany and China. Their annual trade balance is still in excess of imports.

Exports to Japan rank third, running after the Soviet and Czechoslovakia. Mongolia mainly exports Cashmere wool and furs, importing from Japan chemicals, machinery, and so on. Both in 1988 and 1989, Mongolia shared a trade surplus with Japan.

2-1-3 National Developing Plan

The National Developing Plan in Mongolia has long been administrated under the National Plan modeled by the Government after other Eastern countries. This plan sets up five-year targets, with evaluations made by ratio accomplished.

Since their principle of economic administration has been changed into the market economy from the planned economy by carrying out a series of political reforms, Mongolia is scheduled to abandon setting its five-year targets after this term of 1986 through 1990, and will adopt a rolling yearly plan.

As explained in the previous Chapter with regard to the recent results of the 8th Five-Year Plan, Mongolia changed its policy to support the stock farming industry, rather than attaching importance to industrialization, in order to

overcome the slackened industry, which is the country's mainstay industry. Consequently, the total number of cattles reached 24.6 million in 1989, a noteworthy outcome in these years. The Central Statistics Bureau analyzed that the promotion was effective in the system to contract cattle, and the expanded quota of livestock for private owners also helped its increase together with fine weather conditions.

The year 1989 was a year for starting series of economic reforms. The National Corporate Law was put in force in this year, establishing a rule that plant operation and management be controlled under the principle of an independent profit system. By this movement, the Co-operative Association Law was concluded for the purpose of covering a part of economic and social developments by private ventures. This allows them to operate freely in the formulation of a corporation as well as in its production, sales, price and service.

In addition to this, it is an urgent task to set up and consolidate the necessary measures regarding foreign trade such as transportation and international telecommunication, together with requests for more brisk activities for the adjustment of the related laws and ordinances, the active national system, and the self-reformation of private companies.

To reflect these movements, Mongolia progressed its work for the adjustment of the related laws and ordinances since the second half of 1990, and the People's Session passed a bill for the Custom Tariff Law, in effect from March 1, 1991, by which the export and import tariff rate was revised. The tariff rate for subsistence commodities is controlled at a lower level and those of its major export items such as furs and leather products, meat and mining minerals are also in the level between 10 to 20%, showing the aim to expand their exports.

A series of national policies based on free competition has shown good results in several fields; however, the nation's trade today has still been heavily dependent upon the Soviet Union. More time is needed to achieve the full effects of the introduced free economy by the political reforms.

2-2 Situation of Telecommunications

2-2-1 Administration and Activities on Telecommunications

The activities on telecommunications in the Mongolian People's Republic had been operated by the MOT (Ministry of Telecommunications) both for domestic and international communications; however, due to the administrative reform, the operation and management has been transferred to the present MTA (Mongolian Telecommunications Authority). However, the Ministry of Trade and

Industry still performs some administrative control with regard to telecommunications.

The MTA controls overall operation and management in relation to the operation of facilities, decision-making, financial and personnel management in the telecommunications and postal activities.

For the purpose of proceeding its telecommunication policy smoothly in long-range vision, the Authority also planned a Five-Year Plan for the development and modernization of their telecommunications, which has been lagging in service quality.

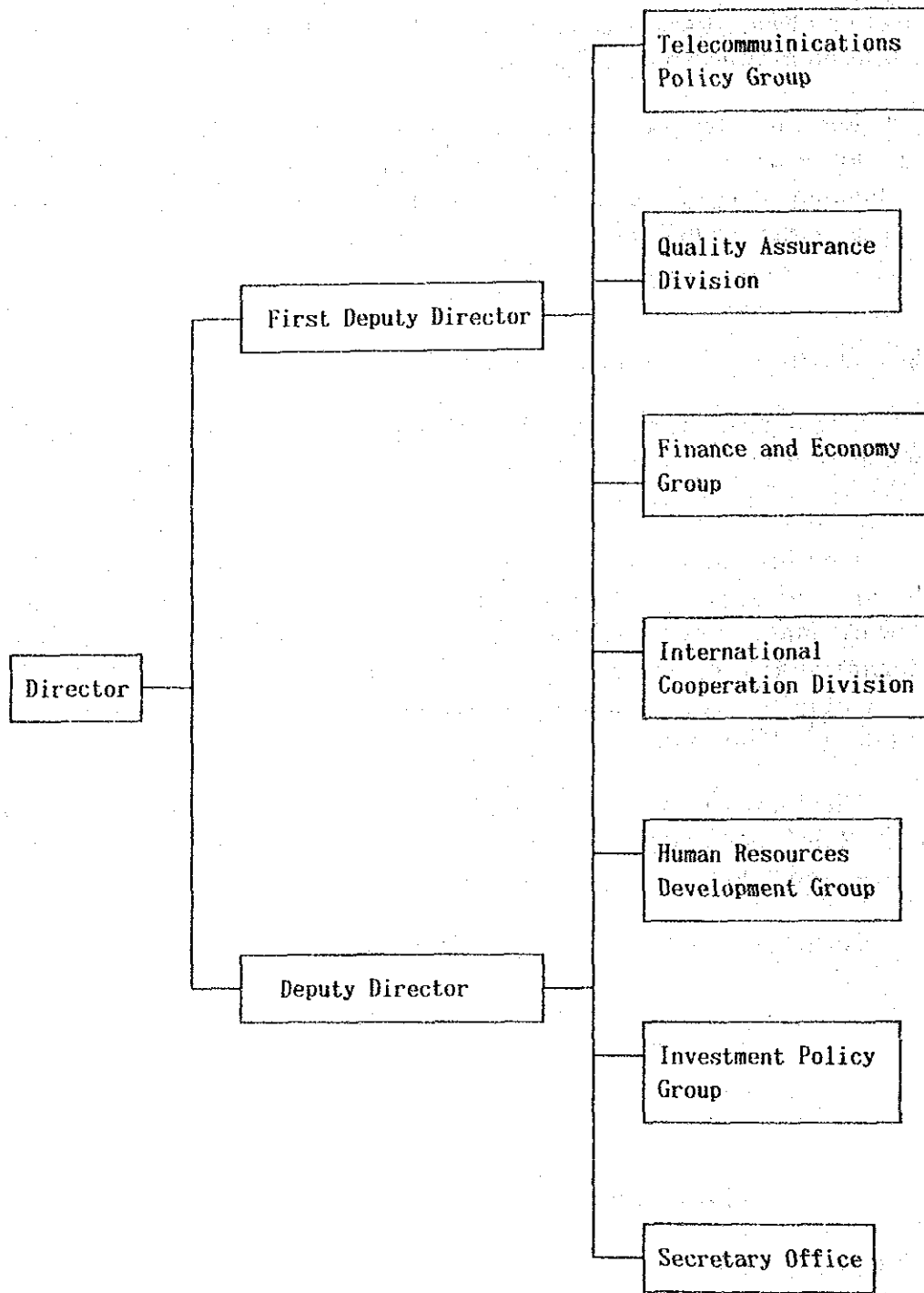
2-2-2 Outlook of System and Operation

The organization of the MTA (Mongolian Telecommunications Authority) consists of a headquarter supervised by a Director with supporting two Deputy Directors and its local offices.

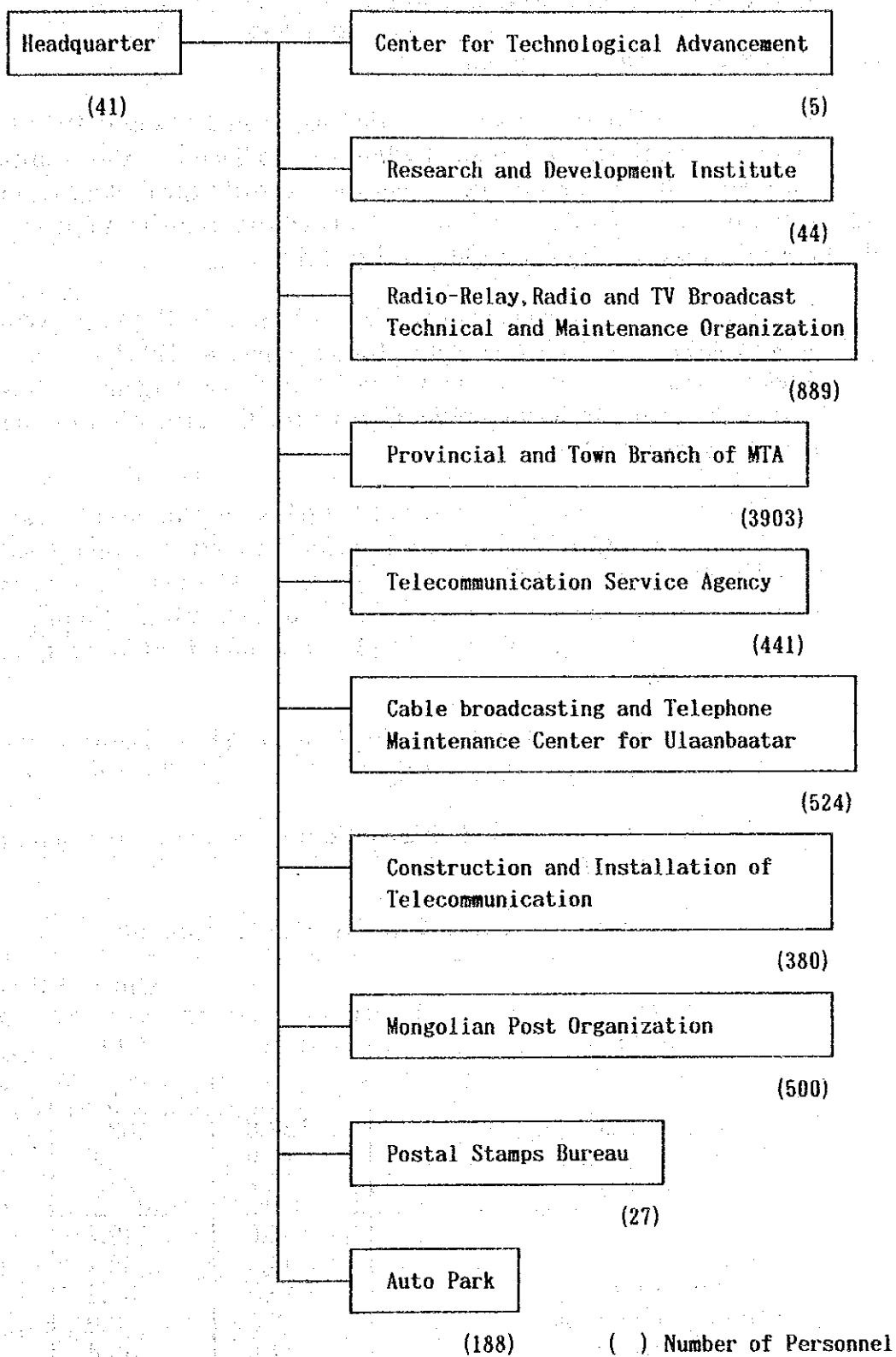
Headquarter, responsible for the operation and management of telecommunications, is divided into seven groups; Telecommunications policy, Network management, Human resources, Finance and economy, Investment, International cooperation and the Secretary's office. The local offices are responsible for telecommunications and postal services in the local areas, including in Ulan Bator.

The total number of personnel is 6,900 including 40 at headquarter, among which 2,500 persons are engaged in telecommunications and 500 in postal services and 3,900 at local telecommunications and post.

Its organization charts are in Figures 2-2-1 and 2-2-2.



**Fig. 2-2-1 Organization System at Headquarters of MTA
(Mongolian Telecommunications Authority)**



**Fig. 2-2-2 Organization System of MTA
(Mongolian Telecommunications Authority)**

2-2-3 Outlook of Finance and Economy

(1) Analysis of present situation

As the operation results in the period between 1988 and 1990 follow the same trend, this analysis work made by the MTA is based on the results of 1989, which are summarized as follows. Operation results (projected) from 1988 to 1990 are shown in Table 2-2-1 and its revenue results of international telecommunications in 1988 and 1989, in Table 2-2-2.

1) The revenues (incomes) of the Organization in the fiscal year of 1989 was at 235.2 million Tugriks and the expenses at 142.1 million Tugriks. And its profit was at approximately 93 million Tugriks, following the favorable results from the previous year; the Organization rendered great services to national revenue.

2) The revenues of 235.2 million Tugriks in the fiscal year of 1989 consisted of roughly 58% in the telecommunications business, 32% in broadcasting and 10% in the postal business. Therefore, the telecommunications business has an important rank. Among the total expenses of 142.1 million Tugriks, 23% was consumed for wages and 36% for depreciation.

3) Revenues (incomes) and expenses index (Expenses out of 100 Tugriks of revenues) is about 60 and healthy.

The profit in the area of international telecommunications comes to 2.4% among total business.

Table 2-2-1 Operation Sales and Expenses

Unit: Million Tugrik

Items/Fiscal year	1988	1989	1990 (Projected)
Sales	219.8	235.2	248.4
Telecommunications	122.6	133.8	
Broadcasting (TV, radio)	74.0	77.6	
Postal business	23.2	23.8	
Expenses	134.0	142.1	143.6
Wages	30.3	32.4	
Depreciation	46.3	51.3	
Management cost	2.8	3.0	
Miscellaneous	54.6	55.4	
Profits	85.8	93.1	104.8

**Table 2-2-2 Profits in International Telecommunications
(1988/1989 FY)**

Unit: Thousand Tugrik

Items/Fiscal year	1988	1989
International telephone	2449	2736
Telex	1431	1461
Telegram	561	321
Private network	834	1142
Total	5275	5660

(2) Present problems

Although profits look healthy judging from the sales/expenses index, there is not enough to support a financial basis proceeding with the improvement of the telecommunications and postal businesses in the future as about 80% of the annual profit of approximately one million tugrik is transferred into national revenues.

The Authority realizes the necessity of the following improvement, aside from their facilities and equipment project, in relation to international telecommunications.

- 1) With regard to wider distribution of public services by phones.
- 2) With regard to improvement in the rate of phone distribution taking priority into consideration.
- 3) With regard to wider distribution of main dial lines.
- 4) With regard to immediate arrangements forming networks in direct long-distance dial lines.

In order to proceed with these improvements, it is inevitable to secure a huge amount of finance, together with its steady execution, based on a long-term project; therefore, the matter of highest priority to be requested to the Authority should be the establishment of its financial basis.

(3) Influences on the finance of the Project

The proportion of the profit the international telecommunications among its total sales was not very high (about 2.4%) in the fiscal year 1989. As per Figure 2-2-2, sales of international phones was only 2,736 thousand Tugriks,

which shows a lower revenue judging from the traffic results. The main reason should be the fact that the phone rate to the Soviet Union is set at one fourth that of other areas. Furthermore, most international communications are with the Soviets. However, it is also a task to review the sharing system between nations, with regard to phone charges, and to increase its revenue.

As the demand potential for international phones in the country reflects traffic results, an increase in its revenue is expected which will favorably influence the establishment of the financial basis during the course of the Project.

2-2-4 The 5-Year Telecommunications Development Plan

For the 8th National Project for the five-year plan of national economic development, starting from 1986, priority was set in the arrangements of infrastructures and the expansion of trade. Telecommunications as an infrastructure is one of the important targets in this project. The following 6 targets are set for in the five-year plan for telecommunications.

(1) Introduction of digital switch and automated long-distance calls

The Mongolian Telecommunications Authority has changed its remarkably superannuated machine switch to a digital switch, to improve service and solve the problem of left-overs. The digital switch is scheduled to be introduced into the domestic telephone network from 1991, and 72 thousand subscribers will be accommodated until 1996 when this plan will be completed.

As the first step, the digital switch which will be able to accommodate 34 thousand subscribers will be newly installed in the capital of Ulan Bator in March 1992. In addition, digital switches will be installed in Ulan Bator and in local cities.

The country is aiming at a 12-15% telephone spread rate (12-15 phones per 100 people) in towns and cities, and a nation-wide average rate of 5%, when the installation plan for digital switch is completed.

(2) Modernization of international telecommunications

Through the financial assistance of the Governmental Aid of Japan, the Authority will construct an INTELSAT satellite earth station, an electronic switch for international and national transit, and a digital transmission link as well as establishing international telecommunications through INTELSAT Satellite (Indian Ocean Satellite).

As a temporary step until completion of this Project, the Authority is studying the increase in telephone circuits to Hong Kong through the AsiaSat

satellite in order to secure an international telecommunications route with Western countries.

(3) Arrangements for a microwave communication links and its relay stations

The Authority will construct a 900 km microwave communication links to Aimak (Prefecture) where no such facility now exists. And the existing analog-microwave communication link will be converted to a digitalized system for establishing a domestic network with high quality and high reliability.

(4) Arrangements for rural telecommunications

The Authority plans to introduce wireless telephone through relay stations and a domestic satellite communication network using the AsiaSat transponder.

(5) Improvements and expansion of the broadcasting network by satellite earth stations for receiving television program (TVRO)

The Authority plans to establish a television network using AsiaSat transponder in order to improve and expand its domestic television network.

(6) Introduction of a data communications network

The Authority plans to establish VSAT (Very Small Aperture Terminal) to meet future demand increases in data communications. As international data communications, the Authority aims to connect meteorological, banking and aeronautical data with other countries in the world.

2-2-5 Outlook of Domestic Telecommunication Facilities

(1) Domestic telecommunications network

The domestic telecommunications network in Mongolia consists of terrestrial microwave link for the main route between major cities, and of open wires for branch lines to local areas. Figure 2-2-3 shows the domestic telecommunications network.

The terrestrial microwave link is of an analog system made in the Soviet Union with frequency bands of 4, 6 and 8 GHz, so called Kurs -4, -6 and -8 respectively. The main features of the system are shown in Table 2-2-3, and the configuration of repeater station is shown in Figure 2-2-4. Twenty years have passed since these systems were introduced, therefore, superannuation and parts supply have become difficult. Relay stations are operating manually, among which some stations are forced to operate by their independent power plant due to

no commercial electricity supply, which costs much in terms of wages and electric expenses.

Because of the low density of population (1.2 persons/km²), it is difficult to cover all areas of the country with the telecommunications network. The MTA is studying a satellite communication system using VSAT and a rural communication network using wireless relay stations.

(2) Telephone exchange

Step-by-step or cross-bar type telephone exchanges, made in the Soviet Union, are operated in major cities. The total number of subscribers is approximately 62 thousands as of 1990, and the ratio of the spread has become 3.2% (3.2 phones per 100 inhabitants). And, the waiting list hit over 100 thousand. Table 2-2-4 shows the types of the exchanges and their subscribers, and Figure 2-2-5 shows the configuration of the telephone network. These exchanges are becoming superannuated and the short supply of parts is problem, in the case of the microwave communication network as well.

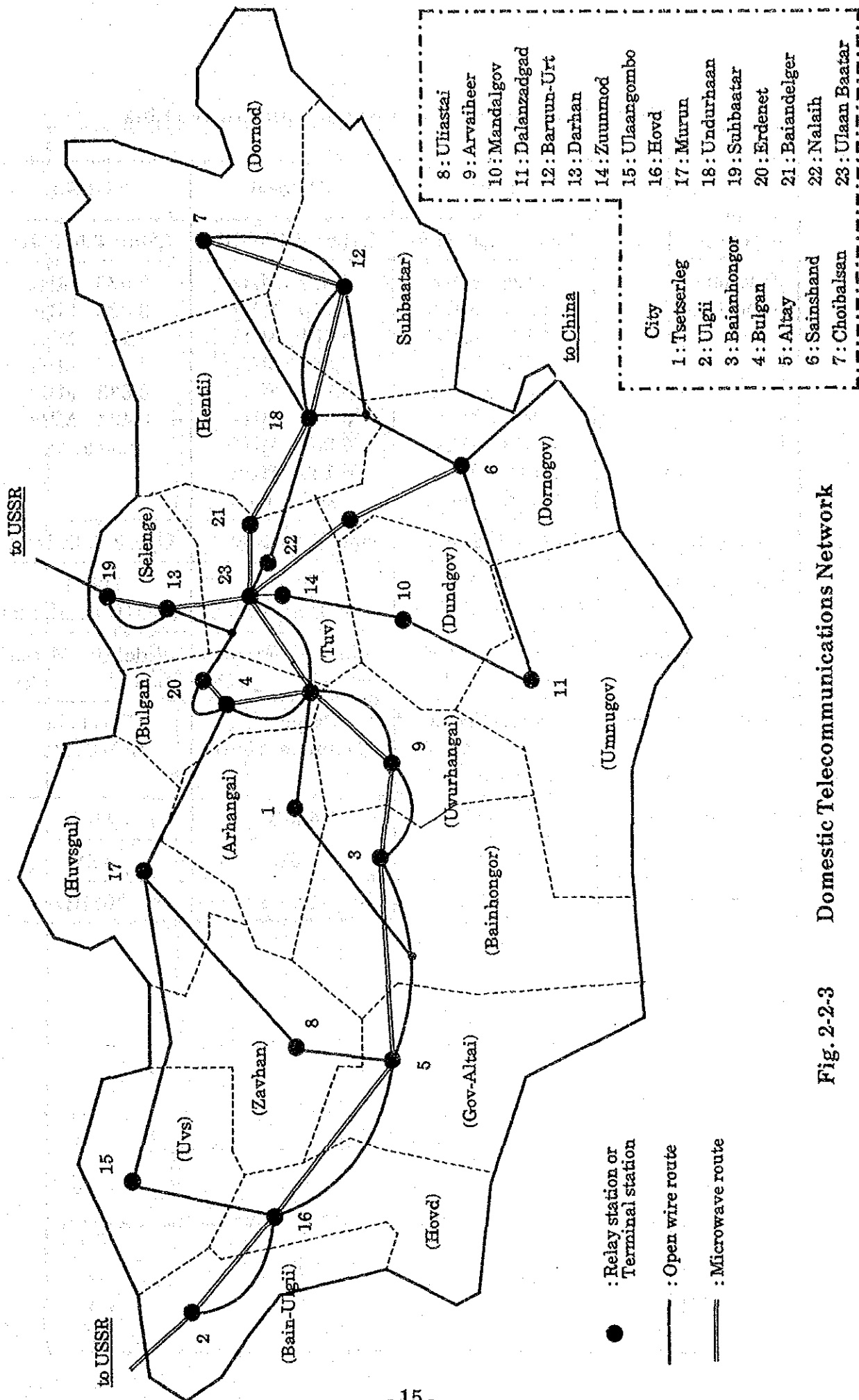


Fig. 2-2-3 Domestic Telecommunications Network

Table 2-2-3 Main Feature of Analog Microwave Link

ITEMS	KURS-4	KURS-6	KURS-8
Frequency band	3,200~4,200MHz	5,725~6,425MHz	7,900~8,500MHz
Frequency allocation	3,126 MHz 3,227 MHz 3,328 MHz 3,429 MHz 3,492.5 MHz 3,520.5 MHz 3,576.5 MHz 3,548.5 MHz and so on	5,689 MHz 5,745 MHz 5,801 MHz 5,857 MHz 5,955 MHz 6,011 MHz 6,067 MHz 6,123 MHz and so on	7,926 MHz 8,082 MHz 8,182 MHz 8,238 MHz 8,338 MHz 8,494 MHz and so on
Configuration	Ope. 3 + St-by. 1	Ope. 3 + St-by. 1	Ope. 3 + St-by. 1
Channel capacity per carrier	720 ch (10kHz available)	720 ch (10kHz available)	300 ch (10kHz available)
TV transmission capability	Video (6.5M)1ch Sound 2ch	Video (6.5M)1ch Sound 2ch	Video (6.5M)1ch Sound 2ch
Type of antenna	Horn reflector (Aperture area : approx. 7sqm)	Parabola (Diameter : 5m)	Parabola (AMD1.75)
Antenna gain	39.5dB	45dB	41dB
Transmit power	0.5W	7.5W	0.5W
IF frequency	70MHz	70MHz	70MHz

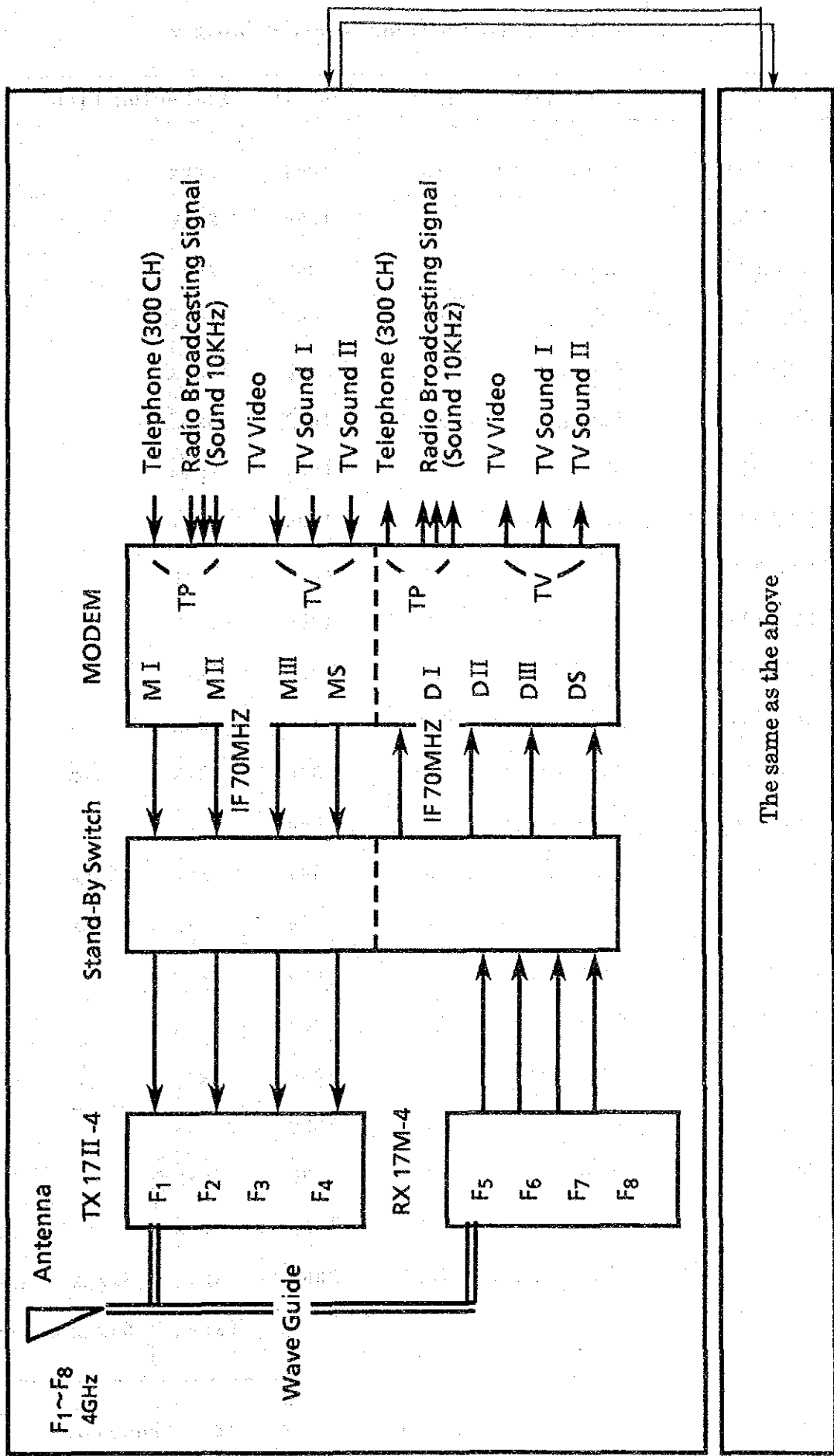


Fig. 2-2-4 Configuration of Microwave Repeater Station

Table 2-2-4 Existing Telephone Exchanges

AIMAK	City name	Type	Capacity	Numbering Plan
ARHANGAI	Tsetserleg	XB	1000	2xxx
BIAN-ULGI	Ulgii	XB	1000	2xxx
BIANHONGOR	Bainhongor	XB	1000	2xxx
BULGAN	Bulgan	XB	1000	2xxx
BULGAN	Erdenet	XB	2000	2xxxx
GOV-ALTAI	Altai	XB	1000	5xxx
DORNOGOV	Sainshand	XB	1000	2xxx
DORNOD	Choibalsan	XB	1300	2xxxx
DZAVHAN	Uliastai	XB	1000	2xxx
UVURHANGAI	Arvaiheer	XB	1000	2xxx
DUNDGOV	Mandalgov	XB	1000	2xxx
UMUNGOV	Dalanzadgad	SxS	800	2xx , 9xx
SUSUBAATAR	Baruun-Urt	SxS	800	2xx , 9xx
SELENGE	Sushbaatar	XB	1000	2xxx
SELENGE	Darhan	XB	2300	4xxx , 5xxx , 6xxx
UVS	Ulaangombo	SxS	800	2xx , 9xx
HOVD	Hovd	XB	1000	2xxx
HUVSGUL	Murun	XB	1000	2xxx
HENTII	Undurhaan	XB	1000	2xxx
HENTII	Bagnuur	XB	1500	2xxxx
TUV	Zuunmod	XB	1000	2xxx
TUV	Nalaih	SxS	900	6xx
TUV	Ulaan-Baatar	XB, SxS	33800	2xxxx , 3xxxx , 4xxxx 5xxxx , 6xxxx , 7xxxx

XB : Crossbar

SxS : Step-by-step

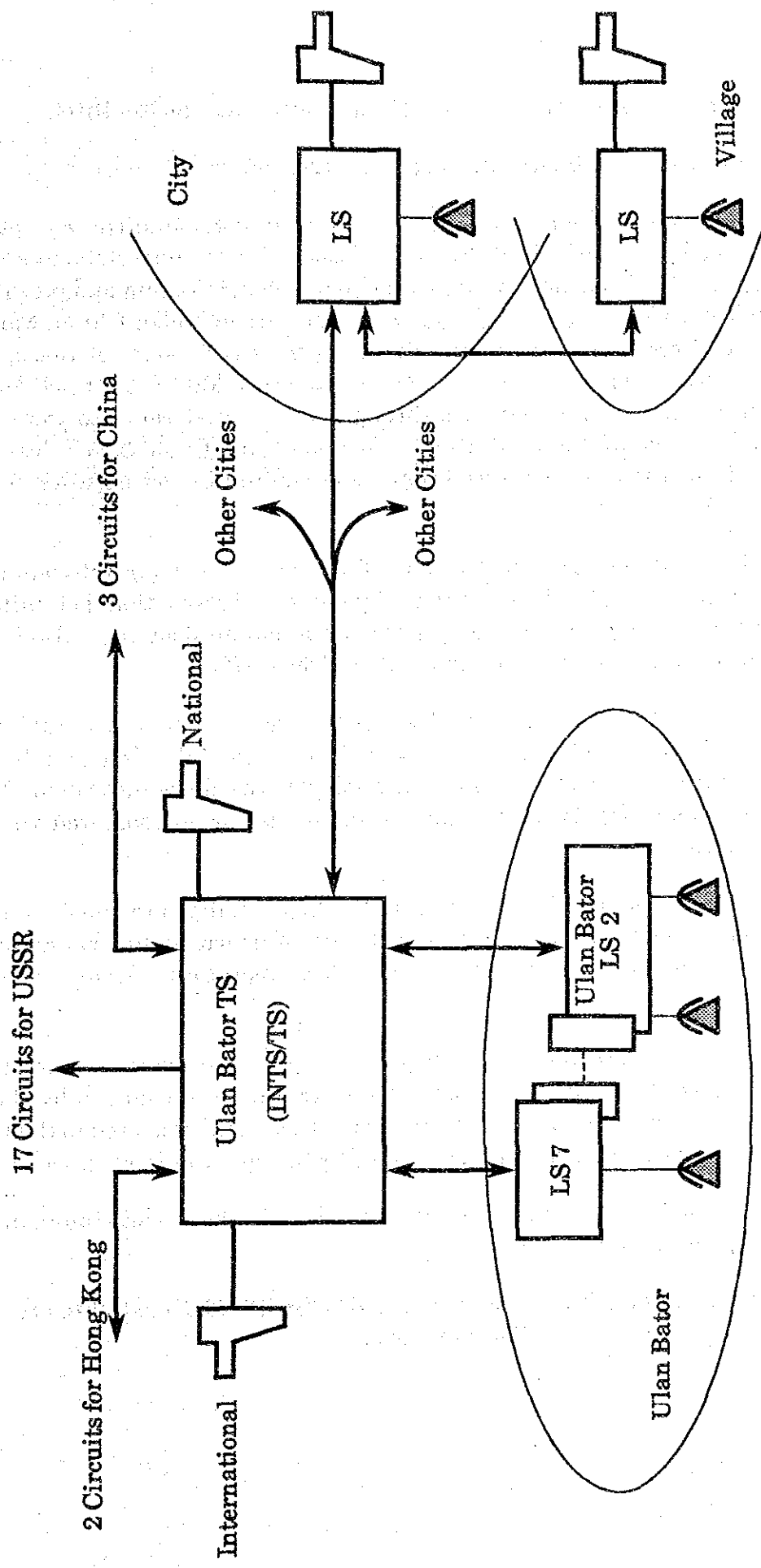


Fig. 2-2-5 Configuration of Telephone Network

2-2-6 Outlook of International Telecommunications Facilities

(1) International telecommunications services

International telecommunications with foreign countries except for China is provided by using the INTERSPUTNIK satellite and terrestrial microwave link through the Soviet Union to carry telephone, telex, telegram and private network together with TV program relay service. With its neighbor China, Mongolia has installed three international circuits by open wires. More of these, open wire circuits will be expanded up to 12 circuits. In addition to these conventional communication circuits, circuits through the AsiaSat satellite were opened in September 1990 by a joint-venture with Hong Kong Cable & Wireless Company. The configuration of an international telecommunication network is shown in Figure 2-2-6.

International telephone is one of the major means in telecommunication; however, Mongolia has just 20 manually operated international circuits. It takes a long time to connect, and the quality of telecommunication is also insufficient. The traffic for Soviet Union occupies 95% of the traffic.

As for its service, a part of phone call received from the Soviet Union is automated, but all of phone calls sent from Ulan Bator is through operators. A three minutes/one minute system is applied to the charging system. The charge to the Soviet Union is set at a special discounted level compared with those to other destinations.

Two telephone circuits via the AsiaSat satellite are considered to be an effective measure of improving contact with Western countries and of reducing stand-by time, in spite of the circuits need both operators at Hong Kong and Ulan Bator.

International telex and telegram are provided for the Soviet Union and China respectively with one circuit. The circuits are exchanged by the operator upon a subscriber's request by phone. For subscribers registered to the telex lines, the exchange and charging are performed by the operator in Moscow.

International private lines are installed via the Soviet Union, and there is one telegraphic circuit line for Tokyo.

International TV services via the INTERSPUTNIK satellite are constantly transmitted between socialist countries.

(2) International telecommunications facilities

1) International telephone network

The International telephone network are configured with: a telephone office as the international exchange and domestic network control office in the MTA building at Ulan Bator; the terrestrial transmission link; and the INTERSPUTNIK earth station adjacent to the capital.

2) International telephone exchange

With the complex function of being the international telephone exchange and domestic network control office, step-by-step type exchange is employed.

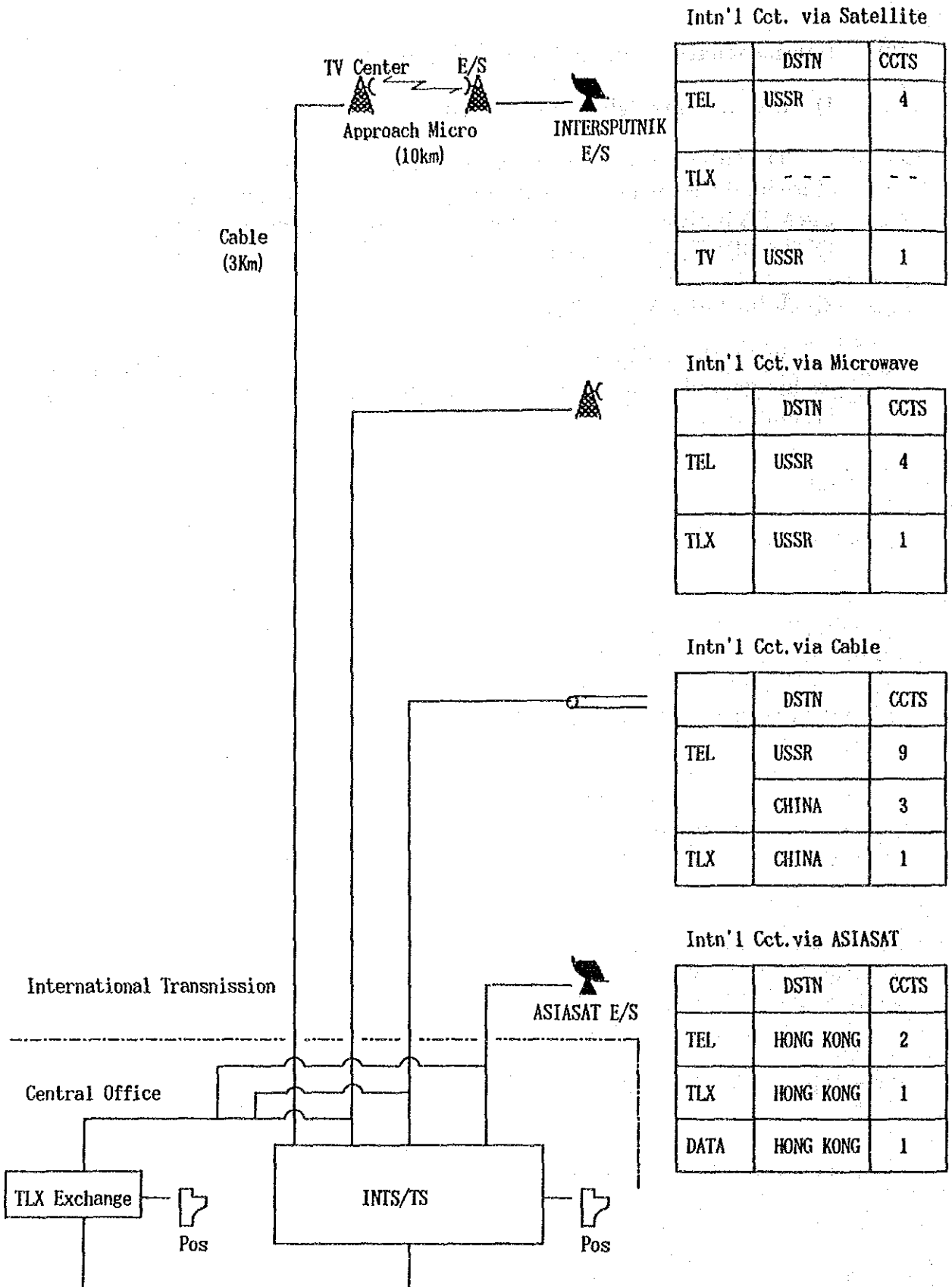


Fig. 2-2-6 International Telecommunications Network

This Soviet-made telephone exchange has been operating since 1979 and accommodates 570 domestic circuits as well as 20 international circuits, with 17 circuits to the Soviet Union and 3 to China.

75 switch boards are installed, among which 45 are operated day and night for 3 international and 42 domestic use. Two telephone circuits for Hong Kong via the AsiaSat satellite are also connected to this exchange through signal converter.

3) International telex exchange

Two telex exchanges, made in the Soviet Union in 1960, are installed with 40 subscriber terminals, among which one switch is operated manually and another is automated. As this switch has no automatic charging function, an automated circuit requires charging transaction at Moscow. Furthermore, as over 30 years has passed since commencement of service, the automatic exchange is scheduled to cease its operation in 1991.

One circuit for Hong Kong via the AsiaSat satellite is carrying the telex circuits by TDM (Time Division Multiplex) and international exchange is carried out at Hong Kong.

4) INTERSPUTNIK earth station

This Soviet-made earth station, locating at 11 km from the center of Ulan Bator, has been operating since 1970 as a station for the INTERSPUTNIK satellite. The station is equipped with a 12-meter antenna in diameter, a high power amplifier with a maximum output power of 3 kW, an electrically cooled receiver and a Ground Communication Equipment and so on. The transmission of the telephone circuits is carried by the SCPC (Single Channel per Carrier) system of 20 channels which has been assigned to Mongolia. And a SECAM system is used for TV transmission. The main feature of the earth station is shown in Table 2-2-5 and its configuration in Figure 2-2-7.

The transmission facilities between the earth station, the central office, and the TV center are of a Soviet-made analog micro wave link or a coaxial cable.

As twenty years have been passed since put into service, it has become old in spite of several improvements. In Appendix 3-1, the trouble records in the past five years at the station are listed. It is noted that the down time of each trouble sometimes took many hours although the trouble occurrences were quite few. The availability is ranked below the average, compared with other foreign INTELSAT earth stations.

5) AsiaSat earth station

The earth station for the AsiaSat is located near the MTA control office in the center of Ulan Bator. The station is equipped with a 6-meter dish antenna and the latest styled solidstate communication facilities. Main feature is shown in Table 2-2-6.

Table 2-2-5 Main Feature of the INTERSPUTNIK Earth Station

Items	Characteristics
<p>1. Antenna</p> <p>Type of antenna</p> <p>Diameter of antenna</p> <p>Transmit antenna gain</p> <p>Tracking</p> <p>Drive mechanism</p> <p>Pointing of antenna</p> <p>De-Icing</p>	<p>TNA57M, made in USSR</p> <p>12m</p> <p>54dB</p> <p>Automatic linear tracking by beacon</p> <p>Electric drive</p> <p>EL : 32°、AZ : 218.2° (80°E Satellite)</p> <p>Not equipped</p>
<p>2. High Power Amplifier</p> <p>Type of HPA</p> <p>Number of amplifiers</p> <p>Maximum output power</p> <p>Transmit power</p> <p>Center frequencies</p>	<p>GRADIENT OPPD, made in USSR</p> <p>TV : 2、TP : 1</p> <p>TV : 3KW、TP : 500W</p> <p>TV : 2KW、SCPC : 1.5W / 1carrier</p> <p>TV : 6,100MHz、TP : 6,200MHz</p>
<p>3. Low Noise Amplifier</p> <p>Type</p> <p>Number of amplifiers</p> <p>Gain</p> <p>Type of cooling</p> <p>Noise temperature</p> <p>System G/T</p> <p>Nominal receive signal level</p> <p>Center frequencies</p>	<p>ELECTORNIX MSHU60, made in USSR</p> <p>1 for TV and TP</p> <p>60dB</p> <p>Thermo-electrically cooled</p> <p>70°K</p> <p>31dB/°K</p> <p>-116dBm</p> <p>TV : 3,875MHz、TP : 3,775MHz</p>
<p>4. Others</p> <p>TV standard</p> <p>TV carrier</p> <p>TP carriers</p>	<p>SECAM</p> <p>RF bandwidth of 36MHz for 1carrier</p> <p>CFM/SCPC of 20 carriers in maximum</p> <p>(4KHz / 1 carrier)</p>

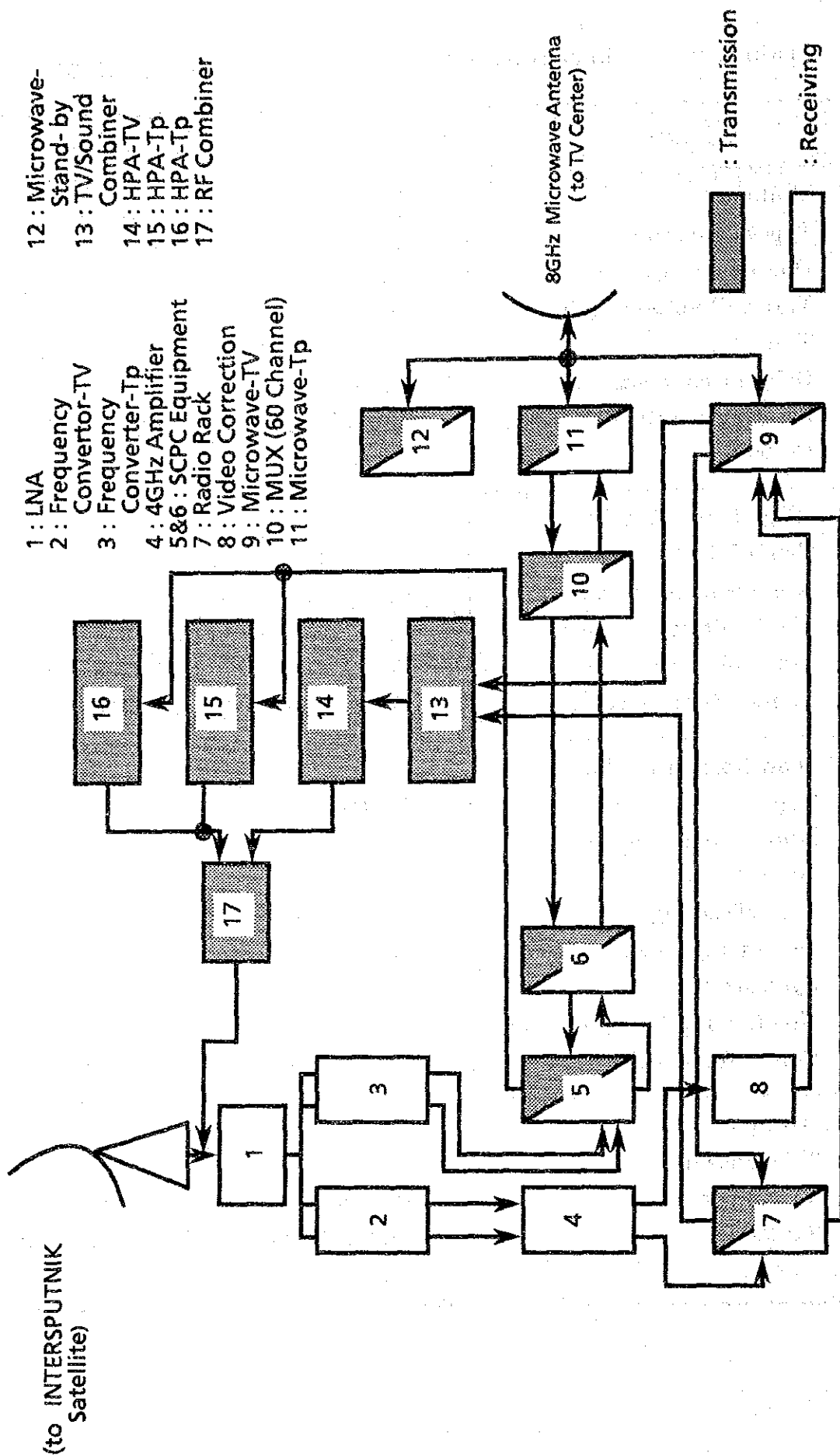


Fig. 2-2-7 Configuration of the INTERSPUTNIK Earth Station

Table 2-2-6 Main Feature of AsiaSat Earth Station

Items	Characteristics
<p>1. Antenna Type of antenna Diameter of antenna Antenna gain Drive mechanism De-Icing</p>	<p>Cassegrain, AZ/EL type, made by NEC 6mϕ Transmit : 49.3dB、 Receive : 46.1dB Mannual drive Not equipped</p>
<p>2. High Power Amplifier Type Number of amplifiers Transmit power TX Center frequency Carrier frequencies Bandwidth</p>	<p>SSPA, made by NEC 2 sets for (1 + 1) redundancy 50W 6,137.5MHz 5,855、 6,175、 6,420MHz 575MHz</p>
<p>3. Low Niose Amplifier Type Number of amplifiers Gain Noise temperature System G/T Carrier frequencies</p>	<p>Non cooled FET amplifier 2 sets for (1 + 1) redundancy 60dB 80°K 25.6dB/°K 3,630、 4,000、 4,195MHz</p>
<p>4. Others Number of SCPC carriers Modulation method Uninterruptible power supply TDM</p>	<p>4 carriers CFM / SCPC (4KHz / 1 carrier) 15KVA 96 channels in 1 carrier</p>

2-3 Outline of the Request

2-3-1 Circumstances of the Request

The telephone is the major means in international telecommunication in the Mongolian People's Republic same as in other foreign countries. 95% of the total number of international calls is for communication with the Soviet Union, with whom Mongolia has close contacts in political and economic relations. Under the influence of Perestroika which brought democracy to Eastern countries, Mongolia has set their political policy trying to expand their relationship with Western countries. Mongolia also started aggressive activities aimed at developing the national economy by introducing a market economy.

The government decided that international communications would be an urgent and indispensable matter on their agenda when the economic developing project will be promoted under the introduction of the market economy. This decision was made because the several matters have still been pending despite brisk demand.

First of all, there is much troubles in connections and quality by the shortage of circuit capacity, although most of Mongolia's traffic to the rest of the world is connecting through the Soviet Union. This is mainly because their international telecommunication network fully depends on the INTERSPUTNIK satellite circuits, which are servicing the Soviet Union and other Socialist countries.

Next on the agenda is that, because of their older facilities it is impossible to improve and expand their capacity and facilities as well as services, such as International Subscriber Dialing, to fulfill the future demand increase in traffic.

Third on the agenda is that, in addition to their only earth station, which is 20 years old, the current communications system is in an insecure position because it is extremely difficult to procure the facilities, components and spare parts. Some major facilities have already stopped manufacturing.

The demand increase in international telecommunication indicates bright futures from the data such as: The percentage of the increased number of subscribers has come to approximately 34% in these past 5 years which shows a favorable trend. The total number of subscribers as of 1990 reached 62 thousands. The telephone density reached 3.2%, which is equivalent to 3.2 telephone among 100 persons. Those who are requesting to have telephones installed but who are still waiting number in the tens of thousands. All of this data points to a prosperous future.

In order to improve the poor situations in international telecommunications, the country decided on a project to rearrange the current system of international telecommunications, mainly by the construction of a satellite earth station and telephone exchange.

Under such circumstances, the Government of M.P.R. requested a Grant Aid from the Government of Japan.

For its success, it will be important that the project be linked with their renovation program for the domestic network. Therefore, prior to this project, the government will carry out one of the long-term projects by installing a digital telephone exchange, to be completed in March, 1992, in the capital city of Ulan Bator where the demands are brisk.

Consequently, these renovations will be able to offer high-grade services in auto-dial connections to users of international calls at the capital city where such demands are extremely high. Furthermore, the promotion of the 5-year project for a digital network will contribute to the increase in the ratio of international auto dialing which is the basic purpose of this project.

2-3-2 Contents of the Request

The requests of the Government of M.P.R. to the Japanese government are:

- 1) Construction of an INTELSAT New standard A earth station
- 2) Installation of electronic exchange usable both in international and national transit
- 3) Installation of digital transmission link to connect the earth station and telephone center in Ulan Bator

- (1) Construction of INTELSAT New standard A earth station

By direct transmission with Western countries via the INTELSAT satellite, much improved speedy and reliable information exchange will be available, and reception of international television programs including telephone and telegrams will also be available.

- (2) Installation of electronic exchange usable both in international and national transit

Due to the older exchange currently in service, connections are still operated manually. Therefore, it is impossible to achieve auto-dial or the latest

services. The installation of electronic exchange will enable to substantially improve the quality and its connectivity as well as to meet the latest services.

- (3) Installation of digital transmission link to connect the earth station and telephone center in Ulan Bator

The purpose of the installation of digital transmission link between earth station and telephone center is to improve the quality of the circuit by relaying signals in digital.