THE REPUBLIC OF VIET NAM

FEASIBILITY STUDY REPORT
ON
THE CONSTRUCTION OF SATELLITE COMMUNICATIONS EARTH STATION

JUNE 1973

OVERSEAS TECHNICAL COOPERATION AGENCY
JAPAN

PREFACE

The Republic of Viet-Nam has earlier made a request to the Japanese Government for economic and technical cooperation in implementing a satellite earth station construction project in the country, which has long been put aside because of the war.

In order to extend cooperation to this project, the Japanese Government decided to send a survey team to Viet-Nam and consigned the survey to the Overseas Technical Cooperation Agency.

The Agency organized a 5-member team headed by Mr. Shosaku ITO of Radio Regulatory Bureau, Ministry of Posts and Telecommunications and dispatched it to Viet-Nam for 20 days from January 10, 1973 to carry out feasibility survey for constructing a satellite earth station in Viet-Nam.

The team, during its stay of Saigon, had discussions with Mr. Bui Huu Lan, Director General of Posts and Telecommunications, Mr. Le Van Duyet, Director, Foreign Aid Section of Posts and Telecommunications and other government officials, and made on-site inspection and collection of data and information councerning the Saigon Central Office, Radio Transmitting and Receiving Stations, and three proposed sites of earth station at the Vung Tau area where a satellite earth station is planned to be set up. This report has been drawn up by the team members upon their return to Japan.

I shall be most pleased if this report proves to be of some help for the future improvement of telecommunications in the Republic of Viet-Nam and serves to contribute to the economic development of the country as well as to the promotion of friendly relationship between the Republic of Viet-Nam and Japan.

In conclusion, I would like to express my deep appreciation to the Government of Viet-Nam for the helpful cooperation in the implementation of this survey.

I also wish to extend my hearty thanks to the members of Japanese Embassy in Viet-Nam, the officials of the Japanese Government Ministries and Agencies concerned and the members of the survey team, who spared no effort to extend their cooperation and support to this survey.

June 1973

K. Tatsuke

Kelichi Tatsuke
Director General, OTCA

REPORT ON FEASIBILITY SURVEY FOR SATELLITE EARTH STATION CONSTRUCTION PROJECT IN THE REPUBLIC OF VIET-NAM

CONTENTS

1. Circumstances and Objectives

From 10 through 30 January this year, the Japanese Government dispatched a survey team to the Republic of Viet-Nam at the request of that country to make a feasibility survey of the satellite earth station construction project for which the Viet-Namese Government has been strongly desiring a financial support of the Japanese Government.

With the aim of making an analysis of this project from technical and economic point of view, the survey team conducted a survey on the followings:

(1) demand estimation for international telecommunications services in Viet-Nam,
(2) proposed earth station site and central office facilities,
(3) connecting link between earth station and central office,
(4) financing program, and others.

The organization of the survey team and the schedule for survey are as described below.

1) Organization of the Survey Team

		Working Period
Leader:	Shosaku Ito (Radio Regulatory Bureau, Ministry of Posts and Telecommunications)	From January 10 to January 29
Team Member:		
	Masaaki Minami (Office of Telecommunications Administration, Ministry of Posts and Telecommunications)	"
"	Yoshiharu Matsumoto (Kokusai Denshin Denwa Co., Ltd.)	"
"	Shizuo Endo (Kokusai Denshin Denwa Co., Ltd.)	"
" (Coordinator)	Takeshi Miura (Overseas Technical Cooperation Agency)	From January 10 to January 20

2) Schedule of Survey

January 10 (Wednesday) 1973	Leave Haneda (morning) Arrive Saigon (afternoon)
" 11 (Thursday)	Holiday (the day of Buddah's passing)
" 12 (Friday)	Visit to the Japanese Embassy (morning) Visit to Direction General of Posts and Telecommunications (DGPT) (afternoon)
" 13 (Saturday)	Inspect Chi Hoa Telephone Transmitting Station, Phu Tho Telegraph Transmitting station, and Citadel Telegraph Receiving Station (morning) Inspect Richard Telegraph Receiving Station;

		courtesy visit to Mr. Bui Huu Lan, Director General of Posts and Telecommunications (afternoon)
January	14 (Sunday) 1973	Holiday
"	15 (Monday)	Visit to DGPT (morning) Courtesy visit to Mr. Nguyen Van Anh, Vice Minister, Ministry of Planning and National Development (afternoon)
"	16 (Tuesday)	Inspect Vung Tau - proposed earth station site. Minami and Miura return to Saigon in the evening. Leader Ito, Matsumoto and Endo stay in Vung Tau to work there.
"	17 (Wednesday)	Visit to DGPT (morning) Visit to a Japanese consultant for water supply system (afternoon) (Leader Ito and two other members stay in Vung Tau).
"	18 (Thursday)	Visit to the Hazamagumi Office at Cho-Ray Hospital (morning) Visit to DGPT (afternoon) Leader Ito and two other members return to Saigon from Vung Tau (evening)
"	19 (Friday)	Discussions with Mr. Duyet, DGPT (all day)
"	20 (Saturday)	Work at DGPT (all day); Miura returns home.
"	21 (Sunday)	Leader Ito, Matsumoto and Endo make a second trip to Vung Tau with Mr. Duyet, DGPT, to stay a couple of days there. Minami remains in Saigon for arranging data.
"	22 (Monday)	Arrange data Members in Vung Tau return to Saigon in the evening.
"	23 (Tuesday)	Work at DGPT
"	24 (Wednesday)	"
"	25 (Thursday)	"
"	26 (Friday)	Courtesy visit to H. E. Mr. Tran Van Vien, Minister of Post and Communications (morning)
"	27 (Saturday)	Work at DGPT (afternoon)
"	28 (Sunday)	Holiday Cease-fire Agreement takes effect as from 8 a.m.

January 29 (Monday) Final discussion with DGPT

" 30 (Tuesday) Return home

2. Necessity of the Project for Viet-Nam

In the Republic of Viet-Nam, telecommunication services are operated under the management of Direction General of Posts and Telecommunications, Ministry of Post and Communications.

As for the domestic communications, local telephone service is making its way into a wider use in the districts of Saigon and Cholon. Automatic switching system is also being introduced in these areas. But in other part of the country, local telephone service is still in an early stage of its development.

At present, there is practically no long distance facilities that interconnect city areas, except some microwave links which lie in the southern districts. Some public communication lines are operated utilizing part of military telephone lines and facilities.

International telecommunication services are operated with 13 foreign countries solely on the high frequency radio system. The radio equipment and facilities are left in an obsolete condition, while international communication traffic is continuing to increase year after year.

In particular, the years 1969 to 1971 saw a marked increase in the volume of international traffic, the greater part of which included traffic with the United States. It is rather difficult to foresee the trend of such traffic growth in the years after 1973 when the cease-fire has come into reality.

As a whole, there is no doubt about a decrease in the traffic of the U.S. military personnel, which will result from the repatriation of the American forces. In this connection, a significant decrement will be brought about temporarily in Viet-Nam's overall international traffic volume.

On the other hand, however, there will be pushed forward a postwar rehabilitation program in this country. The nation's economy will be revitalized by the economic cooperation of other countries. These factors will contribute to upraising the demand for communications traffic.

It is considered almost impossible to cater for the increased traffic requirements with the existing obsolete facilities which were mostly introduced before the beginning of 1960s.

To provide for various rehabilitation activities which are expected to be carried out in an extensive scale, it is essential for the Republic of Viet-Nam to construct, as soon as possible, a satellite earth station which will make it possible to provide high quality and stabilized communication services to the public.

This earth station is also deemed indispensable for improving the international

telecommunications services in the region of Southeast Asia where no other nations than the three Indo-China countries are operating their international traffic on the high frequency radio system alone. Also, this project is adopted in the "Asian Telecommunication Network Plan" which is being advocated and pushed forward by the ECAFE.

With the background stated as above, we describe the findings of our survey in the paragraphs that follow. As a conclusion, we are of opinion that the feasibility of satellite earth station construction project in the Republic of Viet-Nam has sufficiently been demonstrated.

3. Estimation of Traffic Requirements and Number of Channels

1) Present Status

In the Republic of Viet-Nam, international telecommunication services are now operated merely by means of high frequency radio system. The particulars of traffic volume, number of channels and business income are indicated in Tables 1-1, 1-2, and 1-3, respectively.

What is remarkable in the requirements for services is that the traffic with the U.S.A. occupies the major part of country's whole service demand. At present, such traffic is transmitted to Hong Kong, Guam or Manila, and thence to the U.S. Mainland by way of submarine cable or satellite.

2) Estimation of Traffic Requirements

Since Viet-Nam has long been placed under an unusual situation in the past on account of continued war, it is not practical to apply any established method to the estimation of international communications traffic in this country. And it is still difficult under the present situation to foresee what impact the cease-fire will bring to the traffic with the U.S.A. in future. Under the circumstances, traffic estimation is made with respect to each destination, based on the following assumption and the actual figures realized in 1971, and taking also into account the records in the past. The earth station is assumed to be brought into operation in 1976 in this report.

A. Telephone

a) Demand for telephone service will make a slight increase during 1972. But in 1973, it will show a drastic decrease. Particularly, a decrease of 80 per cent is estimated in the traffic outgoing to the U.S.A. through Hong Kong, which probably includes a high percentage of demand of the U.S. military personnel.

b) The traffic will indicate an upward trend in the years 1974-1975.

c) For the years 1976-1980, a 10 per cent increase is estimated in the traffic

with each destination country. It is also estimated that a sharp increase of 20 to 50 per cent will take place, with the inauguration of earth station operation, for the year 1976 in the traffic with the countries where there might have been a potential demand.

d) In 1981 and onwards, the Republic will regain stabilization in the state affairs, and the economic activities will make steady headway. On the other hand, national networks will be organized for telecommunications services.

With the above factors in view, a 15 per cent increase of traffic is estimated with each destination.

B. Telex

a) For the years 1972-1980, a 10 per cent increase is estimated in the telex traffic with each destination.

b) For the years 1981 and onwards, a 15 per cent increase of traffic is estimated as is the case with the telephone service.

C. Telegraph

a) The traffic is assumed to take a declining course during the years 1972 through 1975. Particularly, a 50 per cent traffic decrease is estimated for the year 1973.

b) It is assumed that with an improvement in the service, traffic will increase by 1 to 2 per cent for the years 1976-1980.

c) For the years 1980 and onwards, a 2 to 3 per cent increase is applied to the yearly traffic for the same reason as for the telephone service.

3) Number of Channels Required

A. Direct Circuit Destinations

The countries, which are now linked with the Republic of Viet-Nam over a direct circuit, are included in the direct-circuit destinations under this estimation.

With the exception of the United States, countries other than the above are handling too samll volume of traffic with Viet-Nam to be included in the direct-circuit destinations. Therefore, it is assumed that there will be no new direct-circuit destinations except the United States.

B. Calculation of Channels

The traffic volume and the number of channels estimated for each destination are shown in Table 2.

The number of telegraph channels is calculated on a basis of one channel for

every 440 messages/day. The telex channels are calculated in accordance with the CCITT Recommendation F-64, assuming that for one call, the chargeable time is 6.5 min., operator's handling time 4.5 min., busy hour concentration rate 15 per cent and call loss rate 1/30.

Also, the telephone channels are calculated in accordance with the CCITT Recommendation F-520, assuming that for one call, the chargeable time is 6 min., operator's handling time 5 min., busy hour concentration rate 15 per cent and call loss rate 3 per cent.

No calculation is made with respect to leased telegraph channels, leased telephone channels and other types of service (program transmission, phototelegram, television transmission, etc.), since no reliable information has so far been available on the requirements for such service.

C. Allocation of Traffic

Based on the documents on the earth station construction project as well as the long-term communications plan of the Republic of Viet-Nam, arrangement has been made to allocate the international traffic either to satellite circuit or to circuits on other types of systems.

Table 1-1-(1)

INTERNATIONAL TELEPHONE TRAFFIC

(Chargeable Time)

(Incoming and Outgoing Calls)

Year / Country	1967	1968	1969	1970	1971
	min.	min.	min.	min.	min.
Hong Kong	55.001	59.495	101.953	135.129	127.021
Taiwan	12.396	11.590	12.542	15.385	12.917
Japan	81.190	92.771	69.826	70.547	74.800
Korea	2.183	2.596	3.321	4.883	2.145
U.S.A. (Oakland)	52.696	14.227	15.935	15.714	14.560
U.S.A. (via H.K.)	182.488	279.782	922.505	1.834.938	1,810.854
U.S.A. (via Guam)	-	-	-	234	403.220
Philippines	2.960	521	1.059	938	2.052
Khmer	-	-	-	472	23.547
Laos	-	-	-	-	823
Thailand	-	-	184	434	197
Malaysia	--	-	-	192	215
Singapore	4.120	3.574	5.689	8.399	7.873
India	603	794	634	552	945
France	14.918	16.633	14.915	14.926	17.024
Total	408.555	481.983	1,148.563	2.102.743	2.498.193

Table 1-1-(2) INTERNATIONAL TELEX TRAFFIC

(Chargeable Time)

(Incoming and Outgoing Calls)

Year / Country	1967	1968	1969	1970	1971
	min.	min.	min.	min.	min.
Hong Kong	-	-	25.586	81.668	108.789
Japan	-	-	29.954	72.568	105.962
Philippines *	68.239	143.561	109.198	122.195	133.826
France	-	-	2.014	5.697	8.899
Total	68.239	143.561	166.752	282.128	357.476

* Includes transit messages destined to the U.S.A.

Table 1-1-(3) INTERNATIONAL TELEGRAPH TRAFFIC (WORDS)

(Incoming and Outgoing Messages)

Year / Country	1967	1968	1969	1970	1971
	word	word	word	word	word
Hong Kong	3.551.335	3.323.082	4.240.040	4.078.596	3.866.517
Taiwan	556.849	290.823	275.281	213.067	257.736
Japan	4.327.851	4.407.427	4.588.647	2.544.351	2.170.139
Philippines	5.143.744	4.476.346	4.715.428	4.220.859	3.165.153
Khmer	851.060	920.205	497.255	649.555	539.967
Laos	-	-	-	-	252.759
Thailand	632.681	467.596	509.285	464.673	427.909
India	80.058	34.111	25.915	13.580	10.799
Levanon	456.075	253.092	277.628	236.720	272.007
France	1.181.047	1.146.855	1.187.937	1.233.991	1.270.630
Singapore	965.241	540.912	105.275	-	-
Total	17.745.941	15.860.449	16.422.691	13.655.392	12.233.616

Table 1-2

INTERNATIONAL TELECOMMUNICATIONS CIRCUITS

As of January 1973

Type of Service / Country	Telephone	Telegraph	Telex
France	1	1	1
Hong Kong	4	1	2
India	1	1	
Japan (Tokyo)	1	1	
Japan (Osaka)			2
Khmer	1	1	
Korea	1		
Laos	1	1	
Levanon		1	
Philippines	1	1	4
Singapore	1	1	
Taiwan	1	1	
Thailand	1	1	
U.S.A. (Oakland)	2		
U.S.A. (via H.K.)	18		
U.S.A. (via Guam)	4		
Total	38	11	9

Table 1-3

INCOME FROM INTERNATIONAL TELECOMMUNICATIONS SERVICE

Unit: Piastre

Type of Service \ Year	1967	1968	1969	1970	1971
Telephone	209.785.330	227.636.346	550.405.917	1.003.529.058	1.209.284.201
Telex	34.439.400	102.287.925	118.810.800	201.087.450	254.653.200
Telegram	1.381.509.129	1.205.876.709	1.274.454.047	1.045.899.081	935.148.791
Total	1.625.733.859	1.535.800.980	1.943.660.764	2.250.515.589	2.399.086.192

Note: If an exchange rate 1 dollar = 400 piastre (ruling in 1971) is applied, the figures of total indicated above may be converted as follows:

1967	1968	1969	1970	1971
Thousand dollars	Thousand dollars	Thousand dollars	Thousand dollars	Thousand dollars
4.604	3.840	4.859	5.626	5.998

Table-2

ESTIMATION OF TRAFFIC REQUIREMENTS AND NUMBER OF CHANNELS FOR THE REPUBLIC OF VIET-NAM

Destination	Service	1976 Traffic		1976 CH	1980 Traffic		1980 CH	1985 Traffic		1985 CH	Route
		Thousand messages									
France	TG	34.8		1	37.7		1	43.7		1	PS (via U.S.A) Cable and IS (via Thailand)
		Thousand calls	Thousand minutes								
	TX	2.2	14.3	2	3.2	21.0	3	6.5	42.2	3	
		Thousand calls	Thousand minutes								
	TP	4.8	29.1	3	7.1	42.5	3	14.3	85.5	5	
Hong Kong	TG	84.6		1	88.0		1	97.2		1	PS
	TX	27.0	175.2	6	39.5	256.5	8	79.4	516.0	13	
	TP	29.2	175.4	7	42.8	256.9	8	86.1	516.7	13	
India	TG	0.2		1	0.3		1	0.3		1	High frequency Cable and IS
	TX										
	TP	0.2	1.4	1	0.3	2.0	1	0.7	4.1	2	
Japan	TG	47.5		1	49.4		1	54.5		1	PS
	TX	26.3	170.7	6	38.4	249.8	8	77.3	502.5	12	
	TP	22.1	132.7	6	32.4	194.3	7	65.1	390.8	11	
Khmer	TG	14.0		1	15.2		1	17.6		1	High frequency Microwave
	TX										
	TP	5.5	32.9	3	8.0	48.2	4	16.2	96.9	5	

Destination	Service	1976 Traffic		1976 CH	1980 Traffic		1980 CH	1985 Traffic		1985 CH	Route
Korea	TG										PS
	TX										
	TP	0.3	1.9	1	0.5	2.8	2	0.9	5.6	2	
Laos	TG	9.5		1	10.2		1	11.9		1	High frequency
	TX										
	TP	0.2	1.2	1	0.3	1.8	1	0.6	3.5	2	Microwave
Lebanon	TG	6.0		1	6.2		1	6.9		1	High frequency
	TX										Cable and IS
	TP										
Philippines	TG	8.7		1	9.4		1	10.9		1	
	TX	0.8	5.2	2	1.2	7.6	2	2.3	15.2	2	PS
	TP	0.5	2.9	2	0.7	4.2	2	1.4	8.4	2	
Singapore	TG			1			1			1	PS
	TX										
	TP	1.9	11.4	2	2.8	16.7	2	5.6	33.7	3	
Taiwan	TG	5.6		1	5.9		1	6.5		1	PS
	TX										
	TP	2.2	13.4	2	3.3	19.6	3	6.6	39.3	3	
Thailand	TG	11.7		1	12.7		1	14.7		1	PS
	TX										Cable or microwave
	TP	0.1	0.3	1	0.1	0.4	1	0.1	0.9	1	

Destination	Service	1976		CH	1980		CH	1985		CH	Route
		Traffic			Traffic			Traffic			
U.S.A.	TG	34.6		1	36.0		1	39.8		1	PS
	TX	32.4	210.3	7	47.4	308.0	9	95.3	619.5	14	
	TP	115.8	694.7	17	169.5	1017.1	22	341.0	2045.8	39	
		Thousand messages		CH							
Total	TG	257.2		12	271.0		12	303.9		12	
		Thousand calls	Thousand minutes								
	TX	88.6	575.7	23	129.7	842.9	30	260.8	1695.4	44	
		Thousand calls	Thousand minutes								
	TP	182.9	1097.3	46	267.7	1606.5	56	538.5	3231.2	88	

TG : Telegram
TX : Telex
TP : Telephone

PS : Pacific Ocean satellite
IS : Indian Ocean satellite
Cable: Coaxial submarine cable between Viet-Nam and Thailand
Microwave : International microwave network

4. Satellite Communications System

This chapter describes the details of system and facilities with respect to the satellite earth station, interconnecting microwave link and central office facilities for satellite communications.

1) Basic Considerations for System Design

The standards for design of satellite communications system and their basic considerations are as follows:

a) ITU Regulations

b) CCIR and CCITT Recommendations

c) ICSC-45-13E W/1/70 (Rev. 1) - Performance Characteristics of Earth Station in the INTELSAT IV System

d) Satellite System Operations Plans and Satellite System Operations Guide issued by INTELSAT

e) Other ICSC Documents

Among the above, the ICSC document indicated in Item c) above deals with the technical characteristics of a standard earth station that has access to the IS-IV series satellites now in operation in the INTELSAT satellite network.

The proposed earth station of the Republic of Viet-Nam also should satisfy the requirements of this technical characteristics.

2) Establishment of Satellite Circuits

A. Operational Mode of System

The INTELSAT is currently operating IS-IV series stationary satellites over the Atlantic, Pacific and Indian Oceans. The Republic of Viet-Nam enjoys a geographical advantage that enables her to have access to both Pacific and Indian Ocean satellites. Fig. 1 shows an area where the IS-IV satellite can be viewed with an elevation of 5° or more.

In order to organize a global satellite communications network with participation of a number of earth stations, the Frequency Division Multiplex-Frequency Modulation System (FDM-FM) is at present adopted on the basis of a multi-destination carrier transmission on voice-grade circuits (including telephone, telegraph, and telex circuits). Fig. 2 indicates an example of circuit configuration in this system.

For transmission of telegraph and telex signals, the Voice Frequency Multiple Telegraph System (VFT) will be used which enables transmission of 24 telegraph channels over one voice channel.

International television transmission will be provided on a basis of

on-demand and one-way transmission. A circuit diagram in this system is shown in Fig. 3.

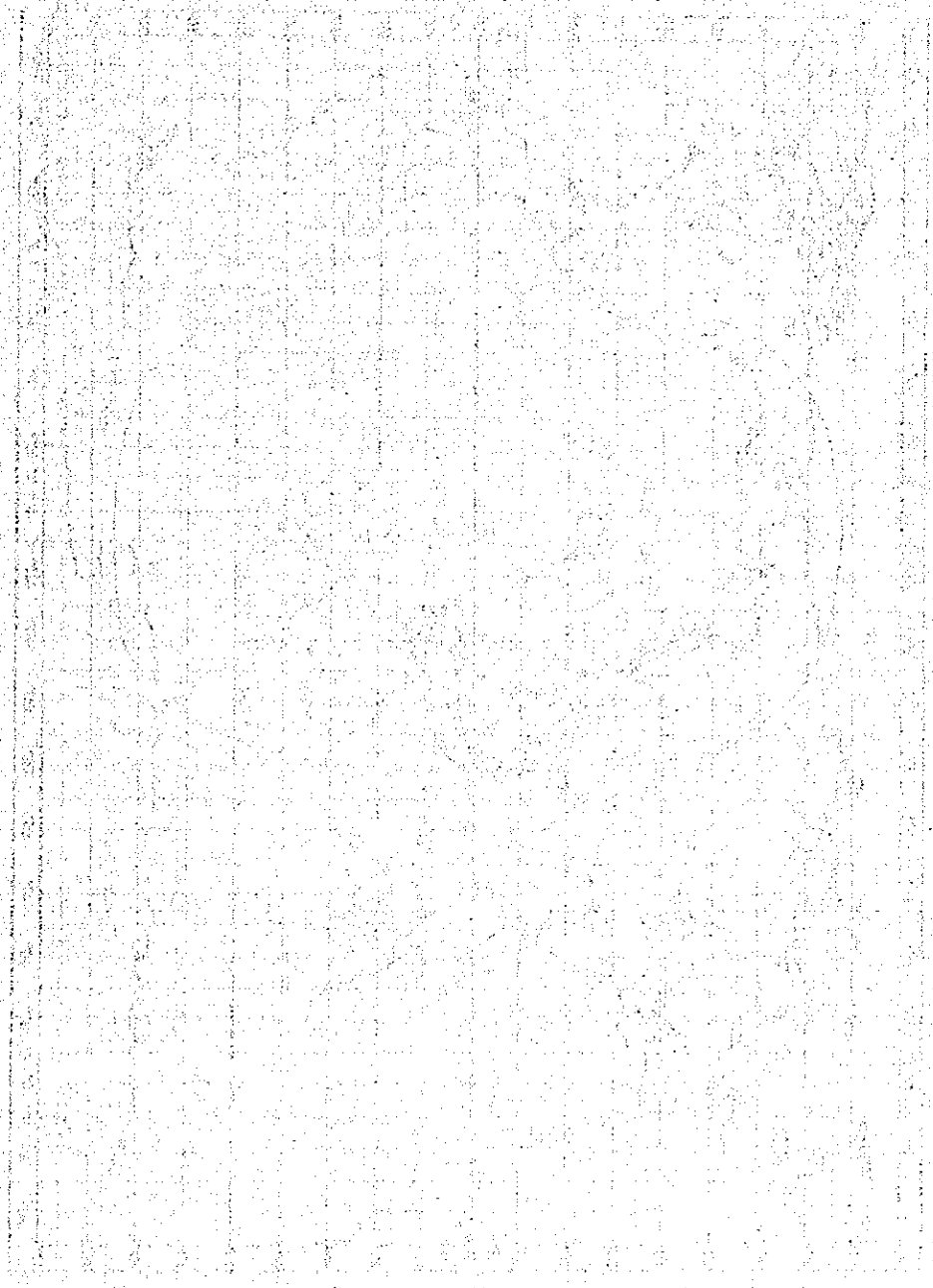


Figure-1 INTELSAT-IV Satellite Coverage (El≧5°)

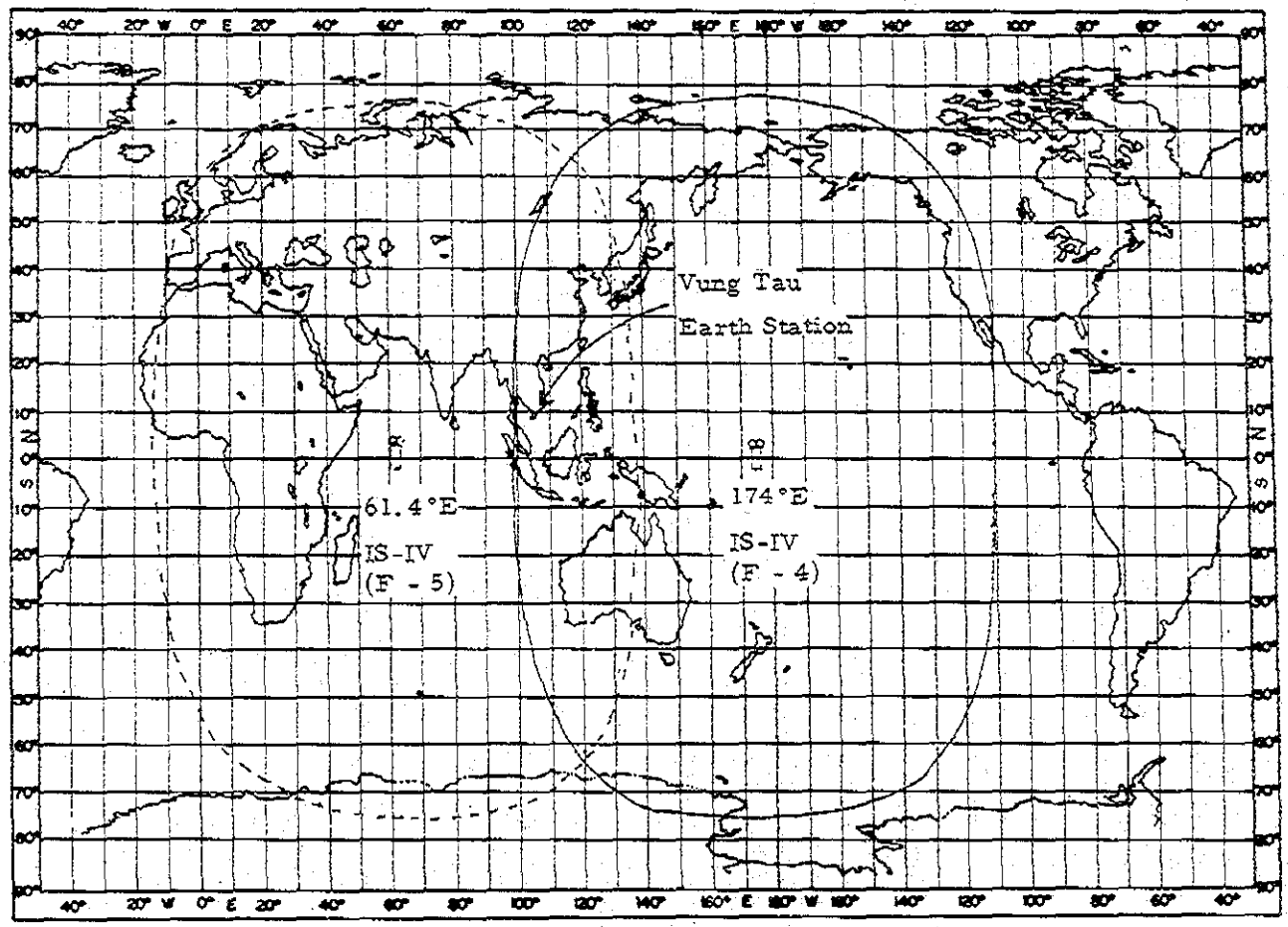


Figure 2 Possible International Transmission Path for Multiple Destination Telephony Transmissions (Only One Direction of Transmission Shown)

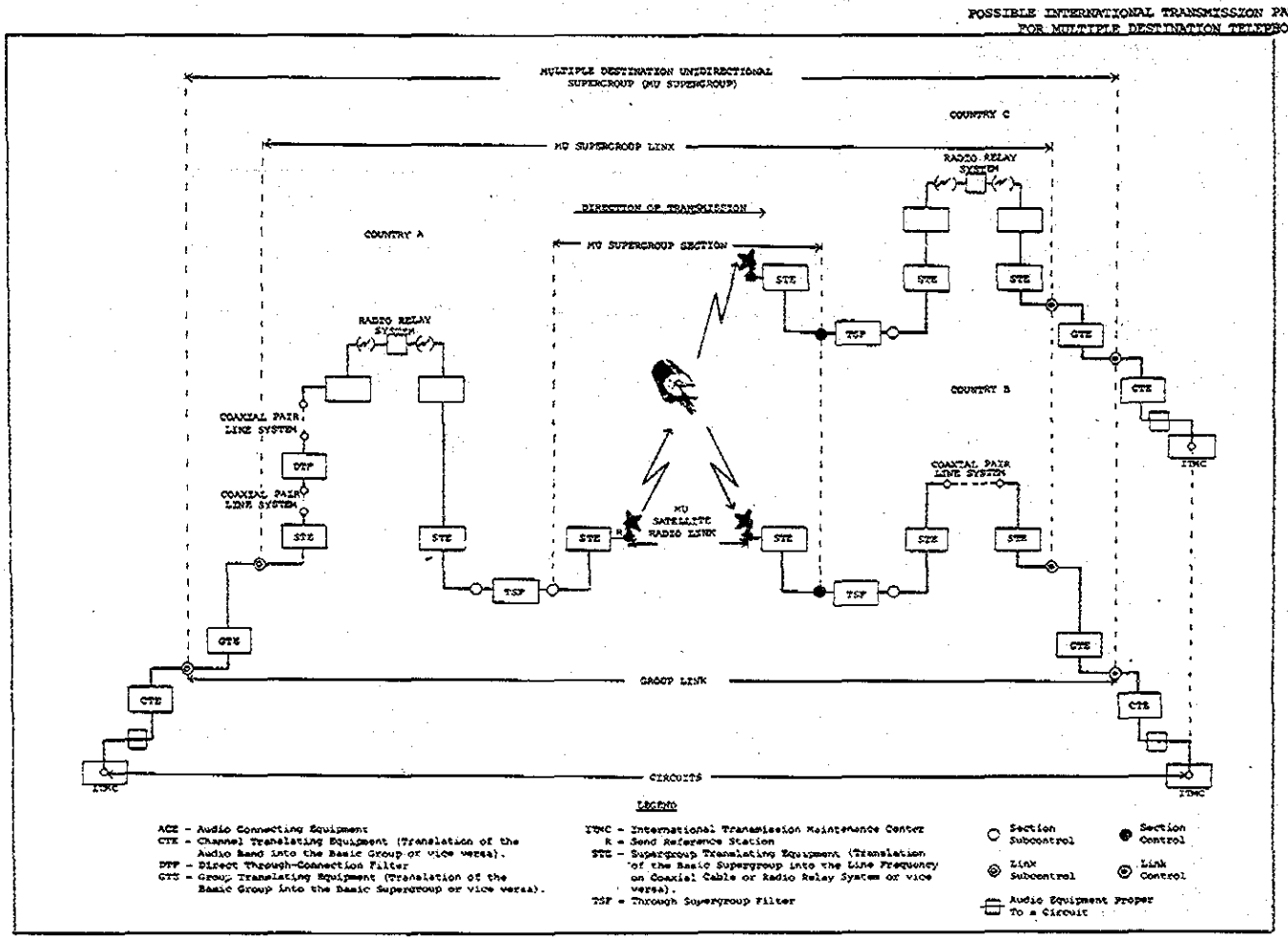
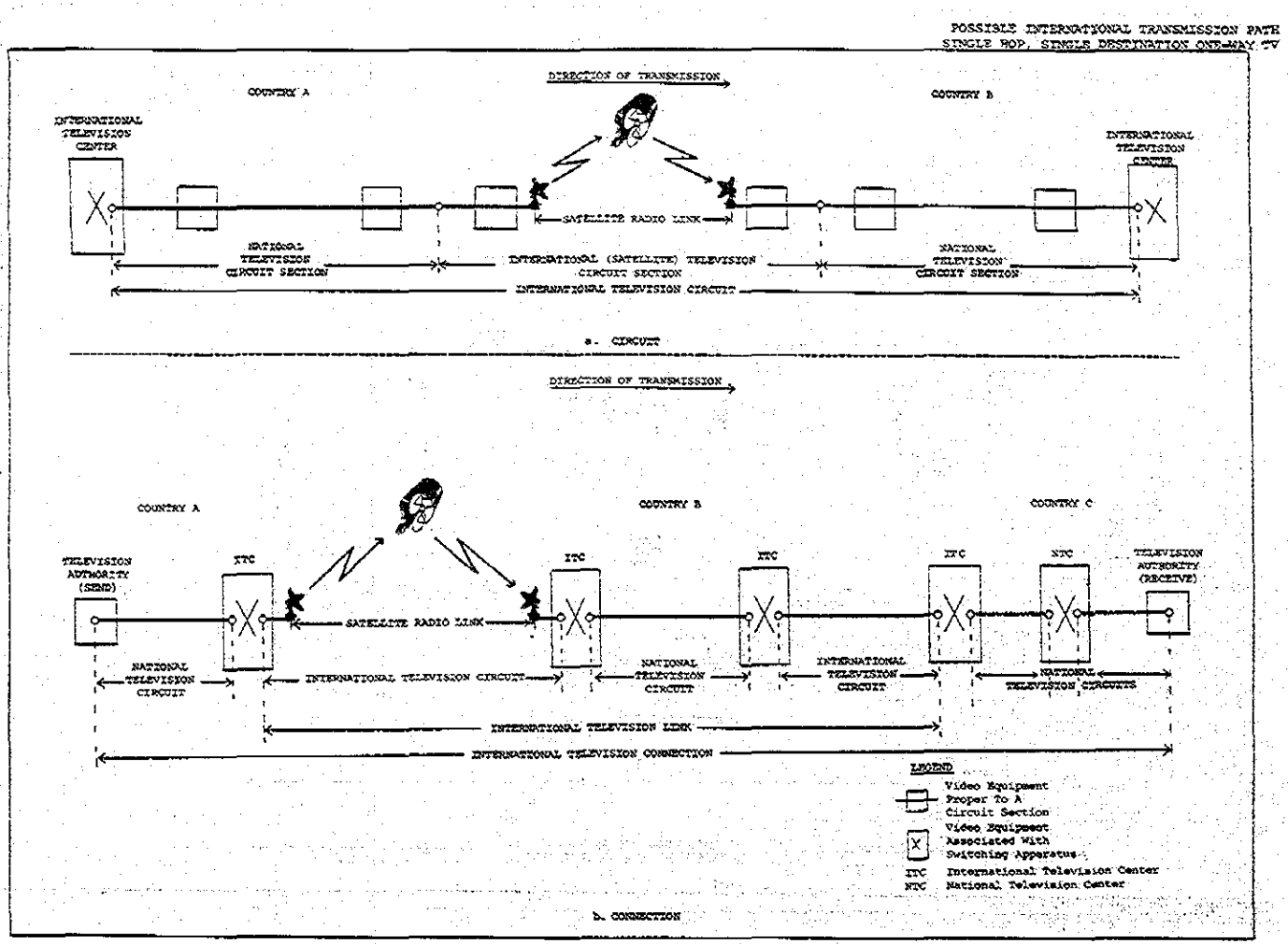


Figure - 3 Possible International Transmission Path for Single Hop, Single Destination, One-Way Television Transmissions



B. Circuit Design

Considering from the present state as well as future development of international telecommunication traffic in Viet-Nam, it is presumed that the traffic requirement can fully be satisfied just by using the pacific satellite only for the time being. Therefore, circuit design was worked out with respect to the terminals that have access to this satellite.

The names of earth stations which are participating in the Pacific satellite as of February 1973 are indicated in Table-3.

Table - 3

EARTH STATIONS IN THE PACIFIC REGION

A. Existing Earth Stations (as of February 1973)

Satellite	Earth Stations	Country
INTELSAT IV(F-4)	Bartlett	U.S. (Alaska)
	Brewster	U.S. (Washington)
	Carnarvon #2	Australia
	Hong Kong #1	U.K. (Hong Kong)
	Ibaraki #3	Japan
	Jamesburg	U.S. (California)
	Kum San	Korea
	Lake Cowichan	Canada
	Mc Murdo	Antarctica
	Moree	Australia
	Paumalu #2	U.S. (Hawaii)
	Peking	People's Republic of China
	Pulantat	U.S. (Guam)
	Shanghai	People's Republic of China
	Si Racha #1	Thailand
	Taipei #1	Taiwan
	Tanay #1	Philippines
	Warkworth	New Zealand

B. Earth Stations Planned

Earth Stations	Country
Sentosa #2	Singapore
Vung Tau	Republic of Vietnam

a) Communication satellite for use: IS-IV F-4 Pacific satellite

b) Destinations of direct circuit : 8 destinations in 8 countries and places
Japan, Korea, Philippines, Singapore, Taiwan, Thailand, Hong Kong, U.S. Mainland

Among the above, the circuit with Thailand will be transferred to other types of system as soon as it is made available (either submarine cable or microwave system seems to be contemplated).

c) Satellite channels: Satellite channel allocation will be planned based on the channel requirement forecast as shown in Table-4.

Table - 4

ESTIMATION OF PACIFIC SATELLITE CHANNELS
FOR THE REPUBLIC OF VIET-NAM

Channels / Destination	Voice-grade channel (including telephone & VFT)		
	1976	1980	1985
Hong Kong	8	9	14
Japan	7	8	12
Korea	1	2	2
Philippines	3	3	3
Singapore	3	3	4
Taiwan	3	4	4
Thailand	2	*) -	-
U.S.A.	18	23	40
Total	45 ch	52 ch	79 ch

*) Messages are assumed to be routed to cable or international microwave link.

d) RF carrier: To accommodate the channels planned as above, transmit and receive carriers as indicated in Table-5 must be provided.

Transmit carrier bandwidth:

Bandwidth for telephone circuits: 5MHz (including telegraph, telex and service channels)

Bandwidth for TV video: 30 MHz

Bandwidth for TV audio or service channel: 2.5 MHz

e) Type of service and operating hours

Type of services: Telephone, telegraph and telex

Television (525/60 NTSC system)

Operating hours: 24 hours continuous

Table - 5

TRANSMIT/RECEIVE RF CARRIER

Item \ Carrier	Transmit Carrier	Receive Carrier
Telephone (including VFT and service circuit)	1	8 (13) *
TV video	1	1
TV sound and cue	2	2
Total	4	11 (16) *

( ) * denotes future requirements

3) Selection of Earth Station Site

The site of the earth station was selected by the Republic of Viet-Nam at the Vung Tau area located some 60 km southeast of Saigon (about 120 km in road distance via Bien Hoa) where there is a fine bathing resort.

This area was once selected at the survey performed in 1967 from among several candidate sites such as the outskirts of Saigon, Bien Hoa in the north, My Tho in the southwest and Vung Tau in the southeast, taking into consideration specific requirements for determining the location of an earth station site as well as the safety of the station which must be a primary necessity under a specific situation of this country.

The survey team arranged to select the site within the limit of the area of Vung Tau and picked up three candidate sites, two being proposed earlier by the Viet-Namese authority and one newly added by the survey team.

The geographical position of Vung Tau and the locations of each candidate site in the Vung Tau area are shown in Figs. 4 and 5.

General Aspects of Candidate Sites

a) Candidate Site No. I

The site is located at the foot of a mountain that lies at the extreme south of a peninsular. This place was formerly a quarry and directly faces the South China Sea. It stands about 30 m above the sea-level, and a highway runs in its front. An area of about 3 ha will be available. It is anticipated that this place and its vicinity will increasingly have tourist facilities in future.

b) Candidate Site No. II

This site is a place where an earth station was earlier planned to be constructed. The soil is of the sand seam that lies on a damp ground. The site has an area of 2 ha (200 m X 100 m) and faces a highway. Urbanization is in progress in the vicinity. It is situated at a position about 0.5 km from the shoreline across a sand hill.

c) Candidate Site No. III

The site is situated at a sand hill region in the central part of a peninsular, being separated far from a highway across a cultivated land that forms a swamp-like damp ground. The neighbouring areas are utilized for cultivating fruit trees. There are only a few dwellings scattered alongside the highway. An access road of about 400 m in length may have to be provided to reach the highway.

The results of survey on each candidate site are as indicated in Table-6.

Particularly careful consideration must be given to be candidate site No. 3, as it may possibly be interrupted by the OH radio beam which is radiated from a military radio base towards the direction of Camranh Bay.

As regards the requirements for clearance of elevation, microwave link to connect with the Central Office, weather conditions, commercial power supply and inhabitability, there is no significant difference in their merit among these three candidate sites, each being satisfactory in this regard. In comparison, however, the site No. I will be considered most suitable.

The azimuth, elevation and range of the IS-IV satellite viewed from the Vung Tau area are shown in Table - 7.

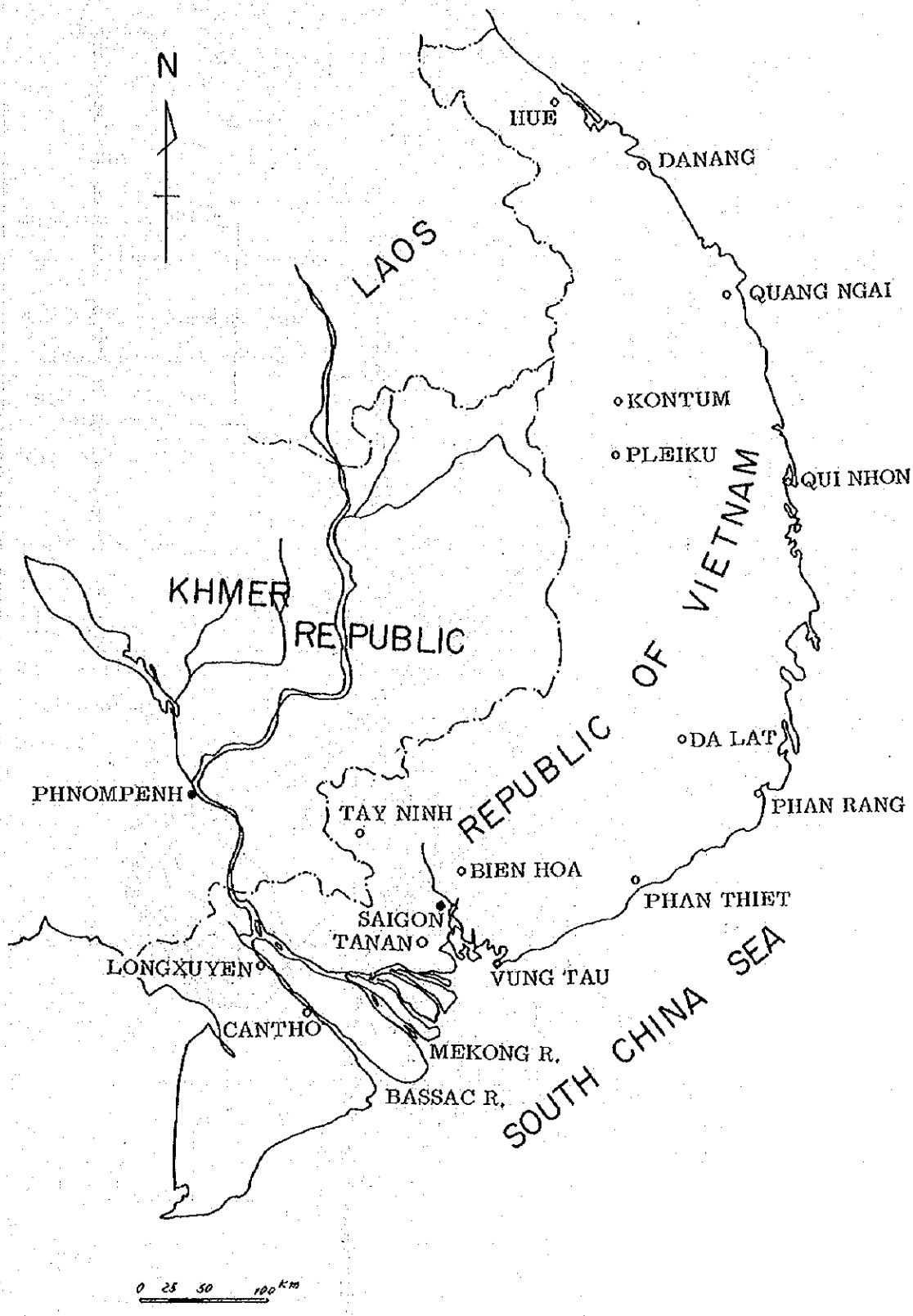


Fig. 4. GEOGRAPHICAL POSITION OF VUNG TAU

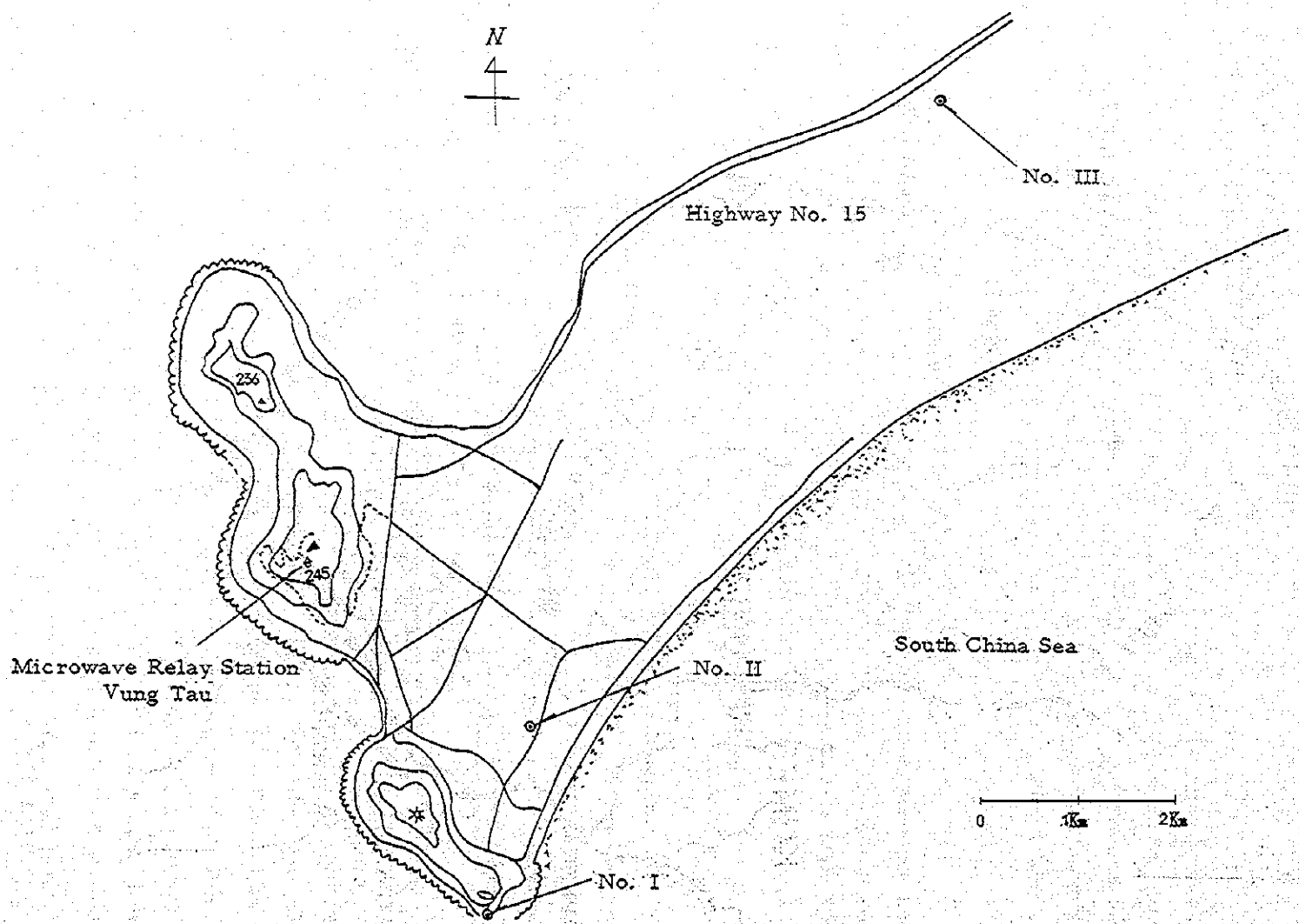


Fig. 5 Proposed Earth Station Locations at Vung Tau

Table - 6

COMPARISON OF CANDIDATE EARTH STATION SITES

Items \ Candidate site	No. I	No. II	No. III
Satellite Visability	good	good	good
Radio Frequency Interference	Estimated Fair	Est. Poor to Fair	Est. Poor
Access to microwave link	good	good	good
Meteorological Condition	mild	mild	mild
Commercial power (from Power Station)	7 km	4 km	7 km
Road accessibility	good	good	fair (0.4 km to highway)
Soil conditions	Estimated good (Rock ground)	Estimated fair (Sand seam on a damp ground)	Estimated fair (Sand hill on a damp ground)
Area	approval	approval	enough
Land arrangement	necessary	necessary	almost not
Surroundings	good	fairly good	good
Others	Isolated from terrestrial interference sources, having a mountain on one side and an open sea on the other.	Susceptible to terrestrial interference, being located at a flat plain.	Susceptible to terrestrial interference, being located at a flat plain.
Order for recommendation	1	3	2

Table - 7

AZIMUTH, ELEVATION AND RANGE OF IS-IV SATELLITE VIEWED FROM VUNG TAU EARTH STATION

Position in orbit	Azimuth in degrees	Elevation in degrees	Range in km.
174°E (Pacific Ocean Region)	94	14	40,170
61.4°E (Indian Ocean Region)	260	36	38,100

4) Facilities of Satellite Communications System

A. Composition of Equipment and Facilities

The satellite communications facilities include earth station facilities, microwave link facilities and central office facilities. A blockdiagram of the overall satellite communications system is shown in Fig. 6.

The earth station facilities are composed of the antenna, tracking equipment, radio transmitter/receiver, terminal equipment, test and supervisory equipment, power supply equipment, station building and ancillary equipment. A blockdiagram of earth station radio facilities such as the antenna, transmitter/receiver, and modulator/demodulator is shown in Fig. 7.

Fig. 8 gives a blockdiagram of the earth station terminal equipment. Fig. 9 is a blockdiagram of power supply equipment that indicates power supply system of the earth station.

In Fig. 10 is shown a blockdiagram of microwave link equipment used for connecting the earth station with the central office. Fig. 11 shows a blockdiagram of central office equipment for satellite communications to be installed in Saigon Central Office building.

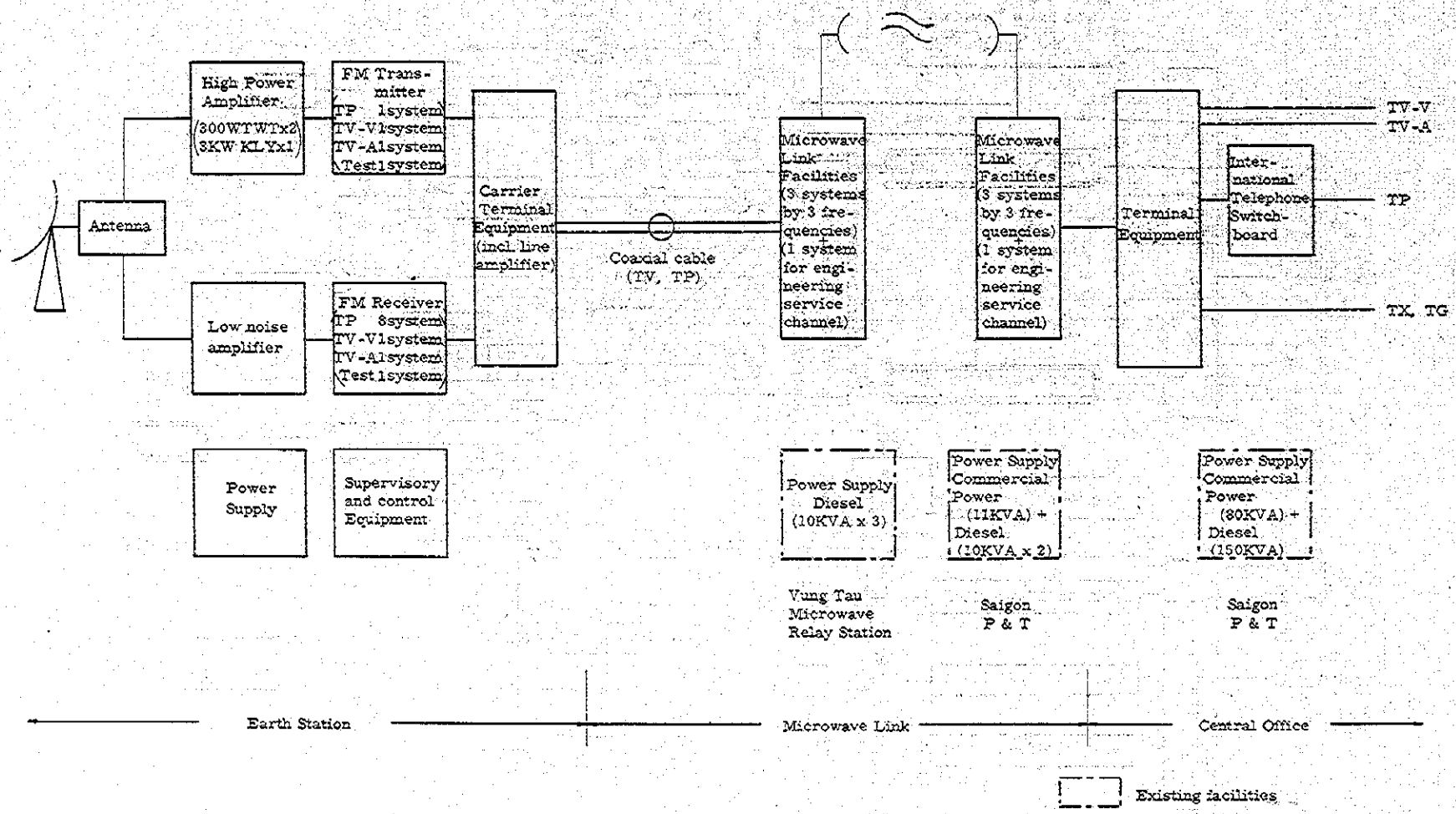


Fig. 6 Blockdiagram of Integrated Earth Station Facilities

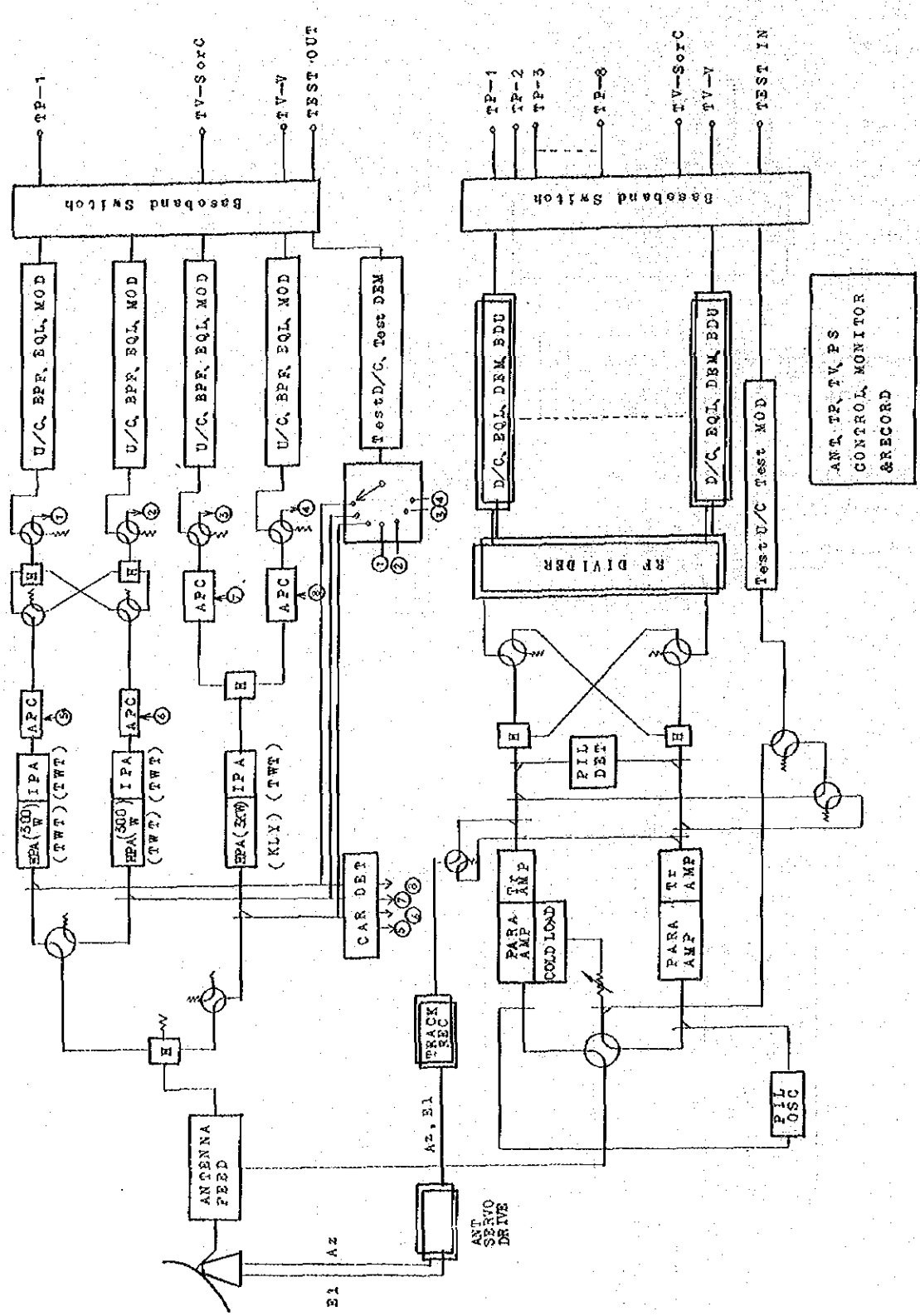


Fig. 7 BLOCKDIAGRAM OF ANTENNA AND RADIO TRANSMITTER/RECEIVER

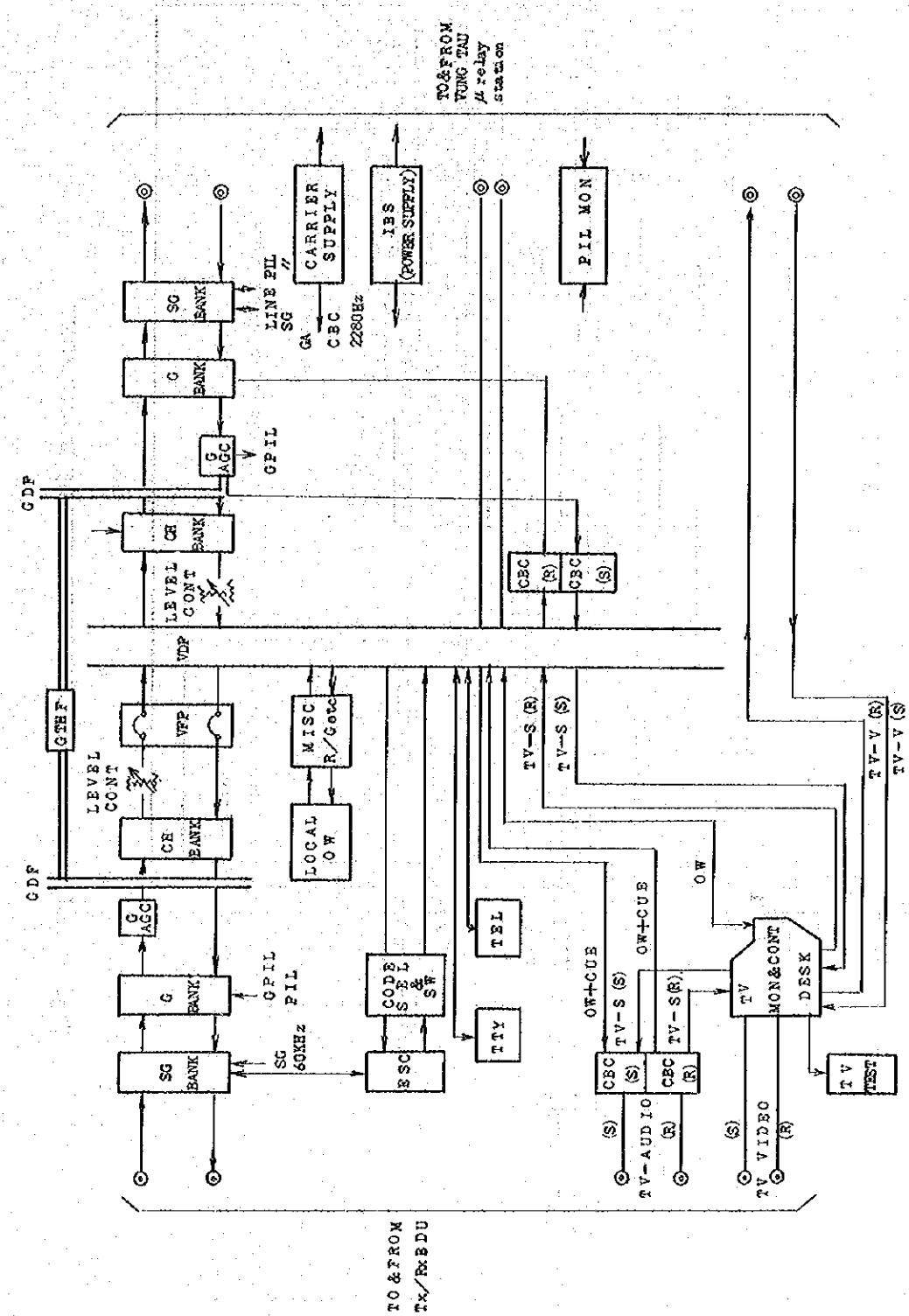


Fig. 8 BLOCKDIAGRAM OF TERMINAL EQUIPMENT

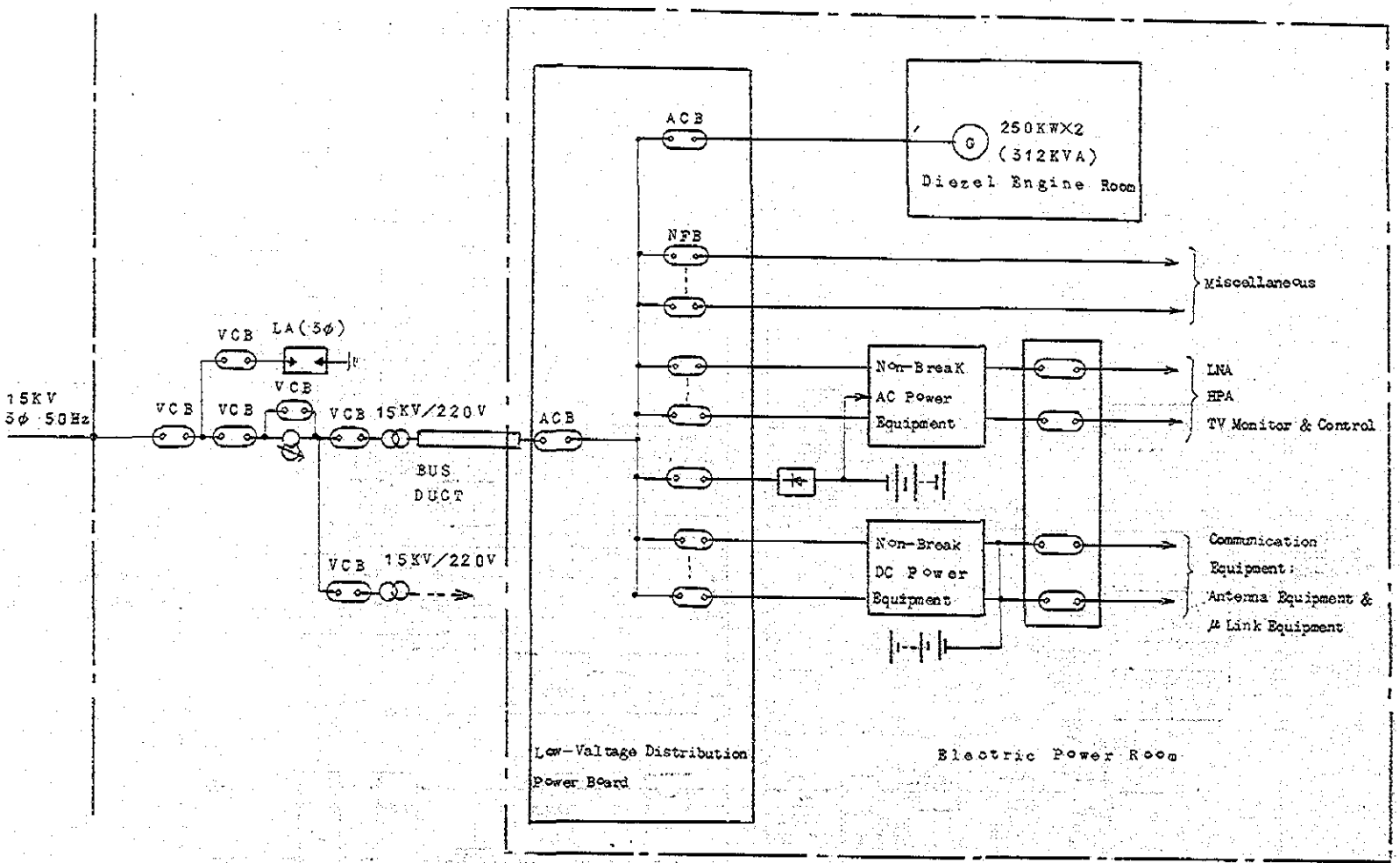
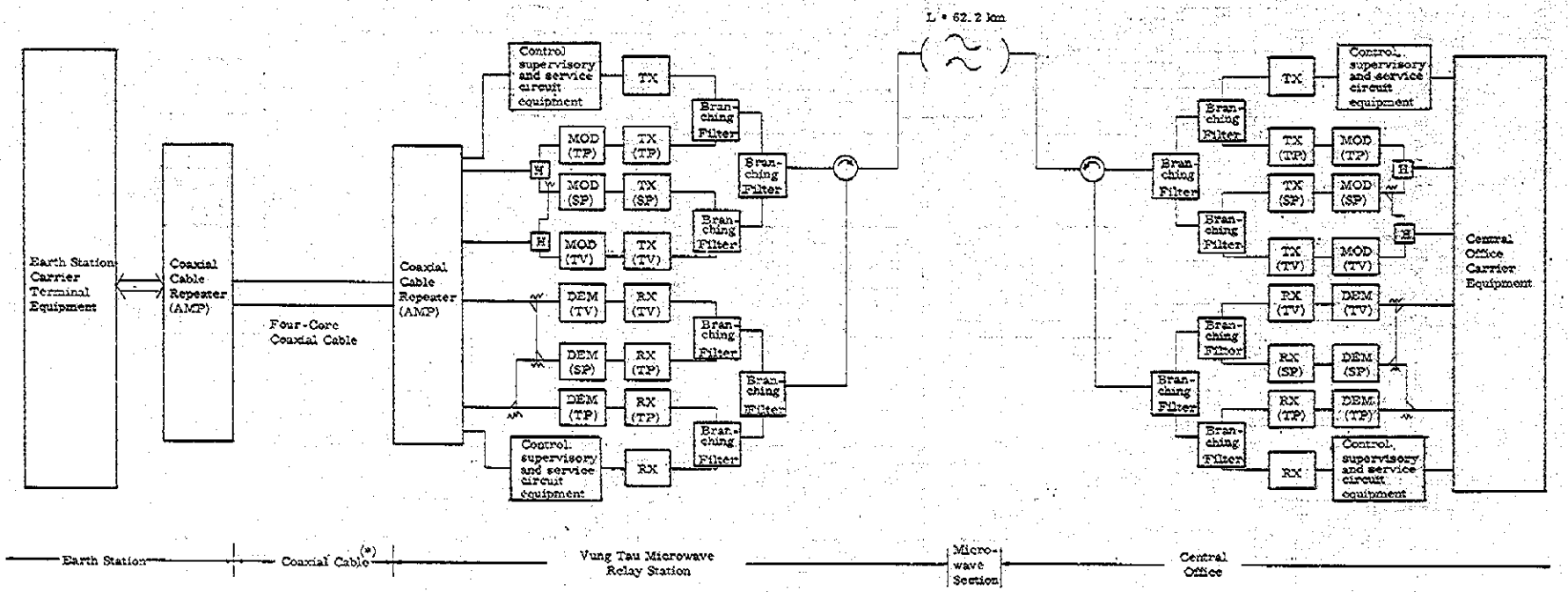


Fig. 9 BLOCKDIAGRAM OF POWER SUPPLY EQUIPMENT



(*) Microwave will be used in the case of the site No. 3.

Fig. 10 Blockdiagram of Connecting Link between Earth Station and Central Office

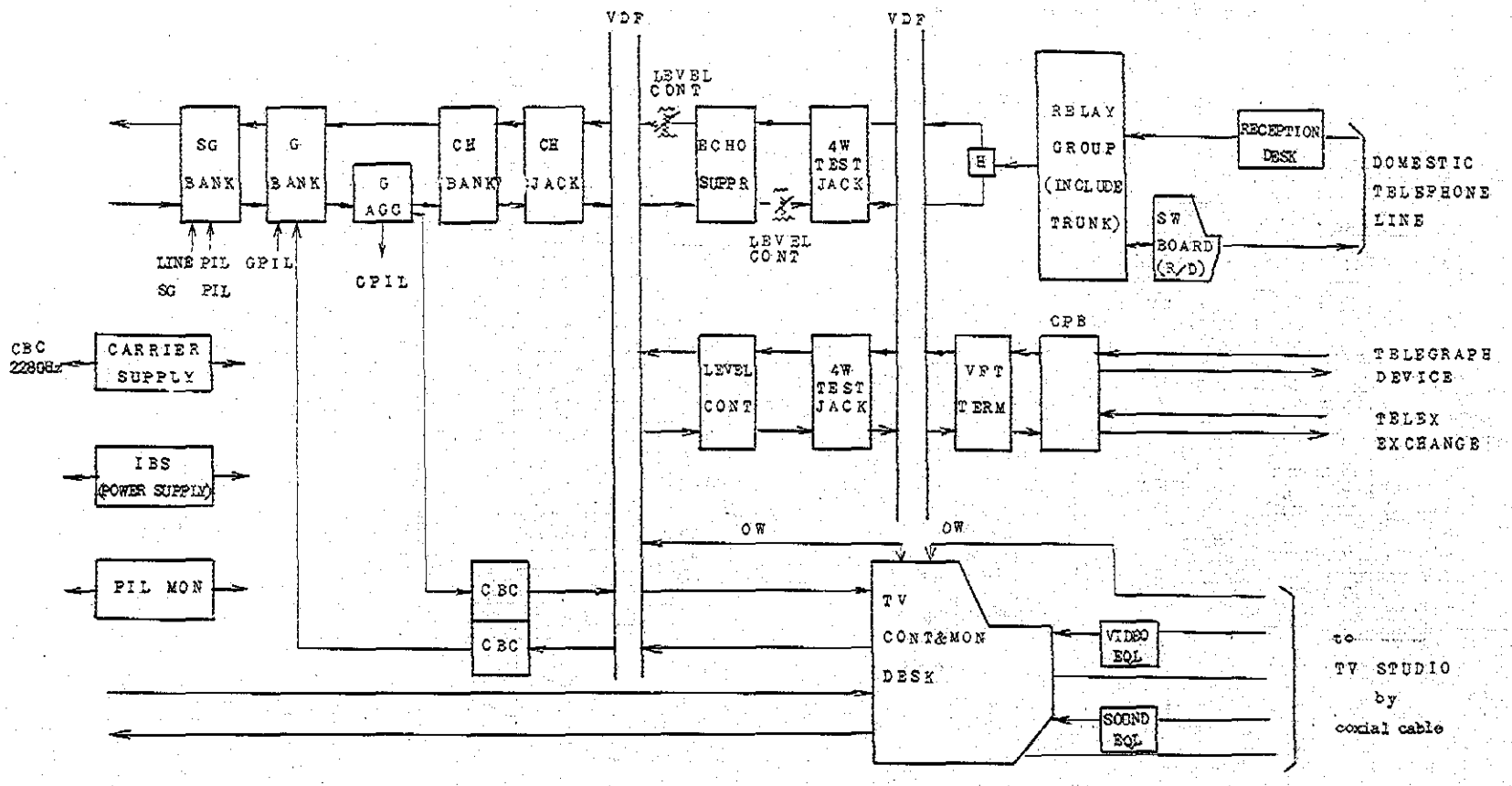


Fig. 11 BLOCKDIAGRAM OF SAIGON CENTRAL OFFICE FACILITIES

B. Outlines of Principal Equipment

a) Antenna

In order to meet the requirements for performance characteristics of the INTELSAT standard earth station, the antenna system should be mounted with a main reflector which measures 28 m or greater in diameter. For the sake of convenience in performing routine maintenance and operation, it is recommended that the antenna should be of Cassegrain type which is fed by four-reflector beam-waveguide, and azimuth rotation should be on the wheel-on-track mode. Tracking will be both automatic and manual.

The antenna pedestal is a supporting structure of the antenna and constitutes part of the station building. Communications equipment will be installed inside of this pedestal.

b) Transmitting Equipment

For telephone signal transmission, two units of TWT amplifiers, for operation and for standby, with the output of 300 W each will be provided. For television transmission, a unit of Klystron amplifier with the output of 3 kw will be used.

FM signal modulators will be provided each for every transmit carrier so that multiplex telephony or television signals may be modulated to take out 6 GHz carrier signals which will be supplied to the power amplifier.

c) Receiving Equipment

For the initial amplifying stage, two units, for operation and for standby, of helium gas-cooled parametric low noise amplifier will be provided. Studies are now under way in many countries to adopt an uncooled parametric amplifier together with a wide aperture reflector just for easier maintenance work. In this project, however, this method is not taken into consideration.

The figure of merit of earth station equipment performance can be expressed by the G/T, that is, the ratio between receive antenna gain and noise temperature. As a standard earth station, a capability must be incorporated to satisfy the requirements for the G/T of 40.7 dB or better (at 4 GHz) under clear sky at an elevation angle of 5°.

The parametric amplifier must be capable of amplifying RF signals in the entire 4 GHz frequency range (3,700-4,200 MHz). FM demodulators will be provided each for every receive carrier. As an initial installation, 9 units (including 1 for monitor) for telephony and 2 units (for video and for sound) for television will be mounted.

d) Terminal Equipment

Carrier telephone terminal equipment will be provided so as to convert

signals incoming from a microwave connecting link into baseband signals for transmission to satellite circuits, and vice versa. There will also be installed engineering service circuit equipment, TV carrier terminal equipment and others. Provision of TV standards converter is not considered.

e) Power Supply Equipment

The power will be supplied to the earth station equipment from the commercial mains 15 kV, 3-phase, 50 Hz available in Vung Tau. For this purpose, a substation plant with a capacity of 350 kVA will be installed. Besides, there will be provided two units of 312 kVA Diesel generator for emergency use.

No-break AC power supply and DC power source will also be provided to ensure continuous power supply to principal earth station equipments in the event of a mains failure.

f) Microwave Connecting Link Equipment

As regards an interconnecting link between earth station and central office, it is desirable to set up a microwave circuit in a frequency range other than that allocated for satellite communications (for instance 7 GHz or 5 GHz range) along the existing 6 GHz domestic microwave route running between Saigon and Vung Tau.

This circuit will be composed of such three systems as multiplex telephony, television and spare.

With respect to the candidate sites Nos. I and II, the microwave relay station may be connected with the earth station by means of a coaxial cable (about 5 km in length). In the case of the site of No. III, connection may be set up by extending the microwave link that will be connected with the Central Office.

Studies should be made to dismantle the existing 6 GHz domestic microwave link sometime in future. There is a strong possibility in this system to cause interference to the satellite system because these two systems are operated in the same frequency range. Obsolescence of this domestic link gives another reason to dismantle it.

The domestic circuits carried in the microwave route to be dismantled may be transferred without difficulty to the microwave link in use for satellite communications, by making arrangement to connect the earth station and Vung Tau Post and Telephone Office with a pair cable.

g) Central Office Equipment

The central office equipment for satellite communications mostly

consists of the equipment and facilities to be used in the International Transmission Maintenance Center (ITMC) and International Television Center (ITC). It also includes the international manual telephone switchboard.

A carrier telephone terminal to be connected with the microwave link, an echo-suppressor and a test panel will be provided for use in the ITMC. A VFT terminal will also be made available. A television supervisory and test console will be provided in the ITC.

A plan is now conceived to establish a new international telephone exchange by integrating the existing international switchboard facilities that are dispersed in several locations such as toll telephone switchboard in Saigon Telephone Office, USO, and Press Center. In this connection, 18 positions (including information and supervisory positions) of manual switchboards will be made available.

5) Schedule of Construction Work and Others

a) Construction Schedule

A construction schedule of this project is shown in Table-8.

b) Personnel and Training

The earth station must be manned with about 25 members for maintenance and operation of the equipment, and the central office with about 9 members for the ITMC (including the ITC). Telephone operators also may have to be increased in number.

To ensure smoother implementation of the earth station operation, training should be given to the technicians and operators prior to the operational commissioning of the earth station. The curriculum of training is shown in Table-9.

c) Coordination Problem with Neighbouring Countries

In establishing an earth station in the Vung Tau area, it becomes necessary to make coordination with neighbouring countries in respect of radiowave interference. For this purpose, we have developed "Cordination Distance" by calculation as is indicated in Figs. 12 and 13. Coordination should be made with the neighbouring countries based on this document.

6) Cost of Construction

Table-10 indicates a cost schedule necessary for construction of the earth station, which has been worked out based upon a general design of the earth station.

It does not include expenses necessary for acquiring an earth station site, for laying a commercial power line and for constructing an access road to the station.

The cost of building construction and land readjustment represents an average figure because there is little difference, say 5 % or so, in the cost of construction of the antenna foundation and land readjustment, which arises from the difference in the conditions of location of the three candidate sites.

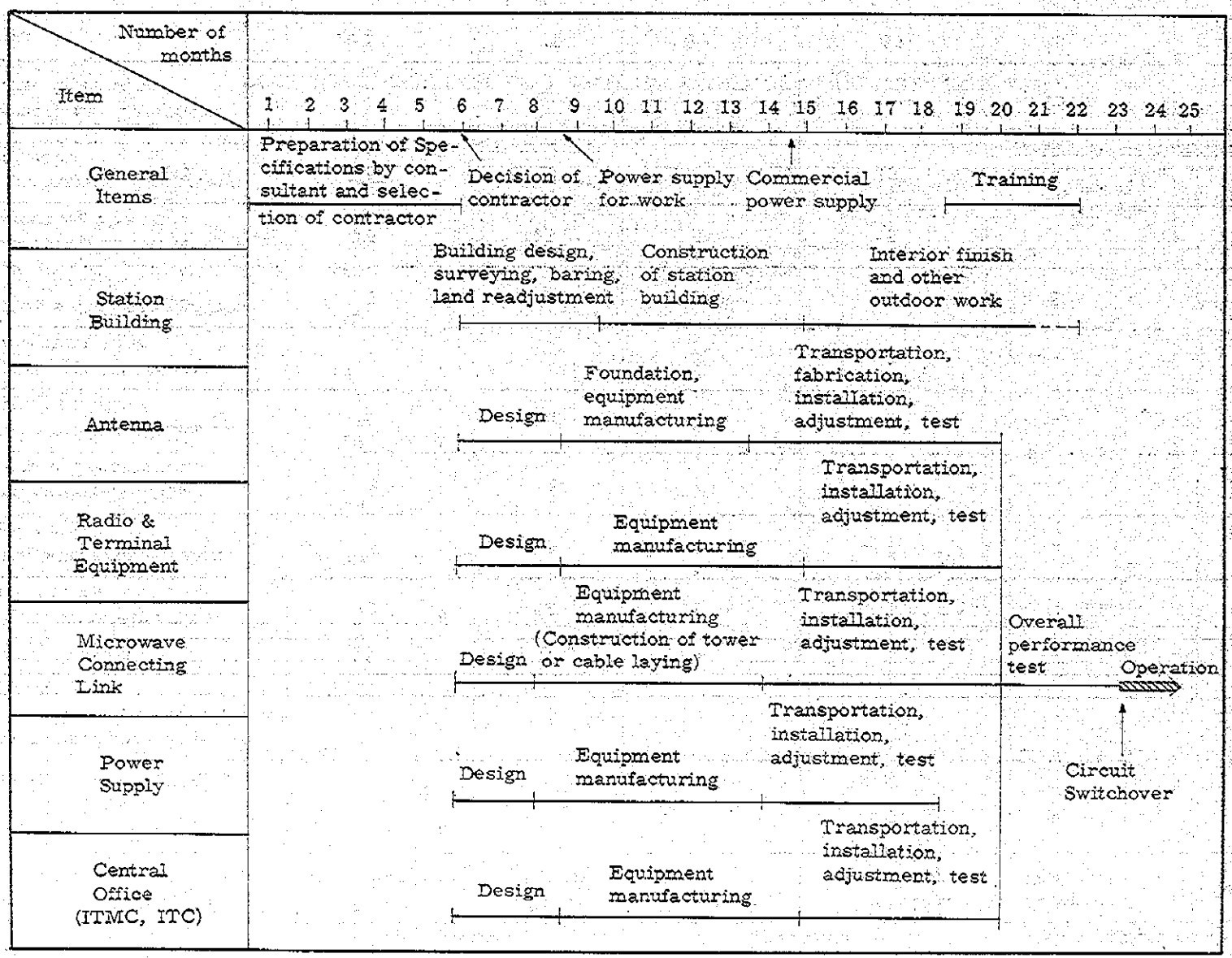


Table 8 Construction Schedule of Viet-Namese Earth Station

Note: "Equipment manufacturing" includes acceptance test in the factory.

Table-9

TRAINING CURRICULUM FOR EARTH STATION AND CENTRAL OFFICE PERSONNEL

Unit: Hour

Subject \ Personnel	Earth Station Maintenance		Earth Station Operation		Central Office	
	Super-visor	Tech-nician	Super-visor	Technical Operator	Telephone Operator	Technician
International tele-communications & organization of INTELSAT	7	3	7	3	-	-
Communications Satellite & Satellite Communications System	5	5	5	5	-	-
Circuit Design	10	10	5	5	-	-
Elementary Microwave Engineering	10	10	5	5	-	5
Elementary Television Engineering	5	5	3	3	-	5
Elementary Multipled Carrier Techniques	3	3	3	3	-	3
Outlines of Earth Station Plant Facilities	30	15	20	10	-	10
Outlines of Microwave Connecting Link	5	3	3	3	-	3
Outlines of Central Office Plant Facilities	5	3	3	3	5	5
Measuring Instruments & Measuring Practice	15	15	5	5	-	5
Earth Station Equipment Operation	5	3	30	20	-	-
International Telephone Traffic Operation	-	-	-	-	15	-
Total	100	75	89	65	20	36

Table - 10

COST SCHEDULE FOR VIET-NAMESE EARTH STATION CONSTRUCTION

Item \ Amount of cost	(Unit: Million yen)			(Unit: Thousand U.S. dollars)		
	Foreign currency	Local currency	Total	Foreign currency	Local currency	Total
Earth Station Facilities	1,098	42	1,140	3,565	136	3,701
Earth Station Building & Land Readjustment	88	71	159	286	230	516
Central Office Facilities	234	5	239	760	16	776
Microwave Link Facilities	98	7	105	318	23	341
Consignment of Maintenance	18		18	58		58
Consultant Fee	75		75	244		244
Total	1,611	125	1,736	5,231	405	5,636
Reserve	30	120	150	97	390	487
Grand Total	1,641	245	1,886	5,328	795	6,123

Exchange Rate: 1 U.S. Dollar = 308 yen

Figure - 12 Co-ordination contours for 6GHz Transmitting

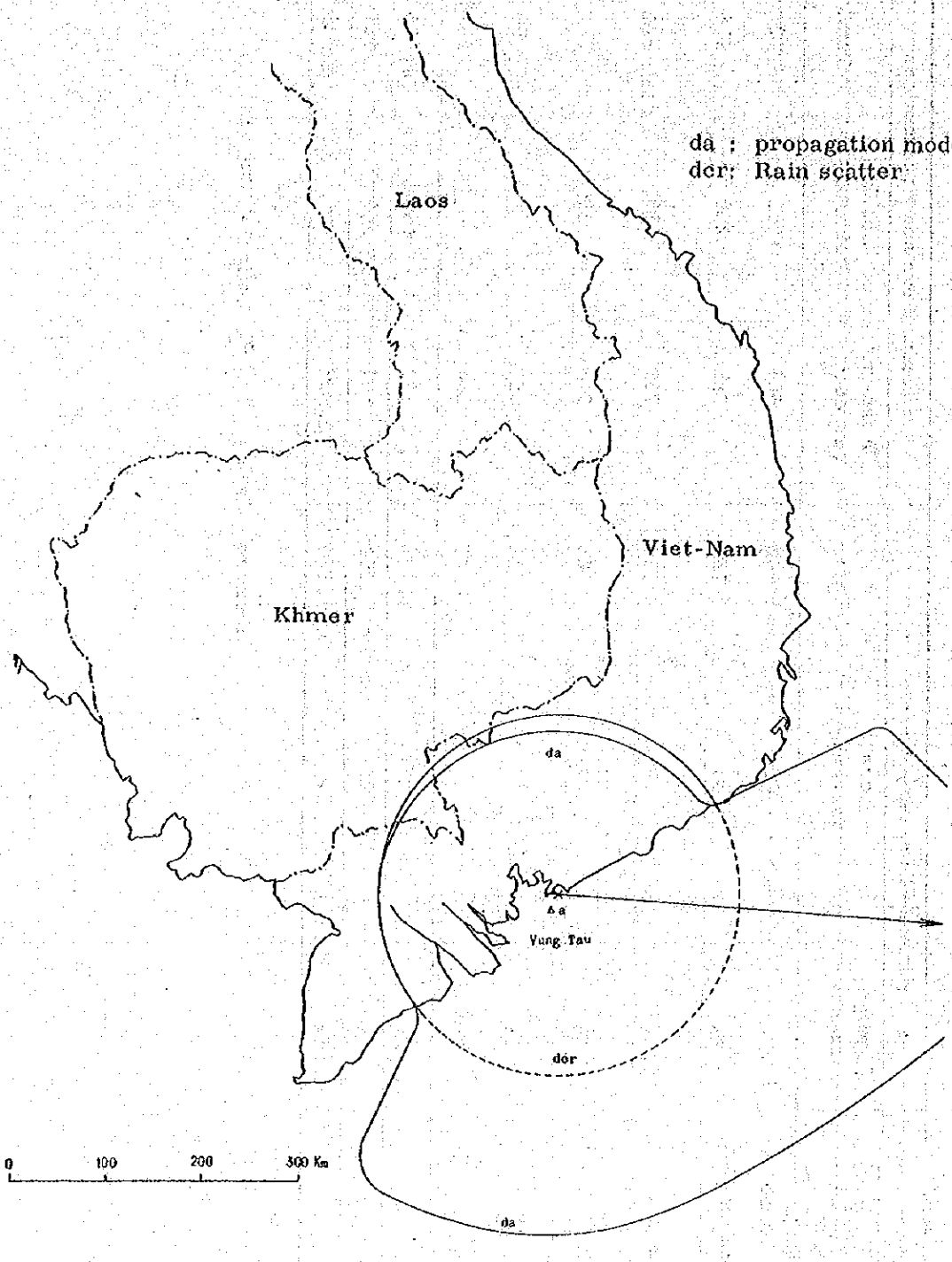
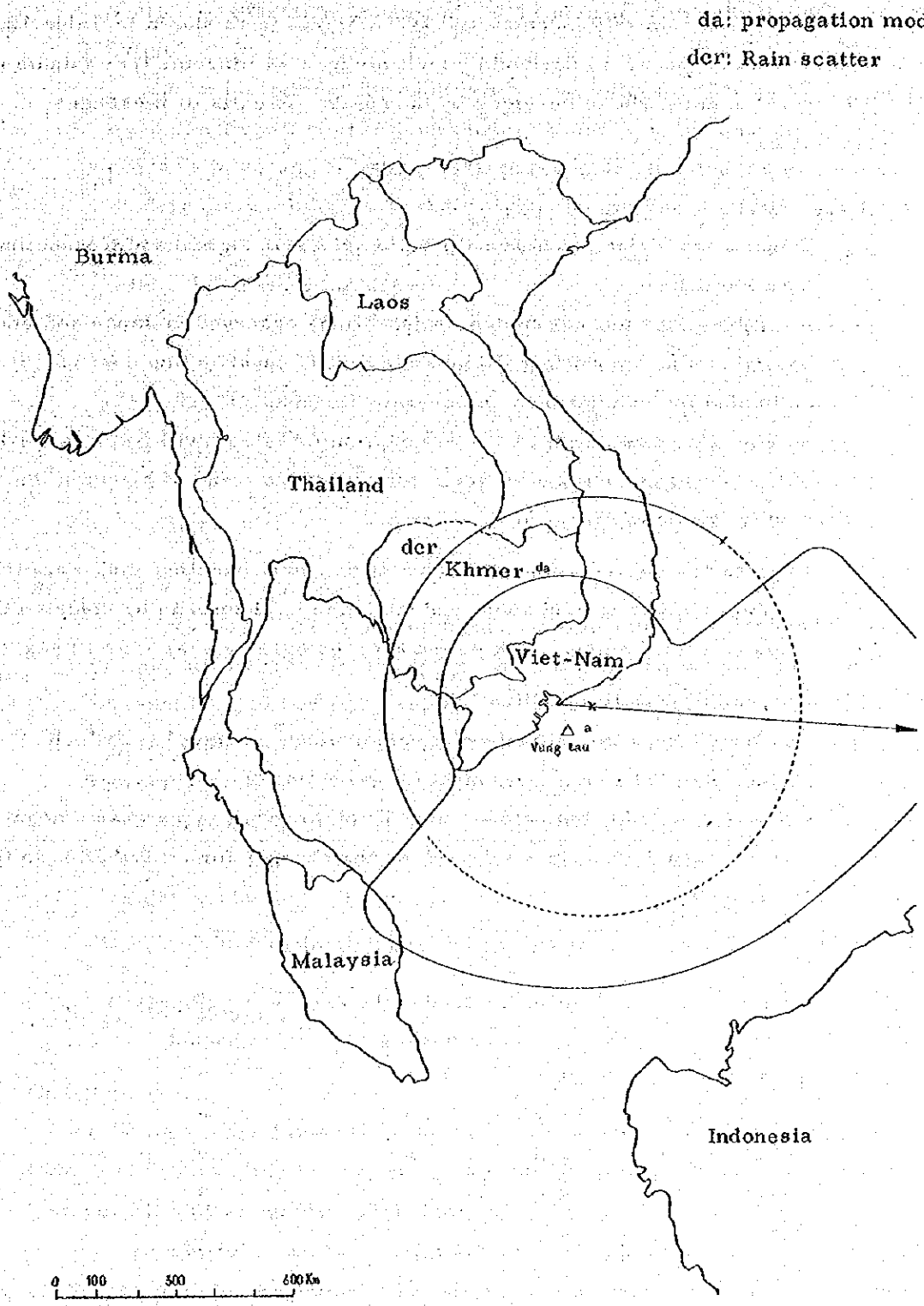


Figure - 13 Co-ordination contours for 4 GHz Reception



5. Economic Evaluation

1) Estimation of Incomes and Expenditures

A. Income

Estimation of yearly incomes and expenditures is as shown in Table 1.2. The amount of income is derived by multiplying a unit income (per minute or per word) of each type of services by the number of calls or messages estimated.

B. Expenditure

a) Expense for Maintenance and Operation of Earth Station and Connecting Link Facilities

Taking into account customary practices observed in Japan and other countries, the amount equal to 15 per cent of construction cost is estimated for maintenance and operation expenses.

Calculation is made on the assumption that there will be an increase of 5 per cent in costs every year, in view of the trend of prices in the past in Viet-Nam.

b) Expense for Depreciation of Earth Station and Connecting Link Facilities

Depreciation of equipment and facilities is planned to be made on the basis of a fixed amount, taking the average durable years for 10 years.

c) Charges for Satellite Utilization

The charges for utilization of communications satellite, which reflect the INTELSAT's proposal for reduction of charges, are estimated as indicated below. In addition to such charges, an amount of 150 thousand dollars is estimated for the charges for contribution to the INTELSAT.

Year		
1976	6.6 thousand dollars a year	Per voice-grade channel
1977	6.2 "	"
1978	5.8 "	"
1979	5.4 "	"
1980	5.0 "	"
1981	4.6 "	"
1982	4.2 "	"
1983	3.8 "	"
1984	3.4 "	"
1985	3.0 "	"

d) Expense for Business Operation and Administration

This expense includes all the expenses relative to personnel, supplies, depreciation and such others in regard to International Telecommunication Section of Direction General of Post and Telecommunications and Central Office.

As an instrument for calculation, the following indices have been set forth for the prime cost per channel, based upon the cost accounting practice in Japan and taking Viet-Nam's specific situation into consideration.

Calculation is made by multiplying the amount of expense per channel of each type of services by the number of channels estimated.

(1) High Frequency Circuit

Telephone:	28 thousand dollars per channel
Telegraph:	77 thousand dollars per channel

(2) Satellite Circuit

Telephone:	12 thousand dollars per channel
Telegraph:	92 thousand dollars per channel
Telex:	10 thousand dollars per channel

e) Interest

As regards interest on the loan, two instances are contemplated. One of them involves the terms of loan set forth by the World Bank (annual interest of 7.25 per cent, repayment in 20 years including 5 years' grace), and the other is on a more soft terms (annual interest of 3 per cent, repayment in 25 years including 7 years' grace). The loan repayment program is shown in Table-11.

C. Balance sheet

Balance sheet estimates by year are shown in Table-12.

2) Cash Flow

Refer to Table-13.

3) Conclusions

As is seen from Table-12, a deficit will continue in the business for about five or six years after the system is put into operation. In the succeeding years, however, it will gradually go into black figures.

As a conclusion, we are of opinion that the implementation of the satellite earth station in the Republic of Viet-Nam is amply feasible in its economic and technical aspects.

Unit : Thousand dollars

Year	Repayment in installments for 20 years (including 5 years of unredeemable period) at annual interest 7.25%			Repayment in installments for 25 years (including 7 years of unredeemable period) at annual interest 3%		
	Amount repaid	Remainder	Interest	Amount repaid	Remainder	Interest
1st year I	0 Loan agreement concluded and			0		
II	0 Deferment term commenced			0		
2nd year I	0 Construction Period : One and half years			0		
II	0			0		
3rd year I	0			0		
II	0 Start of Operation	6123	222) 444	0	6123	92) 184
4th year I	0	6123	222	0	6123	92
II	0	6123	222) 444	0	6123	92) 184
5th year I	0	6123	222	0	6123	92
II	0	6123	222	0	6123	92) 184
6th year I	205	5918	222	0	6123	92
II	205) 410	5713	215) 422	0	6123	92) 184
7th year I	205	5508	207	0	6123	92
II	205) 410	5303	200) 372	0	6123	92
8th year I	205	5098	192	171	5952	92
II	205) 410	4893	185) 362	171) 342	5781	89) 176
9th year I	205	4688	177	171	5610	87
II	205	4483	170	171	5439	84
10th year I	205	4278	163	171	5268	82
II	205 410	4073	155) 303	171) 342	5097	79) 155
11th year I	205	3868	148	171	4926	76
II	205) 410	3663	140) 273	171) 342	4755	74) 145
12th year I	205	3458	133	171	4584	71
II	205) 410	3253	125) 243	171) 342	4413	69) 135
13th year I	205	3048	118	171	4242	66
II	205) 410	2843	110) 213	171) 342	4071	64) 125
14th year I	205	2638	103	171	3900	61
II	205) 410	2433	96) 184	171) 342	3729	59) 115
15th year I	205	2228	88	171	3558	56
II	205) 410	2023	81) 154	171) 342	3387	53) 104
16th year I	205	1818	73	171	3216	51
II	205) 410	1613	66) 124	171) 342	3045	48) 94
17th year I	205	1408	58	171	2874	46
II	205) 410	1203	51) 95	171) 342	2703	43) 84
18th year I	205	998	44	171	2532	41
II	205) 410	793	36) 65	171) 342	2361	38) 73
19th year I	205	588	29	171	2190	35
II	205) 410	383	21) 35	171) 342	2019	33) 63
20th year I	205	178	14	171	1848	30
II	178	0	6	171) 342	1677	28) 53
21st year I				171	1506	25
II				171) 342	1335	23) 43
22nd year I				171	1164	20
II				171	993	18
23rd year I				171	822	15
II				171) 342	651	12) 22
24th year I				171	480	10
II				171) 342	309	7) 12
25th year I				171	138	5
II				138	0	2
Total	6123	0	4536	6123	0	2520

Table - 11 LOAN REPAYMENT PROGRAM

Table - 12 ESTIMATION OF YEARLY INCOMES AND EXPENDITURES (1976-1985)

Upper figures: Interest 7.25%, repayment period 20 years including 5 years' grace.

Lower figure: Interest 3%, repayment period 25 years including 7 years' grace.

Unit: Thousand dollars

Item \ Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
Income from International communications services	3,632	3,889	4,169	4,477	4,814	5,372	6,010	6,740	7,575	8,531
Earth station and microwave link maintenance/ operation expense	918	964	1,012	1,063	1,116	1,172	1,230	1,292	1,356	1,424
Earth station and microwave link facilities depriciation expense	612	612	612	612	612	612	612	612	612	612
Charge for satellite utilization	447	441	428	420	410	417	410	405	398	387
Expense for business operations and administration	1,862	2,010	2,124	2,312	2,525	2,839	3,084	3,350	3,708	4,108
Interest (7.25%)	444	444	444	422	392	362	333	303	273	243
Interest (3%)	184	184	184	184	184	176	166	155	145	135
Total expenditures	4,283	4,471	4,620	4,829	5,055	5,402	5,669	5,962	6,347	6,774
	4,023	4,211	4,360	4,591	4,847	5,216	5,502	5,814	6,219	6,666
Balance between income and expenditure	- 651	- 582	- 451	- 352	- 241	- 30	341	778	1,228	1,757
	- 391	- 322	- 191	- 114	- 33	156	508	926	1,356	1,865

Table - 13 CASH FLOW

Upper figures: Interest 7.25%, repayment period 20 years including 5 years' grace.

Lower figure: Interest 3%, repayment period 25 years including 7 years' grace.

Unit: Thousand dollars

Item \ Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
(1) Balance between income and expenditure	- 651 - 391	- 582 - 322	- 451 - 191	- 352 - 114	- 241 - 33	- 30 156	341 508	778 926	1,228 1,356	1,757 1,865
(2) Depreciation	612	- 612	612	612	612	612	612	612	612	612
(3) Total (1) + (2)	- 39 221	30 290	161 421	260 498	371 579	582 768	953 1,120	1,390 1,538	1,840 1,968	2,369 2,477
(4) Amount repaid	0 0	0 0	205 0	410 0	410 171	410 342	410 342	410 342	410 342	410 342
(5) Remainder	- 39 221	30 290	- 44 421	- 150 498	- 39 408	172 426	543 778	980 1,196	1,430 1,626	1,959 2,135
(6) Grand Total	- 39 221	- 9 511	- 53 932	- 203 1,430	- 242 1,838	- 70 2,264	473 3,042	1,453 4,238	2,883 5,864	4,842 7,999