



This electronic version (PDF) was scanned by the International Telecommunication Union (ITU) Library & Archives Service from an original paper document in the ITU Library & Archives collections.

La présente version électronique (PDF) a été numérisée par le Service de la bibliothèque et des archives de l'Union internationale des télécommunications (UIT) à partir d'un document papier original des collections de ce service.

Esta versión electrónica (PDF) ha sido escaneada por el Servicio de Biblioteca y Archivos de la Unión Internacional de Telecomunicaciones (UIT) a partir de un documento impreso original de las colecciones del Servicio de Biblioteca y Archivos de la UIT.

(ITU) للاتصالات الدولي الاتحاد في والمحفوظات المكتبة قسم أجراه الضوئي بالمسح تصوير نتاج (PDF) الإلكترونية النسخة هذه والمحفوظات المكتبة قسم في المتوفرة الوثائق ضمن أصلية ورقية وثيقة من نقلًا.

此电子版（PDF版本）由国际电信联盟（ITU）图书馆和档案室利用存于该处的纸质文件扫描提供。

Настоящий электронный вариант (PDF) был подготовлен в библиотечно-архивной службе Международного союза электросвязи путем сканирования исходного документа в бумажной форме из библиотечно-архивной службы МСЭ.



INTERNATIONAL TELECOMMUNICATION UNION

# **Twenty-fourth Report by the International Telecommunication Union on telecommunication and the peaceful uses of outer space**

Booklet No. 33

Geneva 1985



## Other information publications on the ITU :

- Book — From semaphore to satellite, 1793-1965 (1965)
- Booklet No. 1 — 1865-1965, a hundred years of international co-operation (1967)
- Booklet No. 2 — ITU and space radiocommunication (1968)
- Booklet No. 3 — Eighth Report by the International Telecommunication Union on telecommunication and the peaceful uses of outer space (1969)
- Booklet No. 4 — Symposium "Space and Radiocommunication", Paris, 1969 (1969)
- Booklet No. 5 — World Telecommunication Day — 17 May 1969 (1969)
- Booklet No. 6 — Ninth Report by the International Telecommunication Union on telecommunication and the peaceful uses of outer space (1970)
- Booklet No. 7 — World Telecommunication Day — 17 May 1970 (1971)
- Booklet No. 8 — Tenth Report by the International Telecommunication Union on telecommunication and the peaceful uses of outer space (1971)
- Booklet No. 9 — Speeches made at the inaugural meeting of the second World Administrative Radio Conference for Space Telecommunications on 7 June 1971 (1971)
- Booklet No. 10 — Eleventh Report by the International Telecommunication Union on telecommunication and the peaceful uses of outer space (1972)
- Booklet No. 11 — Twelfth Report by the International Telecommunication Union on telecommunication and the peaceful uses of outer space (1973)
- Booklet No. 12 — Inauguration of the ITU tower (1973)
- Booklet No. 13 — PANAFTEL — The Pan-African telecommunication network (1974)
- Booklet No. 14 — Symposium "Space and Radiocommunication", Paris, 1973 (1974)
- Booklet No. 15 — Thirteenth Report by the International Telecommunication Union on telecommunication and the peaceful uses of outer space (1974)
- Booklet No. 16 — What is ITU? (1974) (1979)
- Booklet No. 17 — Fourteenth Report by the International Telecommunication Union on telecommunication and the peaceful uses of outer space (1975)
- Booklet No. 18 — Space radiocommunications system for aid following natural disasters (1975)
- Booklet No. 19 — Fifteenth Report by the International Telecommunication Union on telecommunication and the peaceful uses of outer space (1976)
- Booklet No. 20 — Centenary of the telephone
- Booklet No. 21 — Sixteenth Report by the International Telecommunication Union on telecommunication and the peaceful uses of outer space (1977)
- Booklet No. 22 — Telecommunication and development (1978)
- Booklet No. 23 — Seventeenth Report by the International Telecommunication Union on telecommunication and the peaceful uses of outer space (1978)
- Booklet No. 24 — The ITU and vocational training (1978)



Introduction	1
1. International Regulations	2
2. Application of international regulations - International registration of frequency assignments, the use of telecommunications and orbital positions of geostationary satellites	3
3. Telecommunications	22
4. Planning	31
5. Technology	42
6. Information	39
7. Cooperation	34
Annex	
Report of the International Telecommunication Union on telecommunication and the peaceful uses of outer space	
Angola	55
Australia	56
Bahrain (State of)	60
Belgium	41
Canada	43
China (People's Republic of)	30
Costa Rica	46
Denmark	48
Ecuador	49
Egypt (Arab Republic of)	50
Ethiopia	51
Finland	47
France	52
German (Democratic Republic)	54
Germany (Federal Republic of)	33
Ghana	58
Indonesia	52
India (Republic of)	53
Iran (Islamic Republic of)	62
Italy	63
Japan	61
Mexico	71
Netherlands	
New Zealand	

# Twenty-fourth Report by the International Telecommunication Union on telecommunication and the peaceful uses of outer space

Booklet No. 33

Geneva 1985  
ISBN 92-61-02462-9

U.T.U.





# INTERNATIONAL TELECOMMUNICATION UNION

- 1. (1987) Report of the Secretary-General on the work of the Organization
- 2. (1987) Report of the Secretary-General on the work of the Organization
- 3. (1987) Report of the Secretary-General on the work of the Organization
- 4. (1987) Report of the Secretary-General on the work of the Organization
- 5. (1987) Report of the Secretary-General on the work of the Organization
- 6. (1987) Report of the Secretary-General on the work of the Organization
- 7. (1987) Report of the Secretary-General on the work of the Organization
- 8. (1987) Report of the Secretary-General on the work of the Organization
- 9. (1987) Report of the Secretary-General on the work of the Organization
- 10. (1987) Report of the Secretary-General on the work of the Organization

## Twenty-fourth Report by the International Telecommunication Union on telecommunication and the peaceful uses of outer space

Geneva, 1988



© I.T.U.

Geneva 1988  
ISBN 92-61-03482-9

## TABLE OF CONTENTS

	Page
<b>Introduction</b> .....	1
<b>1. International Regulations</b> .....	2
<b>2. Application of international regulations – International registration of frequency assignments for space radiocommunications and orbital positions of geostationary satellites</b> .....	3
<b>3. Telecommunication studies and standardization</b> .....	22
<b>4. Planning</b> .....	31
<b>5. Technical cooperation activities</b> .....	32
<b>6. Information and documentation activities</b> .....	34
<b>7. Cooperation with other international organizations concerned with space</b> .....	34

### Annex

#### Reports on progress made in the development of space communications – Information supplied by the following countries:

Angola (People's Republic of) .....	39
Australia .....	39
Bahrain (State of) .....	40
Belgium .....	41
Canada .....	41
China (People's Republic of) .....	44
Colombia (Republic of) .....	46
Denmark .....	48
Ecuador .....	49
Egypt (Arab Republic of) .....	50
Ethiopia .....	51
Finland .....	47
France .....	52
German (Democratic Republic) .....	54
Germany (Federal Republic of) .....	55
Ghana .....	58
Iceland .....	58
India (Republic of) .....	59
Iran (Islamic Republic of) .....	62
Italy .....	63
Japan .....	67
Mexico .....	71
Netherlands (Kingdom of the) .....	72
New Zealand .....	73

Norway .....	75
Philippines (Republic of the) .....	76
Portugal .....	78
Qatar (State of) .....	79
Saudi Arabia (Kingdom of) .....	80
Singapore (Republic of) .....	81
Spain .....	82
Sweden .....	47
Switzerland (Confederation of) .....	83
Tanzania (United Republic of) .....	85
Thailand .....	85
Union of Soviet Socialist Republics .....	88
United Kingdom of Great Britain and Northern Ireland .....	89
Yemen (People's Democratic Republic of) .....	91
Yugoslavia (Socialist Federal Republic of) .....	91

Annex

Information supplied by the following countries -  
 Reports on progress made in the development of space communications

Angola (People's Republic of) .....	39
Australia .....	39
Bahrain (State of) .....	40
Belgium .....	41
Canada .....	41
China (People's Republic of) .....	44
Colombia (Republic of) .....	45
Denmark .....	48
Ecuador .....	49
Egypt (Arab Republic of) .....	50
Ethiopia .....	51
Finland .....	47
France .....	52
German (Democratic Republic) .....	54
Germany (Federal Republic of) .....	55
Ghana .....	58
Iceland .....	58
India (Republic of) .....	59
Iran (Islamic Republic of) .....	62
Italy .....	63
Japan .....	67
Mexico .....	71
Netherlands (Kingdom of the) .....	72
New Zealand .....	75

## TWENTY-FOURTH REPORT

### OF THE

## INTERNATIONAL TELECOMMUNICATION UNION

### ON TELECOMMUNICATION AND THE PEACEFUL USES

### OF OUTER SPACE

---

#### Introduction

This report provides information on the action taken by the International Telecommunication Union (ITU) with regard to outer space since the submission of the Twenty-third Report in 1984.

It is submitted for the attention of the United Nations Committee on the Peaceful Uses of Outer Space and of the Economic and Social Council (ECOSOC) and for the information of Members of the Union.

While the Plenipotentiary Conference is the supreme organ of the Union, the work of international regulation is done at world administrative conferences; these are intergovernmental conferences and the regulations they adopt have the force of international treaties. The international registration of frequency assignments for space telecommunications is carried out by a permanent organ of the ITU, the International Frequency Registration Board (IFRB), in accordance with Radio Regulations drawn up by the competent ITU world administrative radio conferences. Technical studies relating to the standardization of equipment and systems and their operation and the general use of telecommunications in outer space are conducted by two other permanent organs, the International Radio Consultative Committee (CCIR) and the International Telegraph and Telephone Consultative Committee (CCITT). Work concerning space applications in developing countries is entrusted to the Technical Cooperation Department of the General Secretariat of the ITU.

Details of the work of the conferences and permanent organs of the Union are given in the sections which follow.

---

## 1. International regulations

---

No world administrative radio conference having an agenda related to space matters has been held since 1979.

1.1 At its 39th Session (2-20 April 1984), the Administrative Council maintained the schedule of administrative conferences in Resolution No. 1 of the Plenipotentiary Conference. The schedule of administrative radio conferences having a bearing on space radiocommunications is as follows:

- First Session of the World Administrative Radio Conference on the Use of the Geostationary Satellite Orbit and the Planning of the Space Service Utilizing It (8 August-13 September 1985).
- Second Session of the World Administrative Radio Conference on the Use of the Geostationary Satellite Orbit and the Planning of the Space Services Utilizing It (June-August 1988).

The above Conference to be held in two sessions stems from Resolution No. 3 of WARC-79 and will have as its essential objective: "to guarantee in practice, for all countries, equitable access to the geostationary-satellite orbit and to the frequency bands allocated to the space services utilizing it..." Stated briefly, the task of the First Session will be:

- to decide which space services and frequency bands should be planned;
- to establish the principles, technical parameters and criteria for the planning and provide guidelines for associated regulation procedures;
- recommend a draft agenda for the Second Session for consideration by the ITU Administrative Council.

A Conference Preparatory Meeting of the Union's International Radio Consultative Committee (CCIR) held in June/July 1984 has finalized a report which will serve as a solid technical foundation on which the Conference itself will be able to build up appropriate decisions.

The International Frequency Registration Board (IFRB) has published a report on the operation of the procedures of Articles 11 and 13 of the Radio Regulations. Article 11 deals with the advance publication and co-ordination, and Article 13 with the notification and recording of frequency assignments to space radiocommunication stations except broadcasting satellite stations.

---

**2. Application of international regulations — International registration of frequency assignments for space radiocommunications and orbital positions of geostationary satellites**

---

2.1 Since the publication of the Twenty-third Report, the IFRB has continued to apply the relevant provisions of the Radio Regulations annexed to the International Telecommunication Convention. In accordance with these provisions, Administrations:

- a) send information concerning their planned satellite systems to the IFRB for publication in a special section of its weekly circular;
- b) inform the IFRB whether or not comments have been received as a result of the above publication and of the progress made, with other Administrations, in resolving any difficulties;
- c) where necessary, effect with the Administrations concerned co-ordination of the use of their frequency assignments to space stations on geostationary satellites or to earth stations that are to communicate with such space stations. A copy of the requests for co-ordination addressed to the Administrations concerned is sent to the IFRB for publication in another special section of the IFRB Circular;
- d) notify their frequency assignments to the IFRB for registration in the Master International Frequency Register.

The publication, co-ordination, notification and registration procedures which are applicable are those prescribed in Articles 11, 13, 14 and 15 of the Radio Regulations and Resolution No. 33 of the World Administrative Radio Conference, Geneva, 1979.

2.2 In 1984, the IFRB received information relating to 85 new satellite networks which it published, under the advance publication procedure, in Special Sections of the IFRB Circular (a satellite network consisting of one space station and its associated earth stations). This information was submitted by the following Administrations (listed in French alphabetical order):

Notifying Administration	System or network	Summary Description
Germany (Federal Republic of)	ROSAT	Satellite network designed for the investigation of X-ray emissions of cosmic objects, for the basic astronomical research
Saudi Arabia (Kingdom of)	SABS (SABS 1 - 2)	Saudi Arabian broadcasting satellite system for television and radio networking
United States of America (on behalf of the Member countries of INTELSAT)	INTELSAT  (INTELSAT 5 CONTINENTAL 3, ATLANTIC 6, 343,5 E)  (INTELSAT 5A INDIAN 3, PACIFIC 3, ATLANTIC 6, CONTINENTAL 1, 3, 4, 66 E, 300 E, 304 E, 319,5 E, 338,5 E, 343,5 E)  (INTELSAT IBS 304 E, 307 E, 310 E, 319,5 E, 341,5 E, 343,5 E)  FLTSATCOM-A (FLTSATCOM-A ATL, EAST PAC, WEST PAC, IND OCEAN)  USASAT	Global commercial communication satellite system            Satellite system for exclusive government use providing communications in the mobile-satellite and the fixed-satellite services   Satellite system providing domestic telecommunications services
	(USASAT 9A, 9B, 9C, 9D, 10A, 10B, 10C, 10D, 11A, 11B, 11C, 11D, 12A, 12B, 12C, 12D, 13A, 13B, 13C, 13D, 13E, 13F, 13G, 13H, 14A, 14B, 14C, 14D, 15A, 15B, 15C, 15D)	

Notifying Administration	System or network	Summary Description
United States of America (cont.)	USGCSS PHASE 3, MID-ATL, WEST-ATL  USRDSS (United States Radio-determination satellite system)  (USRDSS EAST, WEST, CENTRAL)	Satellite system providing telecommunications services to the Atlantic, East Pacific, West Pacific and Indian Ocean regions  Satellite system consisting of three geostationary satellites, designed as radiodetermination service which will provide for the exchange of geographical coordinates and coded messages between transceivers located in aeronautical and land mobile vehicles and also carried by hand
	PAM (Payload Assist Module)	Vehicle used to place earth orbiting satellites into high-energy orbits. PAM is intended to operate with space Shuttle Transportation System (STS) and with conventional Delta Expendable Launch Vehicles (ELV)
	GRO (Gamma Ray Observatory)	Scientific observatory which will be placed in low earth orbit to collect data used to study various sources of gamma rays
	ST (Space Telescope)	Scientific satellite consisting of unmanned astronomical observatory containing Support System Module, Optical Telescope and other scientific instruments
France	HIPPARCOS  ARSENE	Scientific satellite of the European Space Agency (ESA), which will provide uniform whole sky stellar catalogue suitable for astrometric and astrophysical studies  Telecommunication satellite for operations in the amateur service intended as a teaching aid for schools

Notifying Administration	System or network	Summary Description
France (cont.)	DORIS-1	Satellite system to be used improve the knowledge of the Earth's geoid, consisting of a network of ground beacons and a receiver on board the SPOT 2 satellite
	VIDEOSAT-3	Satellite network for specialized communication services within the territories of Metropolitan France and the French Overseas Departments and territories in the Caribbean and on the American continent
Inde (Republic of)	INSAT (INSAT-1D)	National satellite system for telecommunications, television, meteorology and broadcasting-satellite service
	IRS	Satellite network designed for acquiring imageries for earth resources applications
Indonesia (Republic of)	PALAPA B-3	Satellite network intended for multiple usage, telephony, telegraphy, television, etc.
Italy	ITALSAT	Satellite network intended to provide pre-operational domestic telecommunication services
Japan	MOS-1 (Marine Observation Satellite)	Satellite network intended for the observations of marine phenomenon, mainly surface colour and temperature, and for the development of common technology for the Earth observation satellites

Notifying Administration	System or network	Summary Description
Japan (cont.)	JAS-1 (Japan Amateur Satellite)	Satellite network intended to be used to improve the knowledge and technique of radio amateurs and to provide fields for exercises in general space engineering
	United Kingdom of Great Britain and Northern Ireland	INMARSAT (on behalf of the Member Administrations of the International Maritime Satellite Organization)  (INMARSAT AOR CENTRAL, EAST, INDIAN OCEAN REGION)  UOSAT-B (University of Surrey Amateur Satellite network)
Union of Soviet Socialist Republics	VOLNA (VOLNA-9, 11)	Satellite system providing communications within the land mobile-satellite and aeronautical mobile-satellite services

2.3 Additional information, or amendments, concerning 25 networks published previously, were also received and published in 25 Special Sections of the IFRB Circular.

2.4 In 23 Special Sections of its weekly Circular, the IFRB published comments submitted by the other Administrations as a result of the publication referred to in sub-paragraph 2.2 above, of information concerning planned satellite systems in the form of a summary of the progress made in solving the difficulties encountered.

2.5 In 15 Special Sections of its weekly Circular, the IFRB published, in accordance with Section I of Article 7 of Appendix 30 to the Radio Regulations, advance information on 15 satellite networks in the Fixed-Satellite Service.

2.6 In 1984 the IFRB published in 424 Special Sections of its weekly Circular the characteristics which Administrations provide when coordinating between themselves the use of frequency assignments to space stations on board geostationary satellites, or to earth stations intended to communicate with such space stations.

2.6.1 In 34 Special Sections of its weekly Circular, the IFRB published information on progress made in effecting coordination (see 2.6 above) and agreements reached on requests for coordination.

2.7 Pursuant to the provisions of Section A of Resolution No. 33 of the WARC-1979, the IFRB published in 3 Special Sections of its weekly Circular, requests for coordination of frequency assignments to the AUSSAT I, AUSSAT II and AUSSAT III space stations (Australia) in the broadcasting-satellite service with respect to stations in the terrestrial radiocommunication services.

2.8 In 1984 the IFRB published in one Special Section of its weekly Circular, requests for agreement in accordance with the procedure prescribed in Article 14 of the Radio Regulations.

2.8.1 In four Special Sections of its weekly Circular, the IFRB published information on the successful completion of the procedure prescribed in Article 14 (see 2.8 above).

2.9 In one Special Section of its weekly Circular, the IFRB published, in accordance with Article 4 of Appendix 30 to the Radio Regulations, information concerning proposed modifications to the Plan for the broadcasting-satellite service on behalf of the Administration of Luxembourg.





Notifying Administration	System or network	Notices received and under treatment with the IFRB in accordance with Article 13 of the Radio Regulations
Bahrain (State of) (cont.)	<ul style="list-style-type: none"> <li>- (ARABSAT 1)</li> <li>- (ARABSAT 2)</li> </ul>	<ul style="list-style-type: none"> <li>- Earth station Ras Abu Jarur (transmission, reception, tracking)</li> <li>- Earth station Ras Abu Jarur (transmission, reception, tracking)</li> </ul>
Brazil (Federative Republic of)	<ul style="list-style-type: none"> <li>- SBTS brazilian satellite telecommunications system</li> <li>- (SBTS A1)</li> <li>- (SBTS A2)</li> </ul>	<ul style="list-style-type: none"> <li>- SBTS A1 Space station (transmission, reception, telecommand, tracking, telemetry)</li> <li>- 128 Earth stations (transmission, reception)</li> <li>- SBTS A2 Space station (transmission, reception, telecommand, tracking, telemetry)</li> <li>- 128 Earth stations (transmission, reception)</li> </ul>
Canada	<ul style="list-style-type: none"> <li>- ANIK national communication satellite system</li> <li>- (ANIK B-1)</li> <li>- (ANIK C-3)</li> <li>- (ANIK D-1)</li> <li>- INTELSAT global commercial communication satellite system</li> </ul>	<ul style="list-style-type: none"> <li>- 3 Earth stations (transmission, reception)</li> <li>- 3 Earth stations (transmission)</li> <li>- 4 Earth stations (transmission, reception, telecommand, telemetry)</li> <li>- 5 Earth stations (transmission, reception)</li> </ul>

Notifying Administration	System or network	Notices received and under treatment with the IFRB in accordance with Article 13 of the Radio Regulations
Canada (cont.)	<ul style="list-style-type: none"> <li>- (INTELSAT 5)</li> </ul>	<ul style="list-style-type: none"> <li>- 5 Earth stations (transmission, reception)</li> </ul>
Chile	<ul style="list-style-type: none"> <li>- INTELSAT global commercial communication satellite system</li> <li>- (INTELSAT 4)</li> </ul>	<ul style="list-style-type: none"> <li>- Earth station Longovilo 3 (transmission, reception)</li> </ul>
China (People's Republic of)	<ul style="list-style-type: none"> <li>- STW experimental communications satellite</li> <li>- (STW-2)</li> <li>- INTELSAT global commercial communication satellite system</li> <li>- (INTELSAT 4A)</li> <li>- (INTELSAT 5)</li> </ul>	<ul style="list-style-type: none"> <li>- STW-2 Space station (transmission, reception)</li> <li>- 3 Earth stations (transmission, reception)</li> <li>- 2 Earth stations (transmission, reception)</li> <li>- 2 Earth stations (transmission, reception)</li> </ul>
Colombia (Republic of)	<ul style="list-style-type: none"> <li>- SATCOL national communication satellite system</li> <li>- (SATCOL 1A)</li> <li>- (SATCOL 1B)</li> <li>- (SATCOL 2)</li> </ul>	<ul style="list-style-type: none"> <li>- SATCOL 1A Space station (transmission, reception)</li> <li>- SATCOL 1B Space station (transmission, reception)</li> <li>- SATCOL 2 Space station (transmission, reception)</li> </ul>



Notifying Administration	System or network	Notices received and under treatment with the IFRB in accordance with Article 13 of the Radio Regulations
France (cont.)	– (TELECOM 1A)	<ul style="list-style-type: none"> <li>– TELECOM 1A Space station (transmission, reception, telecommand, tracking, telemetry)</li> <li>– 5 Earth stations (transmission, reception, telecommand, tracking, telemetry)</li> <li>– 3 Earth stations (French Guyana) (transmission, reception, telecommand, tracking, telemetry)</li> <li>– 2 Earth stations (Guadeloupe) (transmission, reception)</li> <li>– Earth station Pain de Sucre (S. Pierre and Miquelon) (transmission, reception)</li> <li>– Earth station Rivière des Pluies (Réunion) (transmission, reception)</li> <li>– Earth station Trois Ilets (Martinique) (transmission, reception)</li> </ul>
Hungarian People's Republic	<ul style="list-style-type: none"> <li>– STATIONAR communication satellite system</li> <li>– (STATIONAR 4)</li> </ul>	<ul style="list-style-type: none"> <li>– Earth station Taliandorogd (transmission, reception)</li> </ul>
Indonesia (Republic of)	<ul style="list-style-type: none"> <li>– PALAPA national communication satellite system</li> <li>– (PALAPA A-1)</li> <li>– (PALAPA A-2)</li> </ul>	<ul style="list-style-type: none"> <li>– Earth station Gunung Belah (reception)</li> <li>– Earth station Gunung Belah (reception)</li> </ul>

Notifying Administration	System or network	Notices received and under treatment with the IFRB in accordance with Article 13 of the Radio Regulations
Indonesia (Republic of) (cont.)	– (PALAPA B-3)	<ul style="list-style-type: none"> <li>– PALAPA B-3 Space station (transmission, reception)</li> <li>– 14 Earth stations (transmission, reception)</li> </ul>
Iceland	<ul style="list-style-type: none"> <li>– INTELSAT global commercial communication satellite system</li> <li>– (INTELSAT 4)</li> <li>– SATCOM PHASE 3 communication satellite network</li> </ul>	<ul style="list-style-type: none"> <li>– Earth station Skyggnir 2 (reception)</li> <li>– Earth station Keflavik (transmission, reception)</li> </ul>
Italy	<ul style="list-style-type: none"> <li>– INTELSAT global commercial communication satellite system</li> <li>– (INTELSAT 5)</li> </ul>	<ul style="list-style-type: none"> <li>– Earth station Fucino (transmission, reception)</li> </ul>
Japan	<ul style="list-style-type: none"> <li>– GMS radiocommunication system of the meteorological satellite service</li> <li>– GMS-2 radiocommunication system of the meteorological satellite service</li> </ul>	<ul style="list-style-type: none"> <li>– GMS Space station (transmission, reception, telecommand, tracking, telemetry)</li> <li>– 8 Earth stations (transmission, reception, telecommand, tracking, telemetry)</li> <li>– GMS-2 Space station (transmission, reception, telecommand, tracking, telemetry)</li> <li>– 7 Earth stations (transmission, reception, telecommand, tracking, telemetry)</li> </ul>

Notifying Administration	System or network	Notices received and under treatment with the IFRB in accordance with Article 13 of the Radio Regulations
Japan (cont.)	<ul style="list-style-type: none"> <li>- GMS-3 radiocommunication system of the meteorological satellite service</li> </ul>	<ul style="list-style-type: none"> <li>- GMS-3 Space station (transmission, reception, telecommand, tracking, telemetry)</li> <li>- 7 Earth stations (transmission, reception, telecommand, tracking, telemetry)</li> </ul>
Jordan (Hashemite Kingdom of)	<ul style="list-style-type: none"> <li>- ARABSAT communication satellite system</li> <li>- (ARABSAT 1)</li> <li>- (ARABSAT 2)</li> </ul>	<ul style="list-style-type: none"> <li>- Earth station Baqa (transmission, reception)</li> <li>- Earth station Baqa (transmission, reception)</li> </ul>
Morocco (Kingdom of)	<ul style="list-style-type: none"> <li>- ARABSAT communication satellite system</li> <li>- (ARABSAT 1)</li> <li>- (ARABSAT 2)</li> </ul>	<ul style="list-style-type: none"> <li>- Earth station Sehoul 3 (transmission, reception)</li> <li>- Earth station Sehoul 3 (transmission, reception)</li> </ul>
Mauritius	<ul style="list-style-type: none"> <li>- INTELSAT global commercial communication satellite system</li> <li>- (INTELSAT 5)</li> </ul>	<ul style="list-style-type: none"> <li>- Earth station Cassis (transmission, reception)</li> </ul>
Mexico	<ul style="list-style-type: none"> <li>- INTELSAT global commercial communication satellite service</li> </ul>	

Notifying Administration	System or network	Notices received and under treatment with the IFRB in accordance with Article 13 of the Radio Regulations
Mexico (cont.)	<ul style="list-style-type: none"> <li>- (INTELSAT 4A)</li> <li>- MORELOS domestic satellite system</li> <li>- (MORELOS 1)</li> <li>- (MORELOS 2)</li> </ul>	<ul style="list-style-type: none"> <li>- Earth station Iztapalapa 4 (transmission)</li> <li>- Earth station CD Del Carmen (transmission, reception)</li> <li>- MORELOS 1 Space station (transmission, reception, telecommand, telemetry)</li> <li>- MORELOS 2 Space station (transmission, reception, telecommand, telemetry)</li> </ul>
Portugal	<ul style="list-style-type: none"> <li>- INTELSAT global commercial communication satellite system</li> <li>- (INTELSAT 5)</li> </ul>	<ul style="list-style-type: none"> <li>- Earth station Macau (Macau) (transmission, reception)</li> </ul>
United Kingdom of Great Britain and Northern Ireland	<ul style="list-style-type: none"> <li>- INTELSAT global commercial communication satellite system</li> <li>- (INTELSAT 5)</li> <li>- (INTELSAT 5)</li> </ul>	<ul style="list-style-type: none"> <li>- Earth station Bermuda (Bermuda) (transmission, reception)</li> <li>- Earth station BBC Atlantic Relay (Ascension) (reception)</li> </ul>
	<ul style="list-style-type: none"> <li>- SATCOM PHASE 3 communication satellite network</li> </ul>	<ul style="list-style-type: none"> <li>- 2 Earth stations (transmission)</li> </ul>

Notifying Administration	System or network	Notices received and under treatment with the IFRB in accordance with Article 13 of the Radio Regulations	Notifying Administration	System or network	Notices received and under treatment with the IFRB in accordance with Article 13 of the Radio Regulations
Somali Democratic Republic	<ul style="list-style-type: none"> <li>- ARABSAT communication satellite system</li> <li>- (ARABSAT 1)</li> <li>- (ARABSAT 2)</li> </ul>	<ul style="list-style-type: none"> <li>- Earth station Karan 2 (transmission, reception)</li> <li>- Earth station Karan 2 (transmission, reception)</li> </ul>	Thailand (cont.)	<ul style="list-style-type: none"> <li>- (INTELSAT 4A)</li> <li>- (INTELSAT 5)</li> </ul>	<ul style="list-style-type: none"> <li>- Earth station Si Racha (transmission, reception)</li> <li>- Earth station Si Racha (transmission, reception)</li> </ul>
Sri Lanka (Democratic Socialist Republic of)	<ul style="list-style-type: none"> <li>- INTELSAT global commercial communication satellite system</li> <li>- (INTELSAT 5)</li> </ul>	<ul style="list-style-type: none"> <li>- Earth station Padukka (transmission, reception)</li> </ul>	Tonga (Kingdom of)	<ul style="list-style-type: none"> <li>- INTELSAT global commercial communication satellite system</li> <li>- (INTELSAT 4A)</li> </ul>	<ul style="list-style-type: none"> <li>- Earth station Nuku'Alofa (transmission, reception)</li> </ul>
Swaziland (Kingdom of)	<ul style="list-style-type: none"> <li>- INTELSAT global commercial communication satellite system</li> <li>- (INTELSAT 5)</li> </ul>	<ul style="list-style-type: none"> <li>± Earth station Ezulwini (transmission, reception)</li> </ul>	Tunisia	<ul style="list-style-type: none"> <li>- INTELSAT global commercial communication satellite system</li> <li>- (INTELSAT 5)</li> </ul>	<ul style="list-style-type: none"> <li>- Earth station Dkhila-Mateur (transmission, reception)</li> </ul>
Czechoslovak Socialist Republic	<ul style="list-style-type: none"> <li>- STATIONAR communication satellite system</li> <li>- (STATIONAR 4)</li> </ul>	<ul style="list-style-type: none"> <li>- Earth station Praha (transmission, reception)</li> </ul>	Union of Soviet Socialist Republics	<ul style="list-style-type: none"> <li>- SDRS satellite data relay system</li> <li>- (CSDRN)</li> <li>- (ESDRN)</li> <li>- (WSDRN)</li> </ul>	<ul style="list-style-type: none"> <li>- CSDRN Space station (transmission, reception)</li> <li>- 2 Earth stations (transmission, reception)</li> <li>- ESDRN Space station (transmission, reception)</li> <li>- Earth station Nikolaevskamur (transmission, reception)</li> <li>- WSDRN Space station (transmission, reception)</li> </ul>
Thailand	<ul style="list-style-type: none"> <li>- INTELSAT global commercial communication satellite system</li> <li>- (INTELSAT 4)</li> </ul>	<ul style="list-style-type: none"> <li>- Earth station Si Racha (transmission, reception)</li> </ul>			<ul style="list-style-type: none"> <li>- Earth station Gus Khrustalny (transmission, reception)</li> </ul>

Notifying Administration	System or network	Notices received and under treatment with the IFRB in accordance with Article 13 of the Radio Regulations
Union of Soviet Socialist Republics (cont.)	<ul style="list-style-type: none"> <li>- STATIONAR communication satellite system</li> <li>- (STATIONAR 4)</li> <li>- (STATIONAR 12)</li> <li>- (STATIONAR 15)</li> <li>- GALS government satellite system</li> <li>- (GALS 5)</li> <li>- (GALS 6)</li> <li>- POTOK data transmission satellite system</li> <li>- (POTOK 2)</li> </ul>	<ul style="list-style-type: none"> <li>- STATIONAR 4 Space station (transmission, reception)</li> <li>- Earth station Gus Khrustalny (transmission, reception)</li> <li>- STATIONAR 12 Space station (transmission, reception)</li> <li>- Earth station Gus Khrustalny (transmission, reception)</li> <li>- STATIONAR 15 Space station (transmission, reception)</li> <li>- Earth station Novosibirsk (transmission, reception)</li> <li>- GALS 5 Space station (transmission, reception)</li> <li>- GALS 6 Space station (transmission, reception)</li> <li>- POTOK 2 Space station (transmission, reception)</li> <li>- 2 Earth stations (transmission, reception)</li> </ul>
Viet Nam (Socialist Republic of)	<ul style="list-style-type: none"> <li>- STATIONAR communication satellite system</li> <li>- (STATIONAR 5)</li> </ul>	<ul style="list-style-type: none"> <li>- Earth station Hoa sen (transmission, reception)</li> </ul>

Notifying Administration	System or network	Notices received and under treatment with the IFRB in accordance with Article 13 of the Radio Regulations
Yemen (People's Democratic Republic of)	<ul style="list-style-type: none"> <li>- ARABSAT communication satellite system</li> <li>- (ARABSAT 1)</li> <li>- (ARABSAT 2)</li> </ul>	<ul style="list-style-type: none"> <li>- Earth station Aden (transmission, reception)</li> <li>- Earth station Aden (transmission, reception)</li> </ul>
Tuvalu)	<ul style="list-style-type: none"> <li>- GOES WEST geostationary operational environment satellite system</li> </ul>	<ul style="list-style-type: none"> <li>- Earth station Handar 560A (transmission)</li> </ul>

1) Ex-overseas Territory not yet Member of ITU.

2.12 A list of positions assigned to space stations installed on board geostationary satellites together with frequency bands used by these stations which were communicated to the IFRB in the framework of Articles 11 and 13 of the Radio Regulations, is kept up to date by the IFRB and distributed regularly to the Administrations by means of the weekly IFRB Circular. A copy of this list to which are added the projected space stations which have undergone the advance publication procedure referred to in paragraph 2.2 above, is given in the following table:

Country	Frequency band (MHz)	Position	Publication date
USA	137.0-137.8	COMSAT 10	1971
USA	137.8-138.4	COMSAT 10	1971
USA	138.4-139.0	COMSAT 10	1971
USA	139.0-139.6	COMSAT 10	1971
USA	139.6-140.2	COMSAT 10	1971
USA	140.2-140.8	COMSAT 10	1971
USA	140.8-141.4	COMSAT 10	1971
USA	141.4-142.0	COMSAT 10	1971
USA	142.0-142.6	COMSAT 10	1971
USA	142.6-143.2	COMSAT 10	1971
USA	143.2-143.8	COMSAT 10	1971
USA	143.8-144.4	COMSAT 10	1971
USA	144.4-145.0	COMSAT 10	1971
USA	145.0-145.6	COMSAT 10	1971
USA	145.6-146.2	COMSAT 10	1971
USA	146.2-146.8	COMSAT 10	1971
USA	146.8-147.4	COMSAT 10	1971
USA	147.4-148.0	COMSAT 10	1971
USA	148.0-148.6	COMSAT 10	1971
USA	148.6-149.2	COMSAT 10	1971
USA	149.2-149.8	COMSAT 10	1971
USA	149.8-150.4	COMSAT 10	1971
USA	150.4-151.0	COMSAT 10	1971
USA	151.0-151.6	COMSAT 10	1971
USA	151.6-152.2	COMSAT 10	1971
USA	152.2-152.8	COMSAT 10	1971
USA	152.8-153.4	COMSAT 10	1971
USA	153.4-154.0	COMSAT 10	1971
USA	154.0-154.6	COMSAT 10	1971
USA	154.6-155.2	COMSAT 10	1971
USA	155.2-155.8	COMSAT 10	1971
USA	155.8-156.4	COMSAT 10	1971
USA	156.4-157.0	COMSAT 10	1971
USA	157.0-157.6	COMSAT 10	1971
USA	157.6-158.2	COMSAT 10	1971
USA	158.2-158.8	COMSAT 10	1971
USA	158.8-159.4	COMSAT 10	1971
USA	159.4-160.0	COMSAT 10	1971
USA	160.0-160.6	COMSAT 10	1971
USA	160.6-161.2	COMSAT 10	1971
USA	161.2-161.8	COMSAT 10	1971
USA	161.8-162.4	COMSAT 10	1971
USA	162.4-163.0	COMSAT 10	1971
USA	163.0-163.6	COMSAT 10	1971
USA	163.6-164.2	COMSAT 10	1971
USA	164.2-164.8	COMSAT 10	1971
USA	164.8-165.4	COMSAT 10	1971
USA	165.4-166.0	COMSAT 10	1971
USA	166.0-166.6	COMSAT 10	1971
USA	166.6-167.2	COMSAT 10	1971
USA	167.2-167.8	COMSAT 10	1971
USA	167.8-168.4	COMSAT 10	1971
USA	168.4-169.0	COMSAT 10	1971
USA	169.0-169.6	COMSAT 10	1971
USA	169.6-170.2	COMSAT 10	1971
USA	170.2-170.8	COMSAT 10	1971
USA	170.8-171.4	COMSAT 10	1971
USA	171.4-172.0	COMSAT 10	1971
USA	172.0-172.6	COMSAT 10	1971
USA	172.6-173.2	COMSAT 10	1971
USA	173.2-173.8	COMSAT 10	1971
USA	173.8-174.4	COMSAT 10	1971
USA	174.4-175.0	COMSAT 10	1971
USA	175.0-175.6	COMSAT 10	1971
USA	175.6-176.2	COMSAT 10	1971
USA	176.2-176.8	COMSAT 10	1971
USA	176.8-177.4	COMSAT 10	1971
USA	177.4-178.0	COMSAT 10	1971
USA	178.0-178.6	COMSAT 10	1971
USA	178.6-179.2	COMSAT 10	1971
USA	179.2-179.8	COMSAT 10	1971
USA	179.8-180.4	COMSAT 10	1971
USA	180.4-181.0	COMSAT 10	1971
USA	181.0-181.6	COMSAT 10	1971
USA	181.6-182.2	COMSAT 10	1971
USA	182.2-182.8	COMSAT 10	1971
USA	182.8-183.4	COMSAT 10	1971
USA	183.4-184.0	COMSAT 10	1971
USA	184.0-184.6	COMSAT 10	1971
USA	184.6-185.2	COMSAT 10	1971
USA	185.2-185.8	COMSAT 10	1971
USA	185.8-186.4	COMSAT 10	1971
USA	186.4-187.0	COMSAT 10	1971
USA	187.0-187.6	COMSAT 10	1971
USA	187.6-188.2	COMSAT 10	1971
USA	188.2-188.8	COMSAT 10	1971
USA	188.8-189.4	COMSAT 10	1971
USA	189.4-190.0	COMSAT 10	1971
USA	190.0-190.6	COMSAT 10	1971
USA	190.6-191.2	COMSAT 10	1971
USA	191.2-191.8	COMSAT 10	1971
USA	191.8-192.4	COMSAT 10	1971
USA	192.4-193.0	COMSAT 10	1971
USA	193.0-193.6	COMSAT 10	1971
USA	193.6-194.2	COMSAT 10	1971
USA	194.2-194.8	COMSAT 10	1971
USA	194.8-195.4	COMSAT 10	1971
USA	195.4-196.0	COMSAT 10	1971
USA	196.0-196.6	COMSAT 10	1971
USA	196.6-197.2	COMSAT 10	1971
USA	197.2-197.8	COMSAT 10	1971
USA	197.8-198.4	COMSAT 10	1971
USA	198.4-199.0	COMSAT 10	1971
USA	199.0-199.6	COMSAT 10	1971
USA	199.6-200.2	COMSAT 10	1971
USA	200.2-200.8	COMSAT 10	1971
USA	200.8-201.4	COMSAT 10	1971
USA	201.4-202.0	COMSAT 10	1971
USA	202.0-202.6	COMSAT 10	1971
USA	202.6-203.2	COMSAT 10	1971
USA	203.2-203.8	COMSAT 10	1971
USA	203.8-204.4	COMSAT 10	1971
USA	204.4-205.0	COMSAT 10	1971
USA	205.0-205.6	COMSAT 10	1971
USA	205.6-206.2	COMSAT 10	1971
USA	206.2-206.8	COMSAT 10	1971
USA	206.8-207.4	COMSAT 10	1971
USA	207.4-208.0	COMSAT 10	1971
USA	208.0-208.6	COMSAT 10	1971
USA	208.6-209.2	COMSAT 10	1971
USA	209.2-209.8	COMSAT 10	1971
USA	209.8-210.4	COMSAT 10	1971
USA	210.4-211.0	COMSAT 10	1971
USA	211.0-211.6	COMSAT 10	1971
USA	211.6-212.2	COMSAT 10	1971
USA	212.2-212.8	COMSAT 10	1971
USA	212.8-213.4	COMSAT 10	1971
USA	213.4-214.0	COMSAT 10	1971
USA	214.0-214.6	COMSAT 10	1971
USA	214.6-215.2	COMSAT 10	1971
USA	215.2-215.8	COMSAT 10	1971
USA	215.8-216.4	COMSAT 10	1971
USA	216.4-217.0	COMSAT 10	1971
USA	217.0-217.6	COMSAT 10	1971
USA	217.6-218.2	COMSAT 10	1971
USA	218.2-218.8	COMSAT 10	1971
USA	218.8-219.4	COMSAT 10	1971
USA	219.4-220.0	COMSAT 10	1971
USA	220.0-220.6	COMSAT 10	1971
USA	220.6-221.2	COMSAT 10	1971
USA	221.2-221.8	COMSAT 10	1971
USA	221.8-222.4	COMSAT 10	1971
USA	222.4-223.0	COMSAT 10	1971
USA	223.0-223.6	COMSAT 10	1971
USA	223.6-224.2	COMSAT 10	1971
USA	224.2-224.8	COMSAT 10	1971
USA	224.8-225.4	COMSAT 10	1971
USA	225.4-226.0	COMSAT 10	1971
USA	226.0-226.6	COMSAT 10	1971
USA	226.6-227.2	COMSAT 10	1971
USA	227.2-227.8	COMSAT 10	1971
USA	227.8-228.4	COMSAT 10	1971
USA	228.4-229.0	COMSAT 10	1971
USA	229.0-229.6	COMSAT 10	1971
USA	229.6-230.2	COMSAT 10	1971
USA	230.2-230.8	COMSAT 10	1971
USA	230.8-231.4	COMSAT 10	1971
USA	231.4-232.0	COMSAT 10	1971
USA	232.0-232.6	COMSAT 10	1971
USA	232.6-233.2	COMSAT 10	1971
USA	233.2-233.8	COMSAT 10	1971
USA	233.8-234.4	COMSAT 10	1971
USA	234.4-235.0	COMSAT 10	1971
USA	235.0-235.6	COMSAT 10	1971
USA	235.6-236.2	COMSAT 10	1971
USA	236.2-236.8	COMSAT 10	1971
USA	236.8-237.4	COMSAT 10	1971
USA	237.4-238.0	COMSAT 10	1971
USA	238.0-238.6	COMSAT 10	1971
USA	238.6-239.2	COMSAT 10	1971
USA	239.2-239.8	COMSAT 10	1971
USA	239.8-240.4	COMSAT 10	1971
USA	240.4-241.0	COMSAT 10	1971
USA	241.0-241.6	COMSAT 10	1971
USA	241.6-242.2	COMSAT 10	1971
USA	242.2-242.8	COMSAT 10	1971
USA	242.8-243.4	COMSAT 10	1971
USA	243.4-244.0	COMSAT 10	1971
USA	244.0-244.6	COMSAT 10	1971
USA	244.6-245.2	COMSAT 10	1971
USA	245.2-245.8	COMSAT 10	1971
USA	245.8-246.4	COMSAT 10	1971
USA	246.4-247.0	COMSAT 10	1971
USA	247.0-247.6	COMSAT 10	1971
USA	247.6-248.2	COMSAT 10	1971
USA	248.2-248.8	COMSAT 10	1971
USA	248.8-249.4	COMSAT 10	1971
USA	249.4-250.0	COMSAT 10	1971
USA	250.0-250.6	COMSAT 10	1971
USA	250.6-251.2	COMSAT 10	1971
USA	251.2-251.8	COMSAT 10	1971
USA	251.8-252.4	COMSAT 10	1971
USA	252.4-253.0	COMSAT 10	1971
USA	253.0-253.6	COMSAT 10	1971
USA	253.6-254.2	COMSAT 10	1971
USA	254.2-254.8	COMSAT 10	1971
USA	254.8-255.4	COMSAT 10	1971
USA	255.4-256.0	COMSAT 10	1971
USA	256.0-256.6	COMSAT 10	1971
USA	256.6-257.2	COMSAT 10	1971
USA	257.2-257.8	COMSAT 10	1971
USA	257.8-258.4	COMSAT 10	1971
USA	258.4-259.0	COMSAT 10	1971
USA	259.0-259.6	COMSAT 10	1971
USA	259.6-260.2	COMSAT 10	1971
USA	260.2-260.8	COMSAT 10	1971
USA	260.8-261.4	COMSAT 10	1971
USA	261.4-262.0	COMSAT 10	1971
USA	262.0-262.6	COMSAT 10	1971
USA	262.6-263.2	COMSAT 10	1971
USA	263.2-263.8	COMSAT 10	1971
USA	263.8-264.4	COMSAT 10	1971
USA	264.4-265.0	COMSAT 10	1971
USA	265.0-265.6	COMSAT 10	1971
USA	265.6-266.2	COMSAT 10	1971
USA	266.2-266.8	COMSAT 10	1971
USA	266.8-267.4	COMSAT 10	1971
USA	267.4-268.0	COMSAT 10	1971
USA	268.0-268.6	COMSAT 10	1971
USA	268.6-269.2	COMSAT 10	1971
USA	269.2-269.8	COMSAT 10	1971
USA	269.8-270.4	COMSAT 10	1971
USA	270.4-271.0	COMSAT 10	1971
USA	271.0-271.6	COMSAT 10	1971
USA	271.6-272.2	COMSAT 10	1971
USA	272.2-272.8	COMSAT 10	1971
USA	272.8-273.4	COMSAT 10	1971
USA	273.4-274.0	COMSAT 10	1971
USA	274.0-274.6	COMSAT 10	1971
USA	274.6-275.2	COMSAT 10	1971
USA	275.2-275.8	COMSAT 10	1971
USA	275.8-276.4	COMSAT 10	1971
USA	276.4-277.0	COMSAT 10	197

LIST OF GEOSTATIONARY SPACE STATIONS  
BY ORBITAL POSITIONS

(RR 1042, RR 1060, RR 1488-RR 1491)

(31.12.1984)

Orbital position	Space station	Frequency bands GHz								
		<1	<3	4	6	7	11	12	14	>15
171 W	USA TDRS WEST		3						14	15
170 W	URS GALS-4					7				
170 W *	URS LOUTCH P4						11		14	
170 W	URS STATIONAR-10			4	6					
170 W *	URS VOLNA-7	1	3							
168 W	URS POTOK-3			4						
160 W	URS ESDRN						11		14	15
149 W	USA ATS-1	1		4	6					
145 W #	MEX ILHUICAHUA 4			4	6		11	12	14	
143 W *	USA US SATCOM 5			4	6					
141 W #	MEX ILHUICAHUA 3			4	6		11	12	14	
139 W *	USA US SATCOM 1-R			4	6					
136 W	USA US SATCOM-1			4	6					
135 W	USA GOES WEST	1	3							
135 W	USA USGCSS 2E PAC					7				
135 W	USA USGCSS 3E PAC		3*			7				
134 W #	USA USASAT 11D			4	6					
132 W #	USA USASAT 11C						11	12	14	
131 W *	USA US SATCOM 3-R			4	6					
130 W #	USA USASAT 10D						11	12	14	
130 W #	USA USRDSS WEST		3		6					
128 W	USA COMSTAR D1			4	6					
127 W #	USA COMSTAR D4			4	6					
126 W #	USA USASAT 10C						11	12	14	
124 W #	USA USASAT 10B						11	12	14	

FLTSAT = FLTSATCOM  
INT = INTELSAT  
INM = INMARSAT

\* Presently being coordinated under RR1060  
# Only advance publication under RR1042

Orbital position	Space station	Frequency bands GHz								
		<1	<3	4	6	7	11	12	14	>15
123.5 W	USA WESTAR-2				4	6				
123 W *	USA WESTAR-5				4	6				
120 W #	USA USASAT 10A							11	12	14
119 W #	USA SPACENET 1				4	6			12	14
119 W	USA US SATCOM-2				4	6				
117.5 W	CAN ANIK-C3							11		14
116.5 W	MEX MORELOS II		3*	4	6		11*	12	14	
114 W	CAN ANIK-A3				4	6				
114 W #	CAN TELESAT D2				4	6				
113.5 W	MEX MORELOS I		3*	4	6			11	12	14
112.5 W	CAN ANIK-C2							11		14
109 W	CAN ANIK-B1				4	6		11	14	
109 W #	CAN TELESAT C3							11	12	14
108 W #	CAN MUSAT-A		1	3			7			
107.5 W *	CAN ANIK C-1							11		14
106.5 W #	CAN MSAT		1	3						
106 W #	USA GSTAR 1								12	14
106 W	USA USASAT-6B							11		14
105 W	USA ATS-5		1	3						
104.5 W	CAN ANIK-D1				4	6				
103 W #	USA GSTAR 2								12	14
100 W #	USA USRDSS CENTRAL				3	6				
100 W	USA FLTSAT E PAC		1				7			
100 W #	USA FLTSAT-B E PAC									20/45
99 W	USA WESTAR-1				4	6				
99 W *	USA WESTAR-4				4	6				
95 W *	USA USASAT 6A							12	14	
95 W #	USA COMSTAR D1				4	6				
95 W #	USA TELSTAR 3A				4	6				
95 W	USA COMSTAR D2				4	6				
94 W *	USA USASAT 6C							12	14	

FLTSAT = FLTSATCOM  
INT = INTELSAT  
INM = INMARSAT

\* Presently being coordinated under RR1060  
# Only advance publication under RR1042

Orbital position	Space station	Frequency bands GHz								
		<1	<3	4	6	7	11	12	14	>15
93.5 W #	USA USASAT 12B			4	6					
91 W #	USA ADV. WESTAR 1			4	6			12	14	
91 W #	USA WESTAR-3			4	6					
89 W #	USA USASAT 9A						11	12	14	
88.5 W #	USA USASAT 12D			4	6					
87 W #	USA USASAT 9B						11	12	14	
87 W #	USA COMSTAR D3			4	6					
87 W #	USA TELSTAR 3B			4	6					
86 W #	USA ATS-3	1								
86 W *	USA USASAT 3C			4	6					
85 W #	USA USASAT 9C						11	12	14	
83 W #	USA USASAT 9D						11	12	14	
83 W #	CUB STSC-1			4	6					
83 W *	USA USASAT-7B			4	6					
81 W *	USA USASAT 7D			4	6		11		14	
79 W #	USA USASAT 12A			4	6					
79 W #	USA USASAT 11A						11	12	14	
79 W #	USA TDRS CENTRAL		3						14	15
77 W #	USA USASAT 11B						11	12	14	
76 W #	USA USASAT 12C			4	6					
75.4 W	CLM SATCOL 1A			4	6					
75.4 W	CLM SATCOL 1B			4	6					
75 W	CLM SATCOL 2			4	6					
75 W	USA GOES EAST	1	3							
74 W #	USA USASAT 7A			4	6					
72 W *	USA USASAT 8B			4	6					
70 W #	USA USRDSS EAST		3	6						
70 W #	USA USASAT 7C			4				12	14	
70 W #	B SBTS A-1			4	6					
70 W #	USA FLTSAT-B W ATL									20/45
67 W *	USA USASAT 8A			4	6					

FLTSAT = FLTSATCOM  
INT = INTELSAT  
INM = INMARSAT

\* Presently being coordinated under RR1060  
# Only advance publication under RR1042

Orbital position	Space station	Frequency bands GHz								
		<1	<3	4	6	7	11	12	14	>15
66 W #	USA USASAT 15D							11	12	14
65 W #	B SBTS A-2				4	6				
64 W #	USA USASAT 15C							11	12	14
63 W #	USA USASAT 14D				4	6				
62 W #	USA USASAT 8B				4	6				
62 W #	USA USASAT 15B							11	12	14
61 W #	USA USASAT 14C				4	6				
60 W #	USA/IT INT 5A 300 E				4	6		11		14
60 W #	USA/IT INT IBS 300 E				4	6		11	12	14
60 W #	USA USASAT 15A							11	12	14
58 W #	USA USASAT 13E							11	12	14
58 W #	USA USASAT 8C				4	6				
57 W #	USA USASAT 13H				4	6				
56 W #	USA USASAT 13D							11	12	14
56 W #	USA/IT INT 5A 304 E				4	6		11		14
56 W #	USA/IT INT IBS 304 E				4	6		11	12	14
55 W #	USA USASAT 14B				4	6				
53 W #	USA/IT INT 5A CONT 1				4	6		11		14
53 W #	USA/IT INT IBS 307 E				4	6		11	12	14
53 W *	USA/IT INT 4 ATL 5				4	6				
53 W *	USA/IT INT 4A ATL 3				4	6				
53 W *	USA/IT INT 5 CONT 1				4	6		11		14
52.5 W #	USA USGCCSS 3 W ATL		3				7			
50 W #	USA/IT INT IBS 310 E				4	6		11	12	14
50 W #	USA USASAT 13C							11		14
50 W *	USA/IT INT 5A CONT 2				4	6		11		14
50 W *	USA/IT INT 5 CONT 2				4	6		11		14
50 W *	USA/IT INT 4A ATL 2				4	6				
50 W *	USA/IT INT 4 ATL 1				4	6				
47 W #	USA USASAT 13B							11		14
45 W #	USA USASAT 13F							11	12	14

FLTSAT = FLTSATCOM  
INT = INTELSAT  
INM = INMARSAT

\* Presently being coordinated under RR1060  
# Only advance publication under RR1042

Orbital position	Space station	Frequency bands GHz								
		<1	<3	4	6	7	11	12	14	>15
43.5 W #	F VIDEOSAT-3							12	14	
43 W #	USA USASAT 13G						11	12	14	
42.5 W #	USA USGCCS 3MIDATL		3			7				
41 W #	USA USASAT 14A				4	6				
41 W #	USA TDRS EAST		3						14	15
40.5 W #	USA/IT INT 5A 319.5 E			4	6		11	14		
40.5 W #	USA/IT INT IBS 319.5 E			4	6		11	12	14	
37.5 W *	F VIDEOSAT-2		3					12	14	
37.5 W #	USA USASAT 13A						11	14		
34.5 W	USA/IT INT 4 ATL 5			4	6					
34.5 W	USA/IT INT 4A ATL 4			4	6					
34.5 W *	USA/IT INT MCS ATL E		3	4	6					
34.5 W	USA/IT INT 5 ATL 4			4	6		11	14		
34.5 W *	USA/IT INT 5A ATL 3			4	6		11	14		
31 W #	USA/IT INT 5 ATL 6			4	6		11	14		
31 W #	USA/IT INT 5A ATL 6			4	6		11	14		
31 W	USA/IT INT 4A ATL 4			4	6					
31 W *	G UNISAT 1 ATL						11	12	14	
31 W *	G UNISAT 1							12	14	17
29.5 W	USA/IT INT 4 ATL 2			4	6					
29.5 W	USA/IT INT 4A ATL 3			4	6					
29.5 W	USA/IT INT 5 ATL 3			4	6		11	14		
27.5 W *	USA/IT INT MCS ATL B		3	4	6					
27.5 W *	USA/IT INT 5 ATL 3			4	6		11	14		
27.5 W *	USA/IT INT 5A ATL 2			4	6		11	14		
27.5 W #	USA/IT INT 6 ATL 2			4	6		11	14		
26.5 W	URS GALS-1					7				
26 W #	G/INM INM.AOR-CENTR		3	4	6					
26 W *	F/MRS MARECS ATL 1		1	3	4	6				
25 W *	URS VOLNA-1		1	3						
25 W	URS STATIONAR-8			4	6					

FLTSAT = FLTSATCOM  
INT = INTELSAT  
INM = INMARSAT

\* Presently being coordinated under RR1060  
# Only advance publication under RR1042

Orbital position	Space station	Frequency bands GHz								
		<1	<3	4	6	7	11	12	14	>15
25 W *	URS LOUTCH P1							11	14	
25 W	F/SIR SIRIO-2		1	3						
24.5 W *	USA/IT INT MCS ATL D			3	4	6				
24.5 W *	USA/IT INT 5A ATL 1				4	6		11	14	
24.5 W	USA/IT INT 5 ATL 1				4	6		11	14	
24.5 W	USA/IT INT 4A ATL 1				4	6				
24.5 W #	USA/IT INT 6 ATL 1				4	6		11	14	
24 W	URS PROGNOZ-1			3	4					
23 W *	F/MRS MARECS ATL 2		1	3	4	6				
23 W	USA FLTSAT ATL		1				7			
23 W #	USA FLTSAT-B E ATL									20/45
21.5 W #	USA/IT INT 5A 338.5 E				4	6		11	14	
21.5 W *	USA/IT INT 5 ATL 5				4	6		11	14	
21.5 W *	USA/IT INT 4A ATL 1				4	6				
21.5 W *	USA/IT INT MCS ATL C		3	4	6					
20 W #	LUX GDL-4				4	6		11	12	14
19.5 W	USA/IT INT 4 ATL 3				4	6				
19.5 W	USA/IT INT 4A ATL 2				4	6				
19 W #	I SARIT							11	12	17/18
19 W #	LUX LUX-SAT							11	12	17/18
19 W #	SUI HELVESAT		3					12		17/18
19 W	F TDF-1		3					11		17
19 W	D TV-SAT		3							17/18*
19 W *	F/LST L-SAT		3					12	14	20/30
										17
18.5 W #	USA/IT INT IBS341.5E				4	6		11	12	14
18.5 W *	USA/IT INT 4A ATL 2				4	6				
18.5 W	USA/IT INT 5 ATL 2				4	6		11	14	
18.5 W	USA/IT INT MCS ATL A		3	4	6					
18.5 W *	USA/IT INT 5A ATL 4				4	6		11	14	
18 W	BEL SATCOM-II						7			

FLTSAT = FLTSATCOM  
INT = INTELSAT  
INM = INMARSAT

\* Presently being coordinated under RR1060  
# Only advance publication under RR1042

Orbital position	Space station	Frequency bands GHz								
		<1	<3	4	6	7	11	12	14	>15
18 W	BEL SATCOM 3					7				
16.5 W #	USA/IT INT 5A 343.5 E			4	6		11		14	
16.5 W #	USA/IT INT IBS 343,5 E			4	6		11	12	14	
16.5 W #	USA/IT INT 5 343.5 E			4	6		11		14	
16 W	URS WSDRN						11		14	15
15 W #	G/INM INM.AOR-EAST		3	4	6					
15 W	USA MARISAT-ATL	1	3	4	6					
14 W	URS LOUTCH-1						11		14	
14 W	URS/IK STATIONAR-4			4	6					
14 W	URS VOLNA-2		3							
13.5 W	URS POTOK-1			4						
12.5 W #	F MAROTS-B	1	3							
12 W #	F/HIP HIPPARCOS		3							
12 W	USA USGCCS 3 ATL		3*			7				
12 W	USA USGCCS 2 ATL					7				
11.5 W	F/SYM SYMPHONIE-2	1		4	6					
11.5 W	F/SYM SYMPHONIE-3	1		4	6					
11 W *	URS STATIONAR-11			4	6					
11 W #	F F-SAT 2		3					12	14	20/30
11 W *	F F-SAT 2							12	14	
8 W *	F TELECOM-1A		3	4	6	7		12	14	
6 W #	G SKYNET	1				7				43/45
5 W *	F TELECOM-1B		3	4	6	7		12	14	
4 W #	USA/IT INT 5 CONT 3			4	6		11		14	
4 W #	USA/IT INT 5A CONT 3			4	6		11		14	
4 W *	USA/IT INT 4A ATL 3			4	6					
4 W *	USA/IT INT 4A ATL 1			4	6					
4 W	USA/IT INT 4 ATL 1			4	6					
1 W #	USA/IT INT 5A CONT 4			4	6		11		14	
1 W *	USA/IT INT 4A ATL 2			4	6					
1 W	USA/IT INT 4 ATL 4			4	6					

FLTSAT = FLTSATCOM  
INT = INTELSAT  
INM = INMARSAT

\* Presently being coordinated under RR1060  
# Only advance publication under RR1042

Orbital position	Space station	Frequency bands GHz								
		<1	<3	4	6	7	11	12	14	>15
1 W *	USA/IT INT 5 CONT 4				4	6		11		14
1 W *	G SKYNET 4A	1					7			44
0 E #	G SKYNET-A	1					7			43/45
0 E	F/GEO GEOS-2	1	3							
0 E	F/MET METEOSAT	1	3							
1 E #	LUX GDL-5				6		11	12	14	
4 E *	F TELECOM 1C		3			7		12	14	
5 E #	S TELEX-X		3				11	12	14	17/18
5 E	F/OTS OTS	1					11		14	
6 E *	G SKYNET 4B	1				7				44
7 E *	F F-SAT 1		3	4	6					20/30
7 E *	F/EUT EUTELSAT 1-3						11	12	14	
10 E #	F APEX		3	4	6					20/30
10 E	F/EUT EUTELSAT I	1					11	12*	14	
12 E	URS PROGNOZ-2		3	4						
13 E #	I ITALSAT		3							19/20 27/29 39/40/50
13 E	F/EUT EUTELSAT 1-2	1					11	12*	14	
14 E #	NIG NAT. SYSTEM			4	6					
15 E #	ISR AMS		4	6		11		14		
16 E #	I SICRAL 1A	1				7		12	14	20/45
17 E #	ARS SABS 1-2						11	12	14	
17 E *	ARS SABS						11		14	
19 E	ARS/AS ARABSAT I		3	4	6					
19 E #	LUX GDL-6				6		11	12	14	
20 E #	NIG NAT. SYSTEM			4	6					
20 E	F/SIR SIRIO-2	1	3							
22 E #	I SICRAL 1B	1				7		12	14	20/45
23.5 E #	D DSF-1		3				11	12	14	20/30
26 E	ARS/AS ARABSAT II		3	4	6					

FLTSAT = FLTSATCOM  
INT = INTELSAT  
INM = INMARSAT

\* Presently being coordinated under RR1060  
# Only advance publication under RR1042

Orbital position	Space station	Frequency bands GHz												
		<1	<3	4	6	7	11	12	14	>15				
26 E *	IRN ZOHREH-2						11	14						
28.5 E #	D DFS-2		3				11	12	14	20/30				
29 E	F/GEO GEOS-2	1	3					12	14					
32 E *	F VIDEOSAT-1		3					12	14					
34 E *	IRN ZOHREH-1						11	12	14					
35 E #	URS VOLNA-11	1	3											
35 E	URS GALS-6					7								
35 E	URS PROGNOZ-3		3	4										
35 E	URS STATIONAR-2			4	6									
38 E #	PAK PAKSAT I						11	12	14					
40 E	URS STATIONAR-12			4	6									
41 E #	IRN ZOHREH-4						11	14						
41 E #	PAK PAKSAT II						11	12	14					
45 E	URS GALS-2					7								
45 E *	URS LOUTCH P2						11	14						
45 E	URS STATIONAR-9			4	6									
45 E *	URS VOLNA-3	1	3											
47 E *	IRN ZOHREH-3						11	14						
53 E #	G SKYNET 4C	1				7				45				
53 E	URS LOUTCH-2						11	14						
53 E	URS/IK STATIONAR-5			4	6									
53 E	URS VOLNA-4		3											
57 E #	USA/IT INT 6 IND 2			4	6		11	14						
57 E *	USA/IT INT 5A IND 2			4	6		11	14						
57 E	USA/IT INT 5 IND 3			4	6		11	14						
57 E *	USA/IT INT 4A IND 2			4	6									
57 E *	USA/IT INT MCS IND C		3	4	6									
60 E *	USA/IT INT 5A IND 1			4	6		11	14						
60 E #	USA/IT INT 6 IND 1			4	6		11	14						
60 E	USA/IT INT 4A IND 2			4	6									
60 E	USA/IT INT 5 IND 2			4	6									

FLTSAT = FLTSATCOM  
INT = INTELSAT  
INM = INMARSAT

\* Presently being coordinated under RR1060  
# Only advance publication under RR1042

Orbital position	Space station	Frequency bands GHz												
		<1	<3	4	6	7	11	12	14	>15				
60 E	USA/IT INT MCS IND B			3	4	6								
60 E	USA USGCCS 2 IND							7						
60 E	USA USGCCS 3 IND			3*	4*	6*		7						
63 E #	USA/IT INT 5A IND 3				4	6		11		14				
63 E	USA/IT INT 4A IND 1				4	6								
63 E	USA/IT INT 5 IND 1				4	6		11		14				
63 E	USA/IT INT MCS IND A			3	4	6								
64.5 E #	G/INM INM.IOR			3	4	6								
64.5 E *	F/MRS MARECS IND 1	1	3	4	6									
65 E #	I SIRIO	1						11	12				17/18	
66 W #	USA/IT INT 5A 66 E				4	6		11		14				
66 E *	USA/IT INT 4A IND 1				4	6								
66 E *	USA/IT INT 5 IND 4				4	6		11		14				
66 E *	USA/IT INT MCS IND D			3	4	6								
70 E #	CHN STW-2				4	6								
72.5 E	USA MARISAT-IND	1	3*	4*	6*									
73 E *	F/MRS MARECS IND 2	1	3	4	6									
74 E	IND INSAT-1B	1	3	4	6									
75 E #	USA FLTSAT-B IND												20/45	
75 E	USA FLTSAT IND	1						7						
76 E *	URS GOMSS	1	3											
77 E	INS PALAPA-2				4	6								
80 E	URS POTOK-2				4	6								
80 E	URS PROGNOZ-4			3	4									
80 E	URS STATIONAR-1				4	6								
80 E *	URS STATIONAR-13				4	6								
82.5 E #	IND INSAT-1D	1		4	6									
83 E	INS PALAPA-1				4	6								
85 E	URS GALS-3							7						
85 E *	URS LOUTCH P3								11		14			
85 E	URS STATIONAR-3			4	6									

FLTSAT = FLTSATCOM  
INT = INTELSAT  
INM = INMARSAT

\* Presently being coordinated under RR1060  
# Only advance publication under RR1042

Orbital position	Space station	Frequency bands GHz								
		1	<3	4	6	7	11	12	14	>15
85 E *	URS VOLNA-5	1	3							
90 E	URS LOUTCH-3					11		14		
90 E	URS STATIONAR-6			4	6					
90 E *	URS VOLNA-8		3							
94 E	IND INSAT-1C	1	3	4	6					
95 E	URS CSDRN					11		14	15	
95 E *	URS STATIONAR-14			4	6					
99 E	URS STATIONAR-T	1		6						
99 E *	URS STATIONAR-T2	1		6						
102 E	IND ISCOM	1		4	6					
108 E	INS PALAPA-B1			4	6					
110 E	J BSE		3					14		
110 E	J BS-2		3				12	14		
113 E	INS PALAPA-B2			4	6					
118 E	INS PALAPA-B3			4	6					
125 E	CHN STW-1			4	6					
128 E #	URS VOLNA-9	1	3							
128 E	URS STATIONAR-15			4	6					
130 E	J ETS-2	1	3			11			34	
130 E	URS GALS-5					7				
132 E	J CS-2A		3	4	6				20/30	
135 E	J CSE		3	4	6				18/29	
135 E *	USA USGCSS 3 E PAC			4	6	11		14		
136 E	J CS-2B		3	4	6				20/30	
140 E	J GMS	1	3							
140 E	J GMS-2	1	3							
140 E *	J GMS-3	1	3							
140 E	URS LOUTCH-4					11		14		
140 E	URS STATIONAR-7			4	6					
140 E	URS VOLNA-6		3							
145 E #	URS STATIONAR-16			4	6					

FLTSAT = FLTSATCOM  
INT = INTELSAT  
INM = INMARSAT

\* Presently being coordinated under RR1060  
# Only advance publication under RR1042

Orbital position	Space station	Frequency bands GHz								
		<1	<3	4	6	7	11	12	14	>15
150 E *	J CSE			4	6					
156 E	AUS AUSSAT I								12	14
160 E	AUS AUSSAT II								12	14
160 E *	J GMS	1	3							
164 E	AUS AUSSAT III								12	14
172 E	USA FLTSAT W PAC	1				7				
172 E #	USA FLTSAT-B W PAC									20/45
173 E *	USA/IT INT 5 PAC 1			4	6		11		14	
173 E *	USA/IT INT 5A PAC 1			4	6		11		14	
173 E *	USA/IT INT 4A PAC 1			4	6					
174 E	USA/IT INT 4A PAC 1			4	6					
174 E *	USA/IT INT 5 PAC 1			4	6		11		14	
175 E	USA USGCSS 2 W PAC					7				
175 E	USA USGCSS 3 W PAC			4*	6*	7				
176 E *	USA/IT INT 4A PAC 2			4	6					
176 E *	USA/IT INT 5 PAC 2			4	6		11		14	
176 E *	USA/IT INT 5A PAC 2			4	6		11		14	
176.5 E	USA MARISAT-PAC	1	3	4	6					
177.5 E *	F/MRS MARECS PAC 1	1	3	4	6					
179 E	USA/IT INT 4A PAC 2			4	6					
179 E *	USA/IT INT 5 PAC 2			4	6		11		14	
179 E *	USA/IT INT MCS PAC A		3	4	6					
179 E #	USA/IT INT 5A PAC 3			4	6		11		14	

FLTSAT = FLTSATCOM  
INT = INTELSAT  
INM = INMARSAT

\* Presently being coordinated under RR1060  
# Only advance publication under RR1042

### 3. Telecommunication studies and standardization

#### 3.1 General

This work is carried out mainly by two permanent organs of the ITU: the CCIR and the CCITT.

#### 3.2 Integration of telecommunication satellites in the general network (activities of the CCITT)

The CCITT is studying the use of telecommunication satellites for telegraph, telephone, data and telematics transmissions and, where necessary, the signalling associated with these various types of information. Numerous Study Groups are developing standards, drawing up specifications and contributing to this work.

##### 3.2.1 Telegraph and data services

###### General

The parts of the Fifteenth Report on data transmission and telegraphy give a general idea of the integration of satellite circuits in the terrestrial telecommunication services.

The study of the use of telecommunication satellites for the provision of a maritime mobile service has been pursued actively and the technical, operational and tariff implications have been highlighted. The general concept of such a new system for the telegraph and telex services has been laid down as well as the access codes, as mentioned in the Seventeenth Report.

The VIIIth CCITT Plenary Assembly (1984) approved a new Recommendation (F.122) prepared by Study Group I on "Operational procedures for the maritime satellite data transmission service" which provides for the standardization of the following:

- the procedures for subscribers of a public data network (PDN) calling ship earth stations in the maritime satellite data transmission service;
- the procedures for calling subscribers of a PDN from ship earth stations using the packet switched data transmission service defined in Recommendations X.25 and X.352;
- the procedures for calling subscribers of a PDN from ship earth stations by accessing packet assembly/disassembly facilities (PAD) as defined in Recommendation X.351.

Both Study Groups I and II updated and rationalized their respective Recommendations (F.121 and E.211) dealing with the numbering and dialling procedures for maritime mobile-satellite services, so that the telephone prefixes, telex access codes (and data transmission prefixes) for equivalent services carried by means of telephone, telex or data circuits, are the same (wherever possible).

For the introduction of the INMARSAT system, amendments were made to Recommendation D.90/F.111 in order to provide guidance on the manner in which maritime mobile satellite accounts should be exchanged between Administrations, taking into account INMARSAT's traffic information requirements.

### 3.2.2 Telephone transmission

Study Group XII (Transmission performance of telephone networks and terminals, is investigating ways of improving the quality of communications, such as satellite communications, with very long propagation times, especially by the use of adaptive echo cancellers.

This Study Group has worked closely with CCIR Study Group 8 to determine values for the transmission parameters envisaged for a maritime satellite telephone communication system. This collaboration resulted in Recommendation G.473, indicating limits for the transmission parameters applicable to this service, and Supplement No. 23 in Fascicle III.2 of the CCITT Yellow Book, containing explanatory notes for engineers concerned with the planning of a maritime mobile satellite system.

With regard to equipments and their use in satellite links, Study Group XV (Transmission systems) has finalized the studies relating to echo suppressors and has completed the Recommendation on echo cancellers with the addition of a new section giving the characteristics of non-linear processors. The echo canceller characteristics are compatible with those of echo suppressors already recommended.

Study Group XVIII (Digital networks), acting as coordinator between the various specialized Study Groups of the CCITT and the CCIR, has agreed on new I-series of Recommendations dedicated to integrated services digital networks.

The work on digital speech interpolation has been mainly devoted to collecting data of currently operating DSI systems on the associated technology. This has allowed a better understanding of the implementation of such systems and will constitute the preparatory work for possible future Recommendations in this field.

The following points have been established for the interworking between digital systems based on different standards:

- the A/ $\mu$  converter is located in the  $\mu$ -law country;
- the multiplex system converter (MSC) location is not necessarily a matter for a CCITT Recommendation. Other signal processing devices would most likely require equipment in both countries (it is possible that the MSC, etc. may not always be required);
- signal processing devices will need to be under the control of the transit exchange. They may be located wherever in the country that allows this control to be exercised, and this location is a national matter, not a subject for a CCITT Recommendation;
- former Recommendation G.722 (present G.802) is revised and amended to reflect the adoption of a hybrid hierarchy operating at 2048, 6312, 44736 and 139264 kbit/s as a standard interworking solution.

The Questions on the quality of service and performance of digital networks including ISDNs and on interworking will require continuous attention and further work and are relevant also for systems using satellite communications.

### 3.2.3 Telephone switching, signalling and operation

Two studies carried out in this field concern the use of satellites in the international telephone network.

The subject of the first study is dealt with under heading 3.3: "Interconnection of maritime satellite communications services..."

The second subject of study relates to the effects of the propagation time of satellite circuits on the signalling systems standardized by the CCITT.

So far, only three of the seven signalling systems standardized by the CCITT have been regarded as compatible with the operation of telephone circuits by satellite: systems No. 5, No. 6 and R1.

Following a long series of studies and careful tests (tests carried out by the Brazilian Administration on its national network and international tests between the CTNE (Spain) and the Deutsche Bundespost over circuits using the Symphonie satellite, etc.), it was found that the R2 system could be used on satellite links with a speed sufficient for automatic operation.

This decision, reflected in a Recommendation approved by the VIIth Plenary Assembly of the CCITT (1980), is of considerable importance in view of the large number of countries in which the R2 system is used both nationally and internationally. It is, in fact, the R2 system which is recommended and is most commonly used for regional international relations in Europe, Africa and some parts of Latin America and South East Asia. The R2 system is also the standardized system for national signalling in certain countries which use satellite links for their long-distance national relations (e.g., Indonesia and the Philippines).

3.3 Interconnection of maritime satellite communications services with terrestrial telephone and telex networks (CCITT activities)

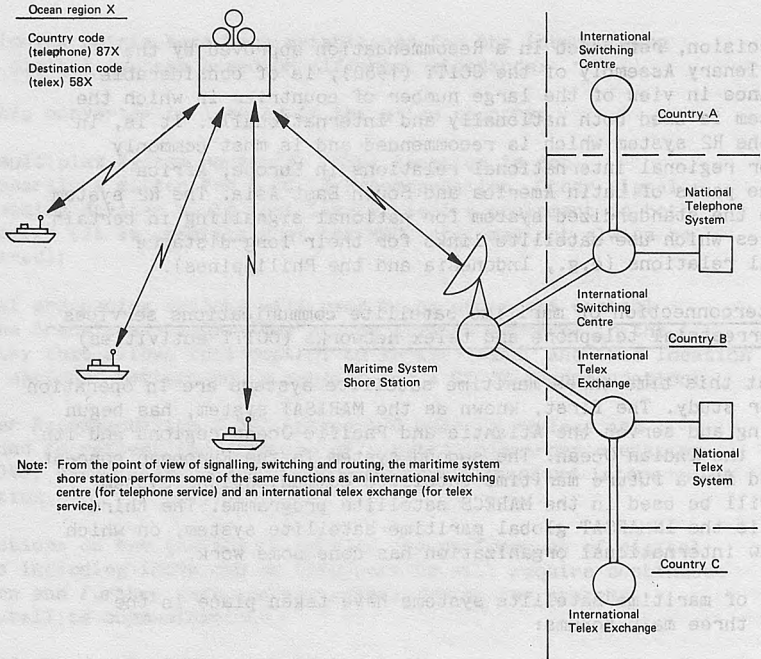
3.3.1 At this time three maritime satellite systems are in operation or under study. The first, known as the MARISAT system, has begun operating and serves the Atlantic and Pacific Ocean regions and its area of the Indian Ocean. The second system is the European concept proposed for a future maritime satellite communications system which will be used in the MARECS satellite programme. The third system is the INMARSAT global maritime satellite system, on which this new international organization has done some work.

Studies of maritime satellite systems have taken place in the past at three main forums:

- the CCITT,
- the CCIR, and
- the "INMARSAT Preparatory Committee" of IMO.

Although these three bodies have different terms of reference, a great deal of coordination has taken place between them through the attendance of representatives of each group at all meetings. As a result, a general agreement appears to have been reached regarding the basic philosophy of a maritime satellite system.

3.3.2 The basic premise is that the maritime satellite service, between country and ship, is an international service and that access to such a service from land should therefore be by use of a country code relating to a given ocean region. Maritime mobile terminals in an ocean region would in many respects be analogous to subscriber equipment in a national telephone, telex or data network. The shore stations (or earth stations) may have some of the functions of an international switching centre for telephony or an international exchange for telegraphy as such centres or exchanges relate to the maritime mobile terminals they serve. The figure below shows a typical arrangement of a maritime satellite system for an ocean region based on the premises described above.



### 3.4 Technical recommendations for radiocommunications by space techniques (CCIR activities)

The International Radio Consultative Committee (CCIR) is the permanent organ of the ITU responsible for the study of technical and operating questions on radiocommunications and for the issuance of recommendations. Current Recommendations and Reports of the CCIR, along with Questions and Study Programmes dealing with space communications are contained in the Volumes of the CCIR XVth Plenary Assembly, Geneva, 1982:

	<u>Volume</u>
- Space research and radioastronomy	II
- Fixed satellite service	IV.1
- Propagation in non-ionized media	V
- Standard frequencies and time signals	VII
- Mobile services	VIII
- Frequency sharing and coordination between systems in the fixed satellite service and radio-relay systems	IV and IX (Part 2)
- Broadcasting-satellite service (sound and television)	X and XI (Part 2)

The texts are prepared by experts and institutions in the respective fields of space communication and are finally approved by Administrations in the Plenary Assembly of the CCIR. They form the basis for harmonious technical development of different space services and contain criteria for the sharing of frequencies among the various space services and between space services and terrestrial radiocommunication services.

#### 3.4.1 Preparations for administrative radio conferences - WARC-ORB(1)

Preparation of technical bases for regional and world administrative radio conferences is an important activity of CCIR Study Groups. In 1984, the CCIR prepared comprehensive technical reports for two such conferences of which one relates to space communications, namely, the first session of the World Administrative Radio Conference on the use of the geostationary-satellite orbit and the planning of the space services using it (WARC-ORB(1), Geneva, August/September 1985).

Resolution No. 3 of the 1979 World Administrative Radio Conference calls for the convening of a conference relating to the use of the geostationary-satellite orbit and to the planning of the space services utilizing it. Among other preparatory activities, the CCIR was invited to carry out preparatory technical studies and to provide the first session of the Conference with technical information concerning principles, criteria and technical parameters, including those required for planning space services.

The work of the individual concerned CCIR-Study Groups was examined and consolidated by a CCIR Conference Preparatory Meeting (CPM, joint meeting of CCIR Study Groups) in June/July 1984. The resulting comprehensive report of 12 chapters provides the technical background needed for WARC-ORB(1). The report includes information of relevance to terminology and propagation, choice of services and bands to be planned, approaches other than planning, principles, parameters, criteria and guidelines for regulatory procedures, sharing criteria and sound broadcasting in the broadcasting-satellite service. Eight annexes to the report elaborate on the material contained in the chapters.

The CPM was attended by 340 delegates from 61 Administrations and 33 other organizations. It had a wealth of material presented to it, not only by the CCIR Study Groups concerned but also by Administrations and participating organizations, from which it drew in the preparation of its report.

3.4.2 Research on space technology, space topics of general interest, space operations, data relay satellites, space research, earth exploration satellites, radioastronomy and radar astronomy

The interim meeting of Study Group 2 (Space research and radioastronomy) that was held at the end of 1983 prepared a draft new report that deals with the difficulties in providing for space operation functions in the broadcasting-satellite service bands. Close attention was paid to the possible effects on radioastronomy due to the increasing use of geostationary-orbit satellites in several services and a criterion intended to reduce such effects was introduced. Important radioastronomy line frequencies above 275 GHz were listed, and information on the interference effects from microwave ovens to the radioastronomy service was updated.

Study Group 2 also prepared a contribution to the CCIR CPM (see above) that provided consolidated information on the following activities of the Study Group, relevant to the 1985 Conference:

- Space research service
- Space operation service
- Meteorological satellite service
- Earth exploration satellite service, and
- Radioastronomy.

3.4.3 Fixed-satellite service

Many of the existing CCIR Recommendations and Reports concerning the fixed-satellite service were revised during the interim meetings of CCIR Study Groups 4 (Fixed-satellite service) and 9 (Fixed service using radio-relay systems) in May 1984 to take account of recent technical developments.

The report "Technical factors influencing the efficiency of use of the geostationary-satellite orbit by radiocommunication satellites sharing the same frequency bands", prepared by an Interim Working Party of Study Group 4 to provide information to the 1985 World Administrative Radio Conference, was revised extensively to include new findings, and was submitted to the CCIR CPM for use in preparing the CCIR Report to the Conference (see above).

Other important activities of Study Group 4 during the interim meeting included:

- Preparation of a new draft Recommendation to establish interference limits from the fixed-satellite service into digital terrestrial radio-relay systems that share the same frequency bands below 15 GHz.

- Preparation for four new draft Reports which deal with the efficient use of the geostationary-satellite orbit, in particular:
  - Performance of small earth station antennas;
  - Off-axis e.i.r.p. density limits for fixed-satellite service earth stations;
  - Flexibility in the positioning of satellites; and
  - A technical method for multilateral coordination among satellite networks.
- Preparation of three new draft Reports on other subjects:
  - Quality standards for the hypothetical reference digital path of the fixed-satellite service as part of an integrated services digital network;
  - Coordination method between earth stations using the same frequency bands for up- and down-links; and
  - E.i.r.p. limits for the fixed-satellite service to protect feeder links to broadcasting satellites in the vicinity of 18 GHz.

The special publication "CCIR Handbook on Satellite Communications (Fixed-satellite service)" will be issued in 1985. It presents the technical bases for the various aspects of fixed-satellite service communications and summarizes fundamentals of the main technologies and equipment used, including digital techniques. The texts are of a tutorial character and are intended to assist Administrations and organizations in the planning and development of satellite communication programs and for training personnel.

#### 3.4.4 Maritime-mobile satellites

At the request of the International Maritime Organisation (IMO), CCIR Study Group 8 (Mobile services) agreed to coordinate the trial of low power transmitter systems for the alerting, via maritime satellites, of distress cases at sea. To this effect, a sub-group was formed to establish the trials programme and carry out the tests which are financed and staffed by the participating Administrations. INMARSAT has offered to the CCIR the necessary space segment capacity to carry out the tests.

The last phase of the trials programme was carried out at the beginning of 1983.

The tests proved that a satellite emergency position indicating radio beacon (EPIRB) with a transmitter power of one watt is capable of providing distress alert, with a message transfer time of 10 minutes or less in severe conditions, or with a transfer time of about one minute in good conditions (i.e., a high elevation angle).

On the basis of the results of these tests, the concerned Interim Working Party prepared draft Recommendations in January 1984 on transmission characteristics of a satellite EPIRB system operating through geostationary satellites in the 1.6 GHz band and for a satellite EPIRB system operating through a low polar orbiting satellite system in the 406 MHz band. Both draft Recommendations were considered and approved by CCIR Study Group 8 at its interim meeting in May/June 1984.

During its interim meeting, the Study Group updated most of the Reports on mobile satellite techniques and prepared a draft new Report which identifies options and issues that urgently require further study to determine the practicability of using a common frequency band for satellite EPIRB transmissions through both geostationary and polar orbiting satellites in the Future Global Maritime Distress and Safety Systems.

#### 3.4.5 Satellites for standard frequencies and time signals

The Interim Working Party of CCIR Study Group 7 (Standard frequencies and time signals) that deals with world-wide time and frequency dissemination by means of satellites updated the Report that deals with satellite techniques and included descriptions of completed experiments and a list of possible future applications.

Various satellite time transfer experiments have demonstrated a potential capability for time transfers with a precision of a few nanoseconds and an accuracy of about 50 ns. The inherent wide coverage capabilities of satellite techniques make regional and international coordination of satellite timing services highly desirable.

CCIR Study Group 7 recommends that organizations interested in, or responsible for, time and frequency dissemination and coordination, participate in experiments to evaluate the relative merits of the various satellite-based techniques and that such techniques be given serious consideration in the development of any new time and frequency dissemination and/or coordination services.

#### 4. Planning

4.1 No administrative radio conferences for planning space radiocommunications were held in 1984.

On the other hand, pursuant to decisions by the World Administrative Radio Conference (Geneva, 1979) and the Plenipotentiary Conference at Nairobi, the ITU Administrative Council at its 39th session in 1984 confirmed the convening of two conferences having a direct bearing on planning (see paragraph 1.1).

#### 4.2 International telecommunication network

The World Plan Committee and the four Regional Plan Committees (Africa, Latin America, Asia and Oceania, Europe and Mediterranean Basin), which are joint CCITT/CCIR Committees administered by the CCITT, are responsible for developing a General Plan for the International Telecommunication Network to facilitate the co-ordinated development of international telecommunication services.

For this purpose, in addition to gathering data on traffic volume and the number of circuits, they have to keep up to date, by region, the list of earth stations, for existing or planned satellite links. This information is published in the "Plan Books" and their supplements.

In pursuance of CCITT Resolution No. 12, the Administrative Council at its 1984 Session made the necessary arrangements to hold the following meetings of the Plan Committees in 1985:

- World Plan Committee
- Regional Plan Committee for Latin America.

---

## 5. Technical Cooperation activities

---

5.1 The regional ITU/UNDP project for development, operations and maintenance of telecommunications in the South Pacific has been assisting Papua New Guinea and Kiribati with their INTELSAT standard B earth station projects which are funded by the EEC under the Lomé II Agreement. On behalf of SPEC (South Pacific Bureau for Economic Cooperation) the project provided contract management and supervision.

5.2 As a contractor under an ITU/UNDP project, P.T. Industri Telekomunikasi Indonesia (INTI) is at present implementing a pilot data network in Indonesia using PALAPA (the Indonesian domestic satellite system) and small earth stations. The novel form of communication architecture employed is called "Packsatnet", i.e., Packet Satellite Data Network. Packsatnet is being evolved as part of an ITU/UNDP project and is receiving a substantial contribution from the Indonesian Government. It aims at providing an appropriate and well-tested concept for a unified nation-wide public data network. In addition, it will serve as a test bed for further research work and use for other developing countries. It is expected that the network will be ready for acceptance beginning 1985.

5.3 Within the framework of an ITU/UNDP project, assistance to the Saudi Arabia Ministry of Information in the field of satellite communications was provided through the services in 1984 of an advisor in satellite broadcasting systems; his services will be called upon again in 1985. Similar assistance was provided to the Ministry of PTT, under a Trust Fund arrangement, in the operation and maintenance of satellite communication earth stations; again, the services of the advisor will be called upon again in 1985.

5.4 In 1984, the ITU/MEDARABTEL team of experts continued their cooperation with four Arab Telecommunication Administrations, viz. Djibouti, Mauritania, Somalia and Sudan, to finalize contracts for their earth stations to work with ARABSAT; assistance was also given to select a consultant who will be entrusted to assist in setting up the earth stations. In People's Democratic Republic of Yemen, the ITU coordinator helped the local administration to finalize contracts with suppliers for Arabsat and Intersputnik earth stations.

5.5 Through an on-going ITU/UNDP project, technical cooperation to the Research and Development Centre of the Brazilian Administration (TELEBRAS) continued to be provided. Significant technical results have been and are being achieved, including the design and manufacture of cassegrain antennae in the 4/6 GHz range and of devices such as corrugated horns.

5.6 The ITU participated very actively in the UNDR0 Pan Caribbean Disaster Preparedness and Prevention Project (PCDPPP) of which satellite communication and hurricane warnings are two of the features.

5.7 Negotiations are being carried out with a donor country for the funding a feasibility study on the application of satellite communications in the Caribbean. The project profile, circulated amongst interested countries and regional and sub-regional organizations, has obtained wide support. A project document, including a plan of activities is under preparation.

5.8 The Regional African Satellite Communication System resulted from African Governments' decision to merge various projects which included a satellite communication component. Preliminary activities for the Feasibility Study of this project are now in progress. On the basis of Resolution ECA/UNTACDA/Res. 83/26, passed by the 3rd UNTACDA Conference of Ministers held in Cairo, the Inter Agency Coordination Committee (IACC), composed of OAU, ECA, ADB, PATU, URTNA, ITU, UNESCO and AFCAC, prepared the Terms of Reference for the Feasibility Study which have been subsequently approved by a very large majority of African countries.

The IACC has adopted a strategy for the mobilization of funds for the Feasibility Study and the modalities of project execution are being finalized.

The ITU, in its capacity as lead agency, has been called upon by the IACC to coordinate activities on this project and also to take the necessary steps to organize a donors' conference in order to ensure the necessary funds for the undertaking of the Feasibility Study.

5.9 In the Sudan, a UNDP/ITU expert continued to advise and assist the Telecommunications Corporation on all matters concerning the efficient operation and maintenance of satellite communication earth stations.

5.10 Within the framework of an ITU/UNDP Planning Project in Ivory Coast, a team of experts made a preliminary study on the comparative economies of development of the telecommunications network via satellite and by terrestrial systems.

5.11 Two ITU experts participated in the planning of a domestic satellite system in Cameroon for which four earth stations with 13 m antennae are initially foreseen. A quarter transponder on an Intelsat leased transponder will be used for the system.

5.12 The ITU initiated action towards organizing three regional seminar meetings in preparation for the 1st Session of the World Administrative Radio Conference on use of the geostationary orbit and the Planning of Space services utilizing it being held in August/September 1985. These three seminar meetings will be held in Buenos Aires in March 1985, in Nairobi in April 1985 and in Bangkok in May 1985 and will elaborate various important issues to be addressed by the Conference.

---

## **6. Information and documentation activities**

---

The General Secretariat continued its activities in pursuance of Administrative Council Resolutions Nos. 636 and 637 concerning the dissemination of information on the activities and role of the ITU in space telecommunications.

The Telecommunication Journal publishes each month a list of the artificial satellites launched during the previous weeks as well as articles and information on space techniques, telecommunications and spacecrafts. In May 1984, a complete list of the artificial satellites launched in 1983 was published as an annex to the Journal. This list together with the 1977, 1978, 1979, 1980, 1981, 1982 and 1983 supplements, completes the Table of satellites launched between 1957 and 1976. Hence with the 1983 supplement, a full catalogue is available.

The Table of Satellites is compiled from information provided by the Member countries of the Union, the International Frequency Registration Board (IFRB), the Committee on Space Research (COSPAR) and national space research bodies. A compilation of cuttings from the specialized press provides further information in certain respects.

It is planned to publish a consolidated Table of satellites in 1985 on the occasion of the Conference on the use of the geostationary orbit.

---

## **7. Cooperation with other international organizations concerned with space**

---

### **7.1 General**

In 1984 the ITU pursued its consistent cooperation with many international organizations concerned with space matters (COSPAR, INTELSAT, INMARSAT, etc.), with a view to exchanging technical data and appropriate documentation. In particular, it took part in the meetings of the United Nations Committee on the Peaceful Uses of Outer Space and its sub-committees.

Under the Legal Sub-Committee a Working Group had been established in pursuance of UN General Assembly Resolution 38/80 to examine matters relating to the definition and delimitation of outer space and to the character and utilization of the geostationary orbit. The ITU participated in the deliberations of this Working Group as well.

The ITU also hosted the Inter-Agency Meeting on Space Activities held in Geneva in October 1984.

In the area of space telecommunications it continued to collaborate with the specialized agencies concerned such as International Civil Aviation Organization (ICAO), International Maritime Organization (IMO), World Meteorological Organization (WMO), United Nations Educational, Scientific and Cultural Organization (UNESCO) as well as intergovernmental regional organizations.

### 7.2 Participation of the International Telecommunication Union in the meetings of the United Nations Groups of Experts

The ITU participated in an advisory capacity in the above two Groups of Experts Meetings which were organized by the United Nations to carry out, in cooperation with other organizations, the following two studies:

- the feasibility of using direct broadcasting satellites for educational purposes and of internationally or regionally-owned space segments;
- the feasibility of obtaining closer spacing of satellites in the geostationary orbit.

The meetings of the Group of Experts were provided with pertinent documentation and information on the questions concerned based on the regulatory and standardization work already carried out or being carried out by the Member countries of the ITU.

### 7.3 Collaboration concerning implementation of UNISPACE 82 recommendations

The ITU maintained close collaboration with the Outer Space Affairs Division of the United Nations in regard to the implementation of the recommendations of UNISPACE 82 also and in respect of the United Nations Space Applications Programme.



---

## ANGOLA (PEOPLE'S REPUBLIC OF)

### 1. INTELSAT system

A contract was signed for the installation of the Cape Verdean INTELSAT station.

The number of direct links will be three (two to West Africa and one to Europe) and the total number of channels about 15-20.

The station will continue operating on a 24-hour basis in 1985.

Operation of new circuits is expected in 1986.

---

### 2. INTERSPUTNIK system

## ANNEX

---

The possibility of joining the INTERSPUTNIK system is being studied.

### 3. Domestic satellite system

A special committee **Reports on progress made in the development of satellite systems covering the continent of Africa** is working on a satellite system for Africa (telephone, data, telex).

**of space communications**

A pre-feasibility study is being conducted for a satellite system for Africa, scheduled for the end of 1985.

---

## AUSTRALIA

### 1. AUSSAT

During 1984, construction of the AUSSAT station in New South Wales of the former earth stations has proceeded satisfactorily.

An agreement was signed with Australia's Space Commission, which was signed on June 1986 to June 1985.



---

## ANGOLA (PEOPLE'S REPUBLIC OF)

### 1. INTELSAT system

A contract was signed for the extension of the Cacuaco Standard A earth station.

The number of direct links will be increased from 6 to 18 (other than Spade connections) and the total number of channels from 63 to 229.

The station will continue operating on an FDMA-FM, SCPC-FM and SPADE basis.

Operation of new circuits is scheduled in 1986.

### 2. INTERSPUTNIK system

The possibility of joining the INTERSPUTNIK system is under study.

### 3. Domestic satellite system

A special committee was set up to carry out a study of a telecommunications system via satellite covering the whole country. This domestic system will provide general communications (telephone, telex, telegraphy), data, and radio and television programmes.

A pre-feasibility study is scheduled for June 1985 and the start of the implementation stage is scheduled for the end of 1987.

---

## AUSTRALIA

### 1. AUSSAT

During 1984, construction of three AUSSAT satellites and all major AUSSAT gateway earth stations has proceeded on schedule.

An agreement was signed with Ariane to launch the third satellite, with a launch window of June 1986 to June 1988.

## 2. OTS

Australia's Melbourne satellite earth station commenced operation on 14 May 1985.

More than sixty per cent (600) of Australia's overseas telecommunications traffic is now conducted by satellite.

3. The minister of communications, Mr. Michael Duffy on 13 September 1984 said that contracts were to be negotiated with an Australian-based company, backed by overseas technology, to use the B-Mac (multiplexed analogue component) transmission system to deliver ABC television and radio services via satellite in 1985. B-Mac is the preferred system because of its ability to deliver a high-quality television signal even under adverse conditions, along with six digital audio channels plus a data channel.

---

## BAHRAIN (STATE OF)

During 1984 the Bahrain telecommunications company owned and operated three satellite communications earth stations.

Two of these earth stations, which are located on the east coast of Bahrain at Ras Abu Jarjur, operate in conjunction with the INTELSAT network, and are designated as standard A terminals. The third terminal which was finally completed in December has been designated as an ARABI-1A terminal for operation in conjunction with the ARABSAT system. As the first regional earth station to be operational, ARABSAT have requested that Bahrain be designated as the secondary monitor station to the Dirash primary control facility during the early stages of operation of the ARABSAT-1A satellite.

At the end of 1984 the two standard A terminals operating via INTGSAT carried a total of 481 circuits giving direct communication with 28 countries. This was an increase of three countries compared with 1983. New routes being opened to Cyprus, South Korea and Switzerland. The increase in satellite pre-assigned circuits was 6 percent in 1984 with approximately 50 percent of circuits via space communications. These figures are slightly lower than previous years due to the transfer of some services to new terrestrial systems, of the total channels 309 are operated in the FDMA and SCPC modes via the Indian Ocean primary satellite, to the Arab world, Europe, and Far East. The remaining 172 channels are operated in the FDMA mode via the Atlantic Major path 2 satellite to Europe and North America. In addition television service is offered via both satellites with 48 561 minutes of programming being carried in 1984.

## BELGIUM

In 1984, the "Régie des télégraphes et des téléphones" completed the construction at Lessive of a third antenna to work with the European satellite ECS 2. This earth station will be operated by the Belgian Administration for the Benelux countries, Belgium, the Netherlands and Luxembourg, which shared in the cost, in proportion to their requirements estimated in EUTELSAT system circuits.

In the same way as for the lessive 2 antenna in the INTELSAT system, Lessive 3 is characterized by a central computerized management system ensuring a high level of automation and reliability.

This new station will be operated initially for purposes of television broadcasting under EUTELSAT-EBU agreements.

In the course of 1985, TDMA telephone circuits will be brought into service.

Furthermore, at the end of 1984, the "Régie des télégraphes et des téléphones" commissioned a new earth station intended for the establishment of the uplink to the European satellite ECS 1, in which the Belgian Administration has leased an 11-14 GHz transponder for television-type applications.

This new station, equipped with a 9.2 m antenna, is located at Liedekerke, a commune situated between Brussels and Ghent, about 20 km west of the capital.

Under contracts concluded with the Régie, two private users will be able to use the circuit at different times, one for videoconferences and the other for the transmission of a commercial television programme to be introduced in the cable teledistribution networks at the downlink terminals.

---

## CANADA

### 1. International satellite communications

In Canada, international satellite communication services are provided by a Crown Corporation, Teleglobe Canada.

Teleglobe Canada, as a Signatory to the INTELSAT operating Agreement has been actively involved with INTELSAT during 1984. The construction and installation of a new Standard A earth station, Mill Village 4, has been completed and the new facility has joined the network to replace the Mill Village 1 antenna which has been in operation since 1966. Preparations are also underway for the introduction of TDMA/DSI traffic terminals at its earth stations. For the INTELSAT TDMA Reference and Monitoring services in the Atlantic Ocean region, two of Teleglobe's earth stations are being equipped to provide monitoring services under contract to INTELSAT. The INTELSAT business service has been established using a small 4.5 metre antenna operating at 14/11 GHz located in downtown Toronto.

As a Signatory to the INMARSAT Agreement, Teleglobe Canada participated in the continued implementation of the INMARSAT satellite system and in evaluating the proposals (RFP) for the second generation space segment.

## **2. Domestic satellite communications**

The Telesat space segment consists of two separate systems – one operating in the 6/4 GHz band (Anik B and Anik D) and the other operating in the 14/12 GHz band (Anik B and Anik C). The 6/4 GHz space segment comprises: Anik B, launched in November 1978; Anik D-1, launched in August 1982; and Anik D-2 launched in November 1984. Anik D-2 is currently in a two year storage orbit and will replace Anik B when the latter reaches the end of its life around mid-1987. The 14/12 GHz space segment comprises Anik B, Anik C-3 and Anik C-2. There are plans to launch Anik C-1 in February 1985 and place it in a three year storage orbit. Anik A-3 was removed from the geostationary orbit in late 1984 after providing nine years of service.

At the end of 1984 there were 192 earth stations operating in the 6/4 GHz band and 100 in the 14/12 GHz band. These include permanent and transportable installations and they are used for radio and television programs and messages. There are also a large number of individually-owned television receive-only systems operating across Canada. Some estimates are as high as 30,000.

## **3. Research, operations and development**

### *3.1 DBS studies programme*

After conducting a comprehensive programme of studies to examine the social, economic, regulatory and technical implications of a DBS service in Canada, the Department of Communications concluded that DBS could be economically feasible in Canada and that its development should be evolutionary. The Department considers that an interim service using low power satellites such as Anik C should be initiated before 1990. In 1984 a Working Group on Direct-to-Home Satellite Broadcasting recommended several initiatives to advance this interim service.

### 3.2 *The M-SAT programme*

In 1980, the Canadian Department of Communications sponsored studies in Canadian industry on a mobile-satellite system called M-SAT to provide nation-wide mobile communications services primarily in the 806-890 MHz allocation. These services would include voice and data communications to land vehicles, ships, aircraft and to transportable terminals, primarily in rural and remote areas of Canada. The Phase A concept feasibility studies, completed in early 1982, established the technical feasibility of M-SAT and indicated strong demand for commercial mobile services in Canada.

Phase B of the programme, which included comprehensive economic and technical studies, was completed in December 1984. Telesat Canada has defined plans to establish a first generation commercial M-SAT system. It is expected that cooperative arrangements will be developed between Telesat Canada and a United States mobile-satellite operator. Cooperation is proposed in such areas as the development of common standards, common procurement, and mutual back-up of Canadian and United States satellites. In this regard, DOC and NASA signed in November 1983 an arrangement providing a framework for cooperation between Canada and the United States for the development of mobile-satellite services. Tenders to industry are expected to be issued in 1986 for the construction and testing of a first generation M-SAT with a launch by the end of the decade.

### 3.3 *The SARSAT programme*

The Satellite-Aided Search and Rescue Project (SARSAT) is a joint Canada-France-USA experimental project with the objective of using space-borne technology to demonstrate the detection and location of emergency beacon signals operating at the 121.5, 243 and 406 MHz distress frequencies. The first search and rescue-equipped satellite developed by the Sarsat participants, a USA NOAA-E weather satellite, was launched in 1983. A new SARSAT Memorandum of Understanding has been negotiated to provide for an additional three NOAA satellites with search and rescue capabilities. This will extend the system's life through to the early 1990's, providing an interim service while long term arrangements for a future fully operational international system are worked out.

An MOU was also signed in 1980 between the SARSAT participants and the USSR's Ministry of Merchant Marine to provide for a joint demonstration project (COSPAS/SARSAT). The first phase officially began in 1983 and was completed in 1984. A new COSPAS/SARSAT MOU was negotiated in 1984.

Since September 1982, the COSPAS/SARSAT system has helped save more than 300 lives.

### 3.4 *Off-shore communications services*

In 1983 the Department of Communications developed a new 14/12 GHz stabilized satellite terminal which would significantly reduce the costs of delivering communications to off-shore installations. In 1984, the Department worked with a manufacturer (SPAR Aerospace Limited) to develop a prototype manufacturing unit. Field trials are scheduled for June 1985.

### 3.5 The European Space Agency

Under the terms of its agreement of co-operation, Canada continues to participate in the activities of the European Space Agency including the Olympus and ERS-1 projects, two major optional ESA programmes.

#### *Reports from industry*

The People's Republic of China awarded satellite earth station contracts to SPAR Aerospace in 1984. The contracts involve the acquisition of equipment as well as technology, and is the first step in the development of a domestic satellite system in China.

SPAR Aerospace completed development and manufacture of the space segment for the Brazilian domestic satellite system in 1984. Launch is due in early 1985.

SPAR Aerospace has completed development of a 14/12 GHz FM-SCPC satellite earth terminal, Sparmarine, using a stabilized antenna platform for offshore telecommunications applications. The system technology was transferred from the Canadian Government's Communications Research Centre to SPAR through an on-going Government/Industry technology transfer programme.

Microtel's low cost transportable digital-SCPC satellite earth terminal, SPACETEL, which initially was only capable of operation in the 14/12 GHz radio frequency band, is now also available in the 6/4 GHz band.

The SED Systems/Mitel owned Skyswitch Communications Company has developed in 1984, an FM/SCPC 14/12 GHz earth terminal, which SED will market in Canada and Skyswitch will do likewise, in the United States of America. A 6/4 GHz version is planned to be available in early 1985.

---

#### **CHINA (PEOPLE'S REPUBLIC OF)**

In 1984, China made satisfied progress in space programme. Only in space communications, they are:

1. In January, China launched an experimental technology satellite, which performed a series of space technology tests, including the tests of satellite communication, from which a lot of valuable experimental data and materials were obtained.

2. In April, the first geostationary experimental communication satellite, STW-1, was successfully launched. Following the normal procedure, the spacecraft was, with eight-days' telemetry and control, located at  $125^{\circ}$  east longitude over the equator.

The launch of this geostationary experimental communication satellite is a unified project, including five systems: spacecraft, launching vehicle, experiment launching site, ground TT&C network and earth communication station, all of which were developed by China.

STW-1 is 2.1 m in diameter including the antenna, 3.1 m high, 900 kg in transfer orbit, and 420 kg in geostationary orbit. The orbit inclination is  $1^{\circ}$ . The accuracy of location keeping exceeds  $\pm 1^{\circ}$  longitude. The spacecraft is consisted of ten subsystems: structure, energy, control, communication, telemetry, telecommand, tracking, antenna, thermal control and apogee motor and spin steadilization. The satellite operates at C band, whose uplink is 6225-6425 GHz and downlink is 4000-4200 GHz. The spacecraft is equipped with three transponders. The antenna transmits a global beam, which covers the whole land of China. The transmission gain is 16.5 dB and peak value of reception gain is 19.5 dB, with circular polarization and the pointing accuracy is about  $0.5^{\circ}$ .

The first and second stages of the launching vehicle are filled with normal propulsion, the third one employs the low temperature propulsion. The weight of liftoff is 202 t, and that in transfer orbit is about 1300 kg.

The TT&C ground network, including the control center located in Weinan, Shanxi province, and two TT&C ground stations equipped with China-made computers and equipments of telemetry, telecommand, tracking, data transmission and communication. Additionally, the tracking ships helped to perform telemetry and control in the extended range to increase the observation ability.

The earth communication stations that are used for tests are linked up with a few ones in 10-15 m in diameter in Beijing, Nanjing and Lasa and few small stations. Through the communication test in Beijing and other earth stations, especially in the remote Lasa station, the satellite has been proved to operate well, whose TV, broadcast, telephone, telegram, facsimile and data transmission have achieved good results. The television programme looks clear and colourful. Broadcast sounds clear. The spacecraft and ground communications have met the fixed design specifications. The satellite is performing normally.

### 3. International cooperation

In accordance of the Agreement of the Joint Experiment via Sirio satellite signed by China and Italy in 1983, Cast and Telespazio of Italy carried out a series of joint scientific experiments between Lario station and Beijing station from March 24th, 1983 to Dec. 31st, 1984.

Experiment items: measurement on the wave absolute attenuation of uplink and downlink, data transmission at 2 Mbit digital telephone of 64 kbit, clock synchronization and newspaper facsimile. A lot of important scientific data have been obtained from the experiment in the past year. Particularly, a lot of data have been collected through the measurement on the wave absolute attenuation of uplink and downlink. Now, the Chinese experts are involved in data processing with Italian experts in Milan Engineering Institute. The joint experiment via Sirio satellite has brought about an advance in contact and cooperation in astronautic circles between the two countries.

The success of the Chinese experimental satellite has not only brought happiness to China with large territory and big population, and has opened a brilliant future to the standard of material life of the Chinese people, the improvement of present conditions of domestic communication, television, and broadcast, but also has established a good condition to develop the international communication service. From now on, China will strengthen further international economy and technology cooperation and exchange while paying much effort on developing the space communication. China is willing to make further contribution to benefit the human being.

---

## COLOMBIA (REPUBLIC OF)

### Earth segment

Construction work began and some of the acceptance tests required by INTELSAT were carried out on the Barranquilla and El Cerrejón earth stations, which are to be used to set up a communications system for the coal mining project at El Cerrejón on the Atlantic coast of Colombia. The stations, which are equipped with 13-metre antennas and offer a capacity of 60 circuits, will be brought into operation in the first quarter of 1985.

### Space segment

In association with the Member countries of the Andean Sub-regional Agreement, Colombia has been pursuing feasibility studies for the establishment of a regional satellite system, called CONDOR.

The meeting of Ministers of Transport, Communications and Public Works of the Member countries of the Agreement recently at Cartagena identified the CONDOR project as a priority activity and recommended that studies on the design of the region's own satellite be continued.

---

## **DENMARK, FINLAND, ICELAND, NORWAY AND SWEDEN**

### **1. The Nordic Intelsat earth station**

The Nordic Intelsat earth station at Tanum in Sweden, jointly owned by the four telecommunications administrations in Denmark, Finland, Norway and Sweden, has been in operation with one antenna for traffic via an Atlantic Ocean satellite since 1971. The traffic has substantially increased since the start of operation of the Tanum earth station. During 1981 a second antenna was introduced at the station. This antenna is, as well as the first antenna, operating in the Atlantic Ocean region.

At the end of 1984, the station carried a traffic of about 890 full-time preassigned circuits.

In addition the stations can carry a traffic of 24 circuits via the SPADE system.

### **2. Eutelsat earth station**

Denmark, Finland, Norway and Sweden are members of EUTELSAT.

An earth station is being built in Stockholm for operation in the Eutelsat system. The station will be ready for operation during 1985 and will be used jointly by the four Nordic countries.

The station will have a capacity of 2000 telephony channels. It can also receive two television channels and transmit one television channel.

Some television programmes originating in England, France, Belgium and Switzerland have been received via ECS/F-1 for distribution into cable networks in Finland, Norway and Sweden. In Finland, for example, 5-metre antennas have been used at 18 locations for this purpose.

### **3. The Nordic Inmarsat coast earth station (CES)**

A joint Nordic coast earth station for the INMARSAT system has been in operation at Eik in Norway since February 1982. It operated in the Atlantic Ocean region (AOR) until February 1983. In accordance with a joint agreement with the United Kingdom, the Eik CES has from then on handled traffic in the Indian Ocean region (IOR) while Goonhilly has carried the traffic in the AOR. There is also an agreement with Telecoms Singapore for the use of their CES in the Pacific Ocean region. The tripartite agreement makes it possible to offer customers global coverage at reasonable charges. The traffic via Eik continued to increase during 1984.

#### 4. TELE-X: an experimental telecommunication satellite system

Finland, Norway and Sweden are engaged in an experimental satellite programme named TELE-X. The Norwegian and Swedish Telecommunication Administrations are collaborating in an operating company called NOTELSAT. The satellite is planned to be ready for launching in 1987. The satellite will be developed, manufactured and tested by Nordic industries in collaboration with European industries. The earth stations will be developed, manufactured and tested by Nordic industries.

The TELE-X mission centres on the following experiments:

- data communications for different services,
- video communications for outside broadcasting and other video applications,
- direct television and sound broadcasting for home receivers and cable television networks.

#### 5. NORDSAT operational Nordic satellite system

Preparation work for an operational Nordic direct broadcast satellite system, named NORDSAT, has been going on since the middle of the 70's.

The NORDSAT project is now subject for political negotiations with the aim to reach an agreement in principle for the establishment of the system.

The first Nordsat satellite is expected to be launched in 1989 at the earliest.

---

### DENMARK

1. The earth station on the production platform Tyra East in the North Sea was brought into operation the 1st of March. This station is connected to the Danish station at Blaavand via the Intelsat V satellite, located at 53 degrees W. At the moment 30 telephone circuits are operational. The antenna diameter is 7.5 metres.

The leased satellite capacity is one half of a 36 MHz transponder which is also used for telephone circuits between Denmark and Greenland and between the Greenlandic stations.

2. Denmark has leased one 72 MHz transponder in the satellite Eutelsat 1, F-3. This transponder will partly be used for communication between Denmark and the Faroe Islands and partly for television distribution. Two stations are planned in 1986, one in Denmark and one at the Faroe Islands.

3. Denmark is participating in a project (Cost 205) within the European co-operation on scientific and technical research concerning collection, combination and analysis of data about the influence of the atmosphere on radio waves at transfer between satellites and the earth at frequencies above 10 GHz.

Propagation measurements at 20 and 30 GHz are performed with radiometers in elevation angles of 10 and 200.

These measurements are supported by the Finnish and Swedish administrations.

Low elevation beacon measurements at 11 GHz on an Intelsat V satellite in the Atlantic Ocean region are going to be performed in the near future in cooperation with the Danish Technical Highschool.

4. Denmark is planning a station to be connected to the ECS/SMS system. This station will be located near Copenhagen, completion is expected to be 1986.

5. Denmark is planning a station to be connected to the IBS system. It is considered to locate this station in Blaavand.

#### **Satellite communication in Greenland**

Since the last review the whole traffic in the Greenlandic INUKSAT DOMSAT system has been transferred from the Intelsat IV (F-1) to the new Intelsat V (F-8) satellite located at 53 degrees west with a marked improvement in the capability and stability of the system. This is certainly appreciated especially on the substation Qanaq, which is situated on 77.5 degrees northern latitude, with a working antenna elevation of only approx 2.5 degrees.

Investigations are continued concerning the feasibility of the Intelsat Vista service for small settlements in Greenland by means of small and cost-effective earth stations.

An Inmarsat ship earth station was established in 1984 at the weather station Danmarkshavn in North-East Greenland on 77 degrees northern latitude for the purpose of transmitting the stations weather reports and observations to the international meteorological networks.

---

#### **ECUADOR**

##### **Quito earth station: second antenna**

The Ecuadorian Telecommunication Institute (IETEL) is engaged in studies with a view to installing its second antenna for space radio communications in the near future. This second antenna, like the first, will be used for international telephone, telegraph and data traffic.

## Island province of Galapagos

The island province of Galapagos, which has been declared part of the heritage of mankind by UNESCO, will shortly be served by satellite telecommunication systems; IETEL is preparing technical studies in order to provide this important archipelago with an earth station for domestic communications.

## Andean telecommunication satellite: Satcom

With a view to optimizing intraregional telecommunication systems, Ecuador, together with the other Andean Pact countries is participating in the project for an Andean telecommunication satellite. The body in charge of the studies is ASETA, the Association of State Telecommunication Enterprises of the Andean Subregional Agreement.

## Satellite broadcasting

Among plans and projects for later implementation is the establishment of an Ecuadorian broadcasting satellite station within its island section of the geostationary orbit.

---

## EGYPT (ARAB REPUBLIC OF)

### 1. International communication via satellites

Egypt continues to take a close interest in satellite communication activities and has been a member of INTELSAT since 1965.

1.1 Maadi No. 1 Standard A earth station, in operation since 1978 and is presently with the Atlantic Ocean, Primary Path Intelsat V satellite. This station currently handles traffic with ten countries on the FM/FDM with a total capacity of 408 channels using two carriers the third carrier will be activated in mid-1985 to operate with four more countries. In addition, there are 30 destinations working with Egypt via the spade system at a capacity of 24 channels.

During 1984, 120 television transmissions and 777 television receptions at a total period of 33 880 minutes were handled by this earth station.

1.2 Maadi No. 2 Standard A earth station has been activated since mid-1984 and is presently with the Indian Ocean. Primary Path Intelsat V satellite, this station currently handles traffic with eleven countries on the FM/FDM and equipped to receive nineteen countries with a total capacity of 348 channels during 1984, 24 television transmission and 84 television receptions at a total period of 3991 minutes were handled by this earth station.

## 2. Maritime satellite communications

Egypt is a member of Inmarsat since 1979. The specifications for the Maadi Inmarsat coast earth station has been announced in international tender on 5 November 1984, and the construction of the station is foreseen at the second quarter of 1986.

## 3. Meteorological satellite applications

Since 1969, the Egyptian Meteorological Authority (APT) earth station operates with near polar orbiting satellites to receive both visible and infra-red channels. In 1979 the earth station has been modified to operate with geo-synchronous satellite (Meteosat). In 1982, a new SDUS earth station has been constructed with the capabilities of receiving pictures from both polar-orbiting and geo-synchronous satellites. Specialized data processing system has been acquired to provide meteorologists with pictorial information about the different types of cloud systems and associated weather phenomena.

## 4. Remote sensing from space

The Egyptian centre for remote sensing is a part of the Egyptian Academy of Scientific Research and Technology. Since 1971 the RSC offers the full range of earth resources data acquisition and processing services.

---

## ETHIOPIA

In order to expand the satellite direct links to/from Ethiopia, ETA issued a tender on July 25 for an Intelsat Standard B satellite communications earth station which is to be co-located with the existing Sululta satellite earth station. The evaluation of the proposal received and subsequently opened on 6 November is in the final stages. The implementation is scheduled to facilitate traffic cut-over in mid-1986 via the Indian Ocean region Intelsat primary satellite.



## FRANCE

### 1. Participation in international organizations

The French Administration continued to participate very actively in the work and decisions of the international satellite telecommunication organizations INTELSAT, INMARSAT and EUTELSAT.

#### 1.1 INTELSAT

France's share of investments in Intelsat was 5.64% in 1984. At the end of that year, over 3850 international satellite circuits were routed via the communication satellite centres of Pleumeur-Bodou (four antennas in operation, including two new Standard A antennas to renew the antenna stock of this centre) and Bercenay-en-Othe (three antennas in operation). A new centre will be opening in 1985 at Rambouillet, near Paris, where a new antenna operating in the band Ku will be used.

France makes intensive use of the INTELSAT system for links between metropolitan France and the overseas departments and territories; in particular, it leases a repeater for communications with Martinique and 3/4 of a repeater for links with La Réunion. The departments and territories of Martinique, Guyana, Tahiti, New Caledonia and Saint-Pierre-et-Miquelon are equipped with earth stations; in 1983 an earth station was also installed on Guadeloupe.

Lastly, France provides services for telemeter, telecommand and supervision of satellites of the INTELSAT, using facilities installed at Pleumeur-Bodou and Bercenay; in this connection, it has helped to place on station Intelsat V satellites.

#### 1.2 INMARSAT

France's share of investments in Inmarsat amounts to 1.67%. Over 40 ships are equipped with stations for traffic with INMARSAT satellites. Early in 1984, a French coast station was brought into service at Pleumeur-Bodou to provide links with the INMARSAT satellite placed in orbit over the Atlantic Ocean.



### 1.3 EUTELSAT

France's share of investments in Eutelsat is 16.4%. In 1983, the French Parliament ratified the Intergovernmental Convention establishing the definitive statute of the organization. The second operational EUTELSAT satellite was successfully launched by the Ariane launcher in August 1984 and, pending the bringing into service of the telephone system in 1985, France is using the F2 satellite for occasional television transmissions in Europe, with two antennas at Bercenay and transportable stations. It also leases one repeater of the system for the transmission of a French-language television programme to twelve European and North African countries.

Finally, France participated in the receipt in orbit of the Eutelsat F-1 and F-2 satellites under a service contract.

### 2. TELECOM 1 national programme

The TELECOM 1 service opened in 1984. It offers French and European companies digital links in the band Ku in a wide range of bit rates for the development of such applications as videoconference, high-speed facsimile, inter-computer data transfers, etc.

The Telecom 1 satellites are also used for setting up telephone and television links in the band C between metropolitan France and the overseas departments and territories. Stations have been or are being installed in Guyana, Martinique, Guadeloupe, Saint-Pierre-et-Miquelon and La Réunion.

The first operational satellite, Telecom 1-A, was launched by Ariane on 4 August 1984. On 8 December 1984, more than 300 circuits between metropolitan France, Saint-Pierre-et-Miquelon, La Réunion and Mayotte were transferred to Telecom 1-A.

By the end of the year there were six digital stations connected to the network operated by the Telecom 1 payload operations centre at Mulhouse. Some twenty other stations are being installed in France and elsewhere in Europe under contracts with EUTELSAT and the DBP.

### 3. TDF 1 programme

France and Germany have begun the execution of a direct-satellite broadcasting system comprising two pre-operational satellites, one French (TDF-1) and the other German (TV-SAT), which are to be launched around 1986 by Ariane.

---

## GERMAN DEMOCRATIC REPUBLIC

The Deutsche Post earth station of the German Democratic Republic, which started operation in 1976, provides steady telephone connections via the satellite link Stationar-4 to Cuba, the Algerian People's Democratic Republic, the Republic of Iraq and the Union of Soviet Socialist Republics and ensures the exchange of television programmes with all associated countries in the INTERSPUTNIK system.

Further extension of the earth station was begun in 1984. For this purpose, modern uncooled redundant input amplifiers and a new scanner device for the antenna follow-up equipment had been installed. These measures resulted in improvement of transmission performance and the serviceability of the station.

The XIIIth Session of the Council of INTERSPUTNIK was held in Karl-Marx-Stadt/GDR in September 1984.

Delegations of the following Member States of the INTERSPUTNIK organization participated: Democratic Republic of Afghanistan, People's Republic of Bulgaria, Hungarian People's Republic, Socialist Republic of Vietnam, German Democratic Republic, People's Democratic Republic of Yemen, Cuba, Mongolian People's Republic, People's Republic of Poland, Socialist Republic of Romania, USSR and Czechoslovak Socialist Republic; observers from the People's Democratic Republic of Algeria, the People's Republic of Angola, India, the Republic of Iraq, the Syrian Arab Republic, France, the Socialist Federal Republic of Yugoslavia as well as from INMARSAT and OIRT attended. In the course of the Session the Democratic People's Republic of Korea was admitted to the organization as a New member.

The Council adopted the Report of the Director General and of the Audit Committee on activities in 1984 and determined the satellite lease capacities, rates of channel utilization and the Organization's financial plan for 1985.

In addition the Council decided to transfer from satellite Stationar 5 (53° E) to Stationar 13 (80° E) in the Indian Ocean region in 1985/1986 to offer more Asian countries the possibility of participating in the INTERSPUTNIK system.

The Council also approved decisions on advanced activities regarding the organization's participation in international efforts to ensure the peaceful uses of outer space.

---

## **GERMANY (FEDERAL REPUBLIC OF)**

### **1. Participation in the INTELSAT and EUTELSAT systems**

A third Standard C antenna has been brought into service at the Usingen earth station. It is used for telephone transmission and television broadcasting via the EUTELSAT satellites.

For the wideband cable networks, 5 feeder earth stations using antennas with a diameter of about 9 m have been ordered – 2 for operation with the EUTELSAT satellites and 3 with leased INTELSAT satellite transponders.

The TDMA reference and monitoring installations using Intelsat have been completed.

Traffic volume and links continued to increase in 1984. New links were set up with Egypt, Bangladesh and Bermuda, with the result that the Federal Republic of Germany has now established connections with a total of 59 countries. At the end of 1984, the Deutsche Bundespost was operating some 2700 circuits via INTELSAT satellites.

On 4 August 1984, the second ECS satellite in the EUTELSAT system was launched with the first Telecom satellite. A number of small stations located at various points throughout the country are being installed for operation with the satellite multiservice system (SMS).

The Deutsche Bundespost has set up a special measurement antenna at Darmstadt for in-orbit reception testing.

### **2. The Federal Republic of Germany's telecommunication satellite system "DFS Kopernikus"**

At the end of 1983, the Deutsche Bundespost awarded to a domestic industrial consortium a contract for the supply of the space and earth segments of the national telecommunication satellite system "DFS Kopernikus".

The space segment consists of 2 satellites with a launch weight of 1400 kg equipped with three transponders operating in the band 11-14 GHz, 7 transponders in the band 12-14 GHz and 1 transponder in the band 20-30 GHz, as well as one standby satellite on the ground.

It is planned to use the satellite system for television transmission and distribution, for the "new services" and for point-to-point digital signalling. In the band 20-30 GHz, trials are planned to ascertain the suitability of this band for television news coverage. The contract also covers the production of 30 small earth stations with TDMA equipment and network access systems for the "new services", as well as two fixed earth stations for the band 20-30 GHz.

The first satellite is scheduled for launching and operation in 1987.

### 3. Participation in the TELECOM 1 system

The participation of the Deutsche Bundespost in the French Telecom 1 system has been covered since March 1981 by a bilateral agreement concluded with the French Directorate-General of Telecommunications.

Since August 1984, Telecom 1 has been positioned on the geostationary satellite orbit.

Seven earth stations belonging to the Deutsche Bundespost were set up at the end of 1984. In 1985, 15 ground stations will be operational for national and international traffic.

The digital transmission system Telecom 1 can be used for speech communication and data transmission circuits at bit rates ranging from 64 to 2048 kbit/s, as well as for video conference links.

### 4. The Federal Republic's television broadcasting satellite TV-SAT

The launching of the German direct broadcasting satellite TV-SAT was delayed for technical reasons. It is now planned for mid-1986.

The Usingen transmitting earth station and its antennas will be operational as early as March 1986.

From mid-1988, after the launching of a second TV-SAT (TV-SAT 2) – largely identical to the first – it is planned to increase the number of channels in the satellite broadcasting system to five and to operate it with four digital TV and six sound programmes designed for stereophony.

### 5. The SPACELAB experiment NAVEX

The NAVEX experiment developed by the Federal Ministry for Research and Technology is designed for a high-precision clock synchronization and one-way telemetry test series which is currently being prepared for the Federal German Spacelab mission D1 scheduled for October 1985.

In the meantime, the satellite intended for this experiment has passed the interfacing test with the Spacelab installations with flying colours. To carry out this mission, a ground control station has now been installed at Oberpfaffenhofen by the German Aeronautics and Space Research and Test Institute (DFVLR) and two ground receiving stations have been set up at Stuttgart-Zuffenhausen and Brunswick for Standard Elektrik Lorenz and the Federal Physical and Technical Institute respectively.

## 6. Maritime distress system DCRS

The maritime distress system in the L band (DRCS, or Distress Radio Call System) developed in the Federal Republic of Germany is intended for the early warning of rescue organizations connected with the ground station network in cases of distress at sea. It is designed for operation with the world maritime communication satellite system INMARSAT.

After the completion of the international comparison tests, the CCIR specified, in a draft Recommendation adopted at the beginning of 1984, the characteristics of this narrowband FSK system in a form modified for the transmission of distress signals via geostationary satellites forming part of the future global maritime distress and safety system (FGMDSM).

At the same time, a real operation trial with international participation has been suggested. This will be carried out from around mid-1985 in the coverage area of the Atlantic satellite (MARECS A) via the British coast earth station at Goonhilly and the Falmouth Rescue Coordination Centre. At present, the reception and evaluation equipment, together with 2 distress beacons, have been prepared for this preoperational test.

The average transmission time (counting from the moment when a distress call is broadcast up to the printing of the report decoded in the Rescue Coordination Centre) is 1 to 5 minutes. In addition to the ship station identification, this report contains the up-to-the-minute information on the ship's position, its bearing, speed, the time at which the distress call was broadcast and the circumstances of the accident.

## 7. Study of wave propagation in the frequency bands above 10 GHz

In 1984, plans were established with a view to conducting a new experiment in the band 20-30 GHz. In a first stage, measurement operations are to be carried out using the Olympus satellite available from mid-1987.

In 1983, propagation measurement operations were based on the study of amplitude scintillation caused when radiation is forward-scattered in tropospheric turbulences. In 1984, the measurement results were analysed and a number of useful relationships and ratios were corroborated.

The measurement operations carried out in connection with hydrometeor scatter effects in the 11 GHz band have been completed; the findings are still in the process of analysis. Preparations are being made for new studies in the 30 GHz band.

## **GHANA**

Ghana has only one satellite earth station, and is ARD A type, located at Nkutunse, 28 km from Accra (latitude: 05° 44' 53'' N, longitude: 00° 18' 19'' W).

It was commissioned in August, 1981 and operates at present a total of 35 circuits made up as follows: Ghana-United Kingdom (21); Ghana-United States of America (7); Ghana-Federal Republic of Germany (3); Ghana-France (2); Ghana-Italy (2).

## **ICELAND**

### **1. Nordic activities in the field of satellite telecommunications**

See under Denmark.

### **2. Domestic activities**

The Intelsat Standard A earth station Skyggnir was in operation continuously throughout the year. At the end of the year, it was carrying traffic on 138 circuits via the primary path satellite to Tanum in Sweden, Goonhilly in the United Kingdom, Raisting in the Federal Republic of Germany and Etam in the United States.

In addition a Standard B earth station was in operation during the year for television reception only accessing a lease transponder in an Intelsat spare satellite.

## **INDIA (REPUBLIC OF)**

### **1. Indian national satellite system (INSAT-1)**

The second spacecraft of the first generation multipurpose Indian national satellite system (Insat-1) launched in August-September 1983 is fully operational. The Insat-1 system provides the following services:

- long-distance telecommunication (telephony, data, facsimile etc.),
- round-the clock meteorological earth observation and data relay,
- direct television broadcasting to augmented community television sets in rural areas and networking of terrestrial television transmitters,
- regional and national networking of radio transmitters.

The launch of the third Insat-1 satellite, Insat-1C, is scheduled for mid-1986.

### **2. INSAT space-segment replenishment with Indian-built spacecraft**

The Space Research and Development Profile for the decade 1980-90 approved by the Government of India, provides for design fabrication and launch of the second generation Insat (Insat-II) test spacecraft. The definition of the functional requirements for INSAT-II system and the basic configuration of the Insat-II spacecraft have been completed in co-operation with the agencies participating in the INSAT system, namely the Department of Telecommunications, the All India Radio, the Doordarshan and the India Meteorological Department. The launch of the first Insat-II test satellite is targeted for late 1989 and the second in late 1990.

### **3. Indian remote sensing satellite programme**

With a view to integrate the expertise gained through the two experimental earth observation mission (Bhaskara I and II) and towards realizing practical applications in the area of remote sensing, a comprehensive Indian remote sensing satellite programme was initiated. This programme envisaged the launch of indigenously built Indian remote sensing (IRS) satellite in 1986.

This satellite will be launched into a polar sun synchronous orbit at an altitude of 904 km. The satellite will carry solid state (CCD) Linear Imaging Self Scan (LISS) Camers systems for imaging the earth's surface in four spectral bands. Development and integration work for the Indian remote sensing satellite (IRS-1) has made headway in the current year.

A National Natural Resources Management System (NNRMS) has been organised including many agencies using remote sensing data in order to bring about effective utilisation of data in the country. The earth station at the National Remote Sensing Agency at Hyderabad has facilities to receive remote sensing data from Landsat-4. There is also a facility to receive a meteorological data from NOAA satellites. Facilities are also being built up for the reception and processing of data from IRS-1. A brief report on the activities of National Remote Sensing Agency is given in Annex.

#### 4. Streched Rohini satellite series (SROSS)

An indigenous capability to put into orbit satellites in the weight range of 150 kg will become available shortly, through the ASLV launcher, which is an augmented version of the existing SLV-3. To make effective use of this class of satellite to carry out technological and scientific experiments, the SROSS Programme is being implemented to develop versatile platforms of 150 kg.

A satellite bus has been designed to allow standardization of main frame systems with flexibility in their capabilities in terms of telemetry data rate, command capability, power supply attitude control and sensing provisions. While the spacecraft main frame is planned to be built using already proven near mature technologies, the adoption of state of the art technologies such as use of microprocessors, VLSI and hybrid micropackaging techniques in their designs are also being emphasised. The bus can be readily adopted to configure either a three-axis stabilized platform or a spin stabilized platform depending upon the specific mission needs. Already two specific payloads viz: a Multi Spectral Electro Optical Stereo Scanner (MEOSS) and an Indian X-ray Astronomy Observation (IXO) experiment have been identified.

#### 5. ISRO telemetry, tracking and command network (ISTRAC)

As a part of ISTRAC Network, a TTC terminal has been commissioned at Sriharikota to provide telemetry and telecommand support in the frequency bands 2025-2110 MHz and 2200-2290 MHz for Indian low earth orbit satellites and launch vehicles.

### ANNEX

#### National Remote Sensing Agency (NRSA)

##### 1. Introduction

The national Remote Sensing Agency (NRSA) made further progress in various activities, viz., aerial and satellite data acquisition, data processing, analysis, interpretation and training. Considerable progress is made towards establishment of ground segment for reception, processing and dissemination of Indian Remote Sensing Satellite (IRS) data.

## **2. Reception, processing and dissemination of satellite data**

### **2.1 IRS data reception**

Significant progress is made towards establishment of ground segment for reception, processing and dissemination of IRS data. The existing Landsat 3 terminal is being modified for IRS data reception. Systems/sub-systems are being developed/procured for data acquisition, quick-look, data pre-processing, photo processing and electrical support facilities.

### **2.2 LANDSAT/METSAT data reception**

Presently two terminals (one operating in S-L band and the other in X-S band) are in operation at the earth station located in Shadnagar near Hyderabad. MSS and Thematic Mapper (TM) (from June 1984) data from Landsat 4 and 5, and AVHRR data from NOAA meteorological satellites are being received and archived regularly.

Raw TM data has been generated for a few scenes and work on producing corrected data is in progress.

Satellite data products were supplied to many users in India and abroad through NRSA Data Centre (NDC). Data pre-processing system is being augmented to meet the increased user demand of satellite data products. A quality control cell and an analytical laboratory have been set-up to evaluate the data products and to monitor performance of photo processing machines.

A separate terminal is being constructed for receiving data from the NOAA series meteorological satellites.

### **2.3 IRS utilisation programme and RRSSC**

As part of IRS Utilisation Programme (IUP), eight applications projects on various themes have been taken up with Indian collaborating organisations. The Regional Remote Sensing Service Centre (RRSSC) of Department of Space, out of the five proposed centres, located at Dehra Dun, Uttar Pradesh has commenced its operation around a Multispectral Interactive Data Analysis System. Short courses were conducted in the Centre on digital analysis of remotely sensed data for different applications.

### **2.4 Training**

About 130 scientists/engineers from various user organisations, both from India and abroad, were trained in the applications of aerial photo-interpretation and remote sensing techniques at the Indian Institute of Remote Sensing (IIRS) of NRSA located at Dehra Dun and at the analysis and interpretation facilities located in Hyderabad.

In view of large scale utilisation of remote sensing data flowing from IRS, new diploma courses in six major disciplines of remote sensing are being introduced at IIRS, NRSA, Dehra Dun.

### 2.5 Earth resources surveys

NRSA has undertaken natural resources surveys using remote sensing technology on behalf of users. Study of pre-monsoon and post-monsoon conditions of river basins in Punjab for hydrological characteristics, and survey of Madras and its environs for land use and groundwater potential are the important projects completed using satellite remote sensing technique. Mapping of Hooghly river (eastern India) water quality and saline/alkaline conditions, and environmental study of the entire Nilgiris biosphere consisting of Silent Valley and its environs in Kerala are two major projects completed using composite (aerial and satellite) technique. The aerial remote sensing surveys are conducted covering seven towns of Andhra Pradesh for town planning purpose, areas in Madhya Pradesh for mineral exploration, over some areas in south India for monitoring changes due to various natural and developmental activities and areas in Assam for survey of road bridge. Small area consultancy projects were carried out using airphoto-interpretation techniques covering some areas in Uttar Pradesh for geological survey, near Dehra Dun for groundwater survey and over Maheshwar Project area in Madhya Pradesh for a semi-detailed soil survey. About 40 projects involving different disciplines and covering different parts of India are at various stages of progress.

### 2.6 Research and development technology transfer

Notable developmental projects completed during the year include a quick-look display system for the earth station, a plan master for cartographic applications, mapping forest and non-forest areas of India and of all the States of India using satellite imagery and software programs for correction of data and analysis of data for different applications.

At the request of users, fabrication and supply of different types of opto-electronic interpretation/analysis equipments, developed by NRSA, were taken up and supplied to users. Know-how on Optical Reflecting Projector, Dual Densitometer and Analog Image Analyser developed by NRSA has been transferred to industry for productionisation.

---

## IRAN (ISLAMIC REPUBLIC OF)

The progress made by the Islamic Republic of Iran in the development of space radiocommunications during 1984 is as follows:

1. To meet the increasing demand for international traffic, the Telecommunication Co. of Iran (TCI) on behalf of the Islamic Republic of Iran is in the process of establishing a second earth station (3rd Standard A antenna) to access the INTELSAT network.

The site for this earth station has been selected near Tehran and coordination with other networks is under way. The RFP for purchase would be issued in the near future with a view to plan implementation.

2. In the field of domestic satellite communications for the television service, a transponder has been leased from INTELSAT and rural communications are being planned for telephony and telegraphy.

This project is bound to undergo some expansion, since the policy of the Islamic Republic of Iran in telecommunications is based on availability of services offered by new technology to everybody in the country, especially those living in the remote and less developed regions. Further expansion and also transition from leased transponder to an independent national satellite system (the ZOHREH project) is under consideration by technical staff of TCI. The ZOHREH satellites will be located at 26° E, 34° E, 47° E and 41° E longitude.

3. 1984 was the year the Islamic Republic of Iran joined Inmarsat. Iran is now considering projects for two coast earth stations, one for access to AOR and the other to IOR in the Inmarsat satellite network. The work for implementation of these earth stations for maritime communications as well as other satellite communications projects, is sponsored by the department of satellite and international telecommunications of TCI.

4. One other satellite communications development which is in its final stage is Shahid Dr. Ghandi new Standard B antenna, which is to handle SDG-1 traffic during the Ketrofit process. The contract for this antenna has been signed and the installation is to be completed in the next four months.

This antenna would later be used as an independent antenna for expansion of satellite communications.

---

## ITALY

### 1. International commercial satellite communications

In 1984 the conventions between the Italian State and the Telephone Companies were renewed. The new Convention has confirmed and strengthened the Telespazio role as “the only Italian carrier” of systems for national, European and international satellite telecommunications.

#### 1.1 *Telecommunications via INTELSAT*

Telespazio, the Italian Signatory of the Operating Agreement in the INTELSAT International Organization, has been exploiting commercial satellite telecommunications within the INTELSAT global system since 1965.

These activities are performed by operating 2 earth stations:

- The Piero Fanti telecommunications center, located at Fucino. It works at 6/4 GHz with the Atlantic primary and the Major Path 2 satellites and with the Indian Primary Path satellite.
- The Lario earth station located near the lake of Como, working at 6/4 GHz with the Atlantic Major path 1 satellite.

In order to meet the continuously increasing demand for traffic, the installation of a second Standard A antenna (Lario 2) was completed at Lario earth station. This antenna will be operating at 6/4 GHz with the Indian Major Path satellite, from 1985.

The important improvement works, on the Fucino Indian and Lario Atlantic antennas have been continued, in view of the introduction of new time division transmission techniques, that is expected in the two earth stations in 1985 and early in 1986 respectively.

At Fucino the appropriate modification of the antenna, previously utilized for Sirio, has also been continued to enable the station to access the primary satellite in the Atlantic Ocean, at 11/14 GHz frequency band.

By the end of 1984, the number of overseas countries linked to Italy by means of Intelsat satellites were 71 for a total of 1658 circuits, 63 of them not terminating in Italy but hard patched, as permanent rigid transit circuits, to several countries, mostly in the Mediterranean basin and the Far East. The network is utilized principally by the Italian international carrier Italcable and by several PTT Administrations and operating entities in other countries for their provision of point-to-point telecommunication services.

As far as television is concerned a total of 2916 transmissions were performed for an overall duration of 2163 hours. The high increase of this service was due to the important events of international interest during the year: Olympic Games, the Presidential election in USA, etc.

Telespazio has also been granted the authorization for construction and operation of a third earth station to be located in Sicily. It will complete the access system to the Italian telecommunication network of intercontinental satellite circuits.

## 1.2 INMARSAT

In 1984, Telespazio completed the installation of the Italian coast earth station at the Fucino center, which will be operational in January 1985.

By means of this new station, Telespazio will take part in the operation of the worldwide maritime communications system, according to the arrangements made with the Direzione centrale dei Servizi Radioelettrici of the PTT Ministry, which is responsible in Italy for telecommunications services to and from ships.

Starting from January 1, 1985, Telespazio will be the Italian Signatory of the International Organization INMARSAT, having been designated to sign the relative Operating Agreement in place of the PTT Administration.

### 1.3 *Interim EUTELSAT*

On December 22, 1984 the Italian Government ratified the Definitive Agreements of the Organization, that had been signed in January 1983.

As for the other two international organizations in the specific field, Telespazio will be the Italian Signatory of the EUTELSAT Operating Agreement, starting from January 1, 1985.

During 1984 the commercial use of the ECS (European Communication Satellite) system began and in July the setting-up of the space segment was improved with the successful launch of ECS-2.

At the Fucino center the beginning of operations, including the provision of digital business services and the distribution of EBU television programmes is expected early in 1985.

A new antenna system is under construction and it will be utilized for providing carrier service to the Italian Broadcasting Company (RAI), over a transponder leased for the latter.

## 2. **Telemetry and in orbit control of satellites**

On the basis of a pluriennial contract, that will last up to 1989, Telespazio has provided the following services:

- telemetry, tracking, command and monitoring services of Intelsat satellites;
- IOT (In Orbit Test) services of the IS V telecommunications payload;
- IOT services of the maritime communications package of the Intelsat V satellite.

The installation of two 9 m LMA (Limited Motion Antennas) was completed in order to increase the INTELSAT TTC&M network for the period 1985-1989.

Telespazio has also continued the installation of the TDMA traffic terminals to provide services as TDMA reference station (TRMS-TDMA Reference and Monitor Station) for the Primary Intelsat satellite on the Indian Ocean and for the satellite in the ECS system. The provision of this kind of services is expected to start in 1985.

At the same Fucino Center Telespazio has continued to perform TTC&M services for Marisat satellites, over the Atlantic and Indian Oceans, and for the Italian Sirio experimental satellite, operating on 18/12 GHz.

A contract was awarded to Telespazio by ESA for the installation of a TTC&M and in Orbit Control Center of the Olympus satellite (previously named L-SAT) and for the subsequent provision of the relative services for a five year period.

### 3. Experiments and other activities

In the framework of Telespazio experimental activities, carried out with the aim of contributing to the development of future utilizations of the satellite telecommunications, the following significant activities were performed in 1984:

- The EVE experiment (European Videoconference Experiment), directed to the establishment of a european network for video-teleconferences via satellite, has been completed via OTS experimental satellite.

The positive results induced the promoting bodies to transfer it to an operational ECS-1 system for which EUTELSAT will make the required capacity available. Italy will take part in the pre-operational phase of this system of videoconferences using equipped rooms in Rome and Milan.

- The successful experimental activity through the Sirio satellite, linking Lario earth station to a telespazio terminal in Peking, was extended to 1984, according to the extension of the intergovernmental agreement between Italy and the People's Republic of China. The experiments consist of measurements of down link attenuation and bit error rate and 64 Kb/s and 2 Mb/s.
- Experiments on a data communication system by means of small terminals and spread-spectrum transmission techniques were performed by Telespazio, through the INTELSAT system, in accordance to the agreement with IBI (International Bureau of Informatics).
- In the framework of the ITALSAT Programme, the 20/30 GHz domestic satellite system, Telespazio has continued the studies of the Phase B, concerning the technical specifications of the system.

The principal technical solutions analyzed concern the use of digital techniques, switching in the integrated satellite earth network system and the possibility of changing the size of the beams used by the single terminals.

As far as the remote sensing activities are concerned, during the year the acquisition data program has been carrying out for MSS date of Landsat 4 and 5 satellites. The last one was successfully launched in March 1984. The acquisitions of "Thematic mapper" (TM) data interrupted last year because of a failure of the Landsat 4, began again from Landsat 5 in 1984.

Furthermore Telespazio ended the study on the applications of TM data for the agricultural resources control and forecasting, that was performed on behalf of the Ministry for Agriculture and Forests.

On behalf of CNR-PSN (National Space Plan) Telespazio provided the operational management of the Matera laser station for measurement using geodetic satellites. The received data are utilized not only to measure movements of the Earth's crust but also to study shifts of the North pole.

#### 4. International cooperation

In the area of the international cooperation activity, a training course on operation maintenance and technology of earth stations for satellite communications was carried out for seven engineers holding scholarships from IRI (Istituto per la Ricostruzione Industriale) and coming from Argentina, Bolivia, China (People's Republic of), Egypt, Honduras and Somalia.

A training course on operation and maintenance of earth stations, lasting two weeks, was organized for two technicians from Uruguay and subsequently a Telespazio expert has been in Uruguay to provide assistance for the operation of the local earth station.

The assistance of another expert in operation of the terminals installed in the People's Republic of China to perform experiments through Sirio satellite was continued during the year.

Telespazio contributed in the organization of the IV<sup>o</sup> Course in digital transmission carried out by CONSUTEL for 14 engineers holding scholarships from the Foreign Office and coming from Bolivia, Columbia, Jordan, India, Marocco, Peru, Somalia, Thailand. The course was divided in three parts: one week was dedicated to the theoretics aspects of the transmission systems by satellite; the program of the second week in Fucino stations dealt with the practical aspects of satellite transmission and the stage of the third week on satellite operation was held in Lario station.

The cooperation with the United Nations and its specialised organizations was also continued. In 1984 Telespazio contributed as for previous years to the organization of the following courses:

- 7th FAO/UNDRO/WMO/ESA Training Course Satellite Applications to Flood Forecast Control and Preparedness (June 1984);
- 9th UN/FAO/Government of Italy: Application of Remote Sensing to Acquaculture and Inland Fisheries (September 1984).

---

## JAPAN

### 1. Satellite projects

#### 1.1 Communications

Japan's first operational communications satellite CS-2 system consists of 2 spacecrafts CS-2A and CS-2B. CS-2A was launched on February 4, 1983, into the geostationary orbit at 132° E and CS-2B on August 6, 1983, at 136° E, both by Japan's N-II launch vehicle from Tanegashima space center of the National Space Development Agency of Japan (NASDA). CS-2 system is now in the stage of operational phase; operational service of the system has started from May 1983 for CS-2A and November 1983 for CS-2B, respectively.

CS-2 system is being used for offering communications with remote islands, and for such services as emergency communications, occasional communications, etc, by the following users: Nippon Telegraph and Telephone Public Corporation, The Japanese National Railways, Electrical Power Companies, The National Police Agency, The Ministry of Construction, The Ministry of Posts and Telecommunications and The Fire Defense Agency.

The Telecommunications Satellite Corporation of Japan (TSCJ) controls the positions and attitudes of CS-2. CS-2 continues to be in a good condition now.

The next-generation communications satellite CS-3 (CS-3A and CS-3B) is scheduled for launch in the winter and the summer of 1988 by Japan's H-1 launch vehicle from Tanegashima Space Center.

CS-3 is designed for the seven year mission. CS-3 is a spin-stabilized satellite weighing approximately 550 kg in orbit and having a capacity of approximately 6000 simultaneous telephone circuits using 12 transponders (10 for 30/20 GHz-band and 2 for 6/4 GHz-band). Its cylindrical body has a diameter of approximately 2.2 m and an overall height of approximately 3.6 m.

The design and launch of CS-3 was also ordered to NASDA by TSCJ under close coordination with the user organizations.

## 1.2 *Broadcasting*

First direct-broadcasting satellite BS-2 system consists of 2 spacecrafts, the operational satellite BS-2A and the back-up satellite BS-2B.

BS-2 (BS-2A and BS-2B) is intended to improve the television broadcasting services in Japan's mountainous areas, remote islands and urban areas where reception of terrestrial television broadcast is hindered, and to acquire the technology of the broadcasting satellite.

BS-2A was launched on January 23, 1984, into the geostationary orbit at 110° E, by Japan's N-II launch vehicle from Tanegashima Space Center of NASDA. TSCJ controls the positions and attitudes of BS-2A, after three months' initial check out by NASDA. Broadcasting service by NHK (the Japan Broadcasting Corporation) has started from May.

Because TWTAs were hit by troubles, only one of the original two channels is now operating.

The back-up satellite BS-2B will be launched in the summer of 1985, if the causes of BS-2A's troubles are clarified and the necessary actions are taken on TWTAs to be used in BS-2B.

### 1.3 *Meteorology*

#### 1.3.1 *Operational Status of GMS-3*

A network of geostationary meteorological satellites is important as a spacebased segment of the World Weather Watch (WWW) Programme of the World Meteorological Organization. Japan has been contributing to the WWW Programme by making meteorological observations of the Asia-Oceania-Pacific area by the GMS-series satellites.

GMS-3 was launched by N-II rocket from Tanegashima Space Centre at 20.30 hours UT on 2 August 1984 and placed in the geostationary orbit at 140° E longitude. After completing its function checks, routine operation was commenced from 27 September.

Major telecommunications functions of GMS-3 are: transmission on 1.7 GHz band to ground station of earth imagery acquired by VISSR (Visible and Infrared Spin Scan Radiometer), facsimile broadcasting on 2 and 1.7 GHz bands, collection of meteorological data from DCPs (Data Collection Platforms) on 402 MHz and 1.7 GHz bands, and transmission to ground station on 1.7 GHz band of space environment monitor data. Design life is about 5 years.

GMS-3 is making 14 imagery acquisitions a day, and the data processed at the ground station are broadcast through GMS-3. Besides being utilized elsewhere, the GMS data are significantly contributing to improving weather forecasts and mitigating meteorological hazards in many countries within the coverage of GMS observations.

#### 1.4 *Space research*

EXOS-C, the ninth Japanese scientific satellite, was successfully launched on February 14, with M-3S-4 rocket from Kagoshima Space Center, Uchinoura, by the Institute of Space and Astronautical Science. EXOS-C was renamed Ohzora (the sky) and was given 1984-015A as the international designation. The orbital parameters of Ohzora are as follows: perigee height 354 km, apogee height 865 km, inclination 74.6° and period 96.9 min.

Ohzora is the fourth Japanese satellite for the measurement of the earth environment. The main objectives are study of the structure and constituents of the middle atmosphere and of the plasmas of auroral regions and South Atlantic magnetic anomaly. They are also main subjects of Middle Atmosphere Programme.

The data from Ohzora are received at not only Kagoshima Space Center but also at Esrange, Sweden and Antarctic Showa Base.

#### 1.5 *Space technology*

##### 1.5.1 *Marine observation satellite-1 (MOS-1)*

MOS-1 is a satellite designed to observe marine phenomena using three kinds of on-board sensors including a Multi-spectrum Electronic Self-Scanning Radiometer (MESSR) whose resolution is about 50 m, and to establish the fundamental technology needed for an earth observation satellite. Weighing approximately 740 kg, MOS-1 will be launched into a sun-synchronous orbit at an altitude of about 900 km by Japan's N-II vehicle in the summer of 1986.

### 1.5.2 *Engineering test satellite-V (ETS-V)*

ETS-V is a satellite intended to verify the performance of H-1 launch vehicle as well as to establish basic technology for the bus systems needed for a three-axis stabilized geostationary satellite. Also this satellite will perform mobile-satellite communications experiments with aircrafts, ships and other mobile, etc. Weighing about 550 kg at the beginning of life, ETS-V will be launched into a geostationary orbit by Japan's H-1 vehicle in the summer of 1987.

## 2. International commercial satellite communications

### 2.1 *INTELSAT*

Kokusai Denshin Denwa Co., Ltd. (KDD), the Signatory of Japan for INTELSAT, has been providing overseas telecommunications services through the INTELSAT system. As of December 31st 1984, KDD had 1,137 voice grade circuits via the Indian Ocean satellites and the Yamaguchi earth station, and 1,345 voice grade circuits via the Pacific Ocean satellites and the Ibaraki earth station.

A new Ibaraki earth station (IBA-4) started its operation with the Primary satellite in the Pacific Ocean region at the end of January and the construction of a new Yamaguchi Earth Station (YAM-3) was completed in December for its operation with the Major Path satellite in the Indian Ocean region. A limited motion antenna (LMA) was constructed in Yamaguchi in December to send command signals to and to receive telemetry signals from INTELSAT satellites.

KDD performed a series of teleconference demonstrations in April via the INTELSAT system connecting five cities (Philadelphia, Toronto, London, Sydney and Tokyo) where International Teleconference Symposium was held.

### 2.2 *INMARSAT*

KDD, the Signatory of Japan for INMARSAT, has been providing maritime satellite communications services through the INMARSAT system. During the period of January 1st to November 30th, the Yamaguchi Coast Earth Station (CES) handled 28,776 ship-to-shore telephone calls, 10,594 shore-to-ship telephone calls, 151,223 ship-to-shore telex calls and 79,696 shore-to-ship telex calls. During the same period, the Ibaraki CES handled 18,813 ship-to-shore telephone calls, 10,021 shore-to-ship telephone calls, 106,013 ship-to-shore telex calls and 55,028 shore-to-ship telex calls.

KDD performed a field test via the Indian Ocean satellite for the development of a new INMARSAT standard ship earth station from the end of June to the beginning of July.

The Ibaraki Tracking, Telemetry and Command (TTC) Station supported the launch and performed the in-orbit-test of MARECS-B2 which was launched on November 10th to serve as the operational satellite in the Pacific Ocean region.

---

## MEXICO

### 1. Introduction

The Mexican Administration's main activities in space communications are connected with the preparations for putting a domestic satellite communications system into operation, known as the MORELOS system, in honour of one of the heroes of Mexican independence.

### 2. MORELOS satellite system

The MORELOS satellite system (SMS) will start operation in 1985. It will consist of two satellites in the positions 113.5° and 116.5° W in the geostationary orbit. It will supply a wide variety of telecommunication services to urban and rural areas, operating in the frequency bands 4/6 and 11/14 GHz.

The SMS control centre, located to the east of Mexico City, has been fully installed and tested. All that remains to be done is to test its compatibility with the satellites. During the launching of the first satellite, the centre will be directly involved in the control of operations.

Tests have been carried out to check the adjustment of the mechanical and electrical interfaces between the servomechanism of the PAM and the satellite. It is expected that in March 1985 preparatory work will begin at the launching site for installation of the perigee motors (PAM/D) in the satellite.

Plans have been drawn up and approved for fitting the PAM satellites into the NASA orbit. The flight missions for satellites MORELOS 1 and 2 are respectively Nos. 51G and 61B.

### 3. International service

Work is continuing on the establishment of international satellite communications via the earth stations Tulancingo 1 and 2, which operate in the Atlantic region with the Intelsat V (F-3) and V (F-2) satellites respectively. In 1984 new links were set up with Austria and New York City, increasing to 20 the number of countries with which Mexico has direct communication via these stations.

The 11-metre station Tulancingo 3 transmits Mexican television programmes to the Spanish-speaking population of the United States. In April 1984 it switched operation from the Westar IV satellite to the Galaxy 1 satellite, located at 134° W in the geostationary orbit.

#### 4. Domestic earth station network

In May the satellite via which the domestic satellite communications system operates was replaced. Satellite IS IV (F-1) came to the end of its working life and was replaced by IS V (F-8).

In February the first telephone link was established via this system, using a 25-channel SCPC-FM equipment between Mexico City and the oilfield in Campeche State.

The 7-metre antenna at Ciudad del Carmen increased to 187 the number of earth stations operating in the system.

---

#### NETHERLANDS (KINGDOM OF THE)

##### ECS-IOT measurements

After the successful launching of the ECS F-1 and ECS F-2 satellites, on behalf of EUTEL-SAT the Netherlands PTT experimental earth station at Nederhorst den Berg participated in co-operation with other European earth stations in the In Orbit Test measurements of both satellites, in order to check whether the specifications were met.

The types of measurements carried out were:

- Effective Isotropic Radiated Power (e.i.r.p.)
- Co-channel Interference
- Beacon e.i.r.p.
- Beacon e.i.r.p. stability
- Beacon Cross Polarization Discrimination.

The following earth stations participated in the F-1 measurements: Bercenay (France), Goonhilly (United Kingdom), Nederhorst den Berg (Netherlands) and Fuccino (Italy); in the F-2 measurements participated the earth stations: Bercenay, Goonhilly, Nederhorst den Berg and Darmstadt (Federal Republic of Germany).

At Nederhorst den Berg an accurately calibrated 10 m earth station (NERA-E)\*, in use for propagation and communication experiments, was used for the F-1 and F-2 measurements.

For ECS F-1 the tests were carried out from 25 July to 29 September 1983 and for ECS F-2 from 29 August to 29 September 1984.

The test results obtained independently by the four participating earth stations all were fully within the limits specified.

## **NEW ZEALAND**

## **INTELSAT**

New Zealand continues to take a close interest in the global commercial communications satellite system and has been an INTELSAT Signatory since 1965. New Zealand is a member of the five nation Asia Pacific Group, formed for the purpose of gaining a seat on the INTELSAT Board of Governors, which is in direct control of the Organisation's affairs, and represented the Group on the Board during 1984.

### **Earth station**

The New Zealand Post Office earth station at Warkworth was brought into service in July 1971, and is an important part of New Zealand's external telecommunication facilities. A second antenna was constructed at Warkworth and took over the primary role from the original antenna during 1984. The second antenna will work to the Intelsat V satellite when it is introduced in the Pacific Ocean region in 1985 and the original antenna will be refurbished and used to operate to the operational spare satellite.

As at December 1984 Warkworth provided a total of 266 circuits to American Samoa, Australia, Canada, Cook Islands, Fiji, Hawaii, Hong Kong, Indonesia, Japan, Korea, Malaysia, New Caledonia, Philippines, Singapore, Tahiti, Taiwan, Tonga, US Mainland, Vanuatu and Western Samoa via the Pacific Ocean Intelsat IV-A satellite. During 1984, 982 television transmissions of a total duration of 30 515 minutes were handled by the earth station.

### **International maritime satellite organisation**

## **INMARSAT**

INMARSAT entered into force in July 1979 and is committed to provide the space segment necessary to improve maritime communications and under Article 3 of the Convention shall act exclusively for peaceful purposes.

As a trading nation heavily dependent on overseas trade, the bulk of which is carried by ships, New Zealand recognised the need for improved communication facilities for the maritime mobile service. New Zealand has been involved in INMARSAT activities since the first international conference which was held in 1975 and has participated in the workings of the Preparatory Committee over a 3 year period. An indication of New Zealand's commitment to INMARSAT is the fact that we were the second Signatory to the Convention and Operating Agreement.

New Zealand spent two years as elected geographical representative on the INMARSAT Council during the period 1981-1983.

The INMARSAT Council has the responsibility to make provision for the space segment necessary for carrying out the purposes of the Organisation.

### **Ionospheric research**

The New Zealand Department of Scientific and Industrial Research's total upper atmosphere research programme is directed towards a fuller understanding of the physical behaviour of the earth's atmosphere, in order to better predict radio propagation conditions. The following activities are relevant in varying degrees to problems of space radio communications.

#### *– Ionosondes*

Five ionosondes operate on an internationally agreed synoptic programme at a chain of stations between Rarotonga (Cook Islands) and Scott Base (Antarctica). The data is sent to 53 users throughout the world for radio communications prediction purposes. The data from the Christchurch station is used, along with those from 12 other stations, to produce the global index of ionospheric activity in  $I_f2$ .

#### *– Topside sounders*

Topside sounder data from the ISIS satellites have been acquired by the National Scientific Satellite Facility at Launder, Central Otago, on a routine basis since 1971. The range of latitude normally covered extends from  $25^{\circ}$  S to  $62^{\circ}$  S. These data are distributed to World Data Centres and to local University and DSIR research groups.

#### *– VLF research*

Observations of VLF signals that travel through the outer atmosphere in the whistler mode have been made regularly since 1955. VLF transmitters in North America and lightning flashes have both been used as signal sources. Methods of measurement of group path and phase path variations of normal traffic signals have been developed locally. These have yielded much information on the physical characteristics of the atmosphere out to geocentric distances of more than 20 000 km, their variations under changing magnetic conditions, and their relation to the total electron content along the path from a geostationary satellite to a ground station. The effects of sporadic-E layers on VLF radio propagation in the earth-ionosphere waveguide are also being studied, using electric-power transmission lines as antennas.

Other relevant research projects include the routine provision of magnetic activity indices from four stations, and studies of the radio aurora and its associated ionospheric absorption.

### **Meteorological activities**

New Zealand's location in the data-sparse Pacific Ocean means that it is very costly to improve or even maintain a good network of meteorological observations by conventional means. The availability of the geostationary satellites GOES-West at 135° W, and GMS-2 at 140° E, and the sun-synchronous polar orbiting pair is essential to provide information over these ocean areas.

The meteorological service routinely operates a composite satellite receiving terminal at Wellington which receives the high resolution picture transmission (HRPT) from NOAA satellites at S band and has back up APT provision. Lower resolution weather facsimile broadcasts from the two geostationary satellites which straddle New Zealand's longitude are taken at S band and digitized. Together with the digital imagery from the HRPT these products are computer processed to give a map-scaled and gridded cloud-cover mosaic over the entire area of New Zealand's concern.

The computer is also used to form sea surface temperature maps, vertical profiles of atmospheric temperature, and water vapour from the outputs of the TIROS-N sensor array.

Surface platforms use the NOAA satellites to relay their environmental data from remote sites. Moving platforms can have their positions located from their transmissions.

---

## **NORWAY**

### **1. Nordic progress in the field of space telecommunications**

See under Denmark.

### **2. Domestic satellite communications**

#### **2.1 INTELSAT transponder**

The Norwegian domestic satellite system NORSAT was established to improve the communications between oil production platforms in the North Sea and the Norwegian mainland. The system has been operational since 1976.

A half global beam transponder is leased in an Intelsat IV satellite.

Seven earth stations are in operation:

- the mainland station Eik,
- five platform stations and
- the Isfjord station at the Arctic islands of Svalbard.

Two additional platform stations are contracted.

## 2.2 EUTELSAT transponders

Norway is leasing a transponder in Eutelsat I (F-2). Since December 1984 the transponder has been used for transmissions of the Norwegian official television programme, modulated in C-MAC, to Svalbard. Work is in progress to prepare for reception of the television transmissions also at the oil rigs in the North Sea. Awaiting the completion of a permanent transmission facility at Nittedal, near Oslo, the programme is being uplinked from the Telecommunications Research Establishment at Kjeller. The leased relay capacity in F-2 will also be used for national business communication. The first ground stations to be employed for national business communication services are due to become operational in April-May 1985.

Two ground stations, serving international business communication by means of the SMS-transponder in F-2, are under construction at Nittedal and Stavanger.

Norway will shortly sign an option contract for the lease of an international transponder in Eutelsat I F-3. The utilization of this transponder is not yet finalized.

---

## PHILIPPINES (REPUBLIC OF THE)

### 1. Overview of the space related activities

#### 1.1 International satellite communications

The Philippine Communications Satellite Corporation, PHILCOMSAT, the government-designated operating entity and signatory in the operating Agreement to INTELSAT continues to participate in all phases of INTELSAT activities through its representation (ASEAN Group) on the Board of Governors and its Advisory Sub-Committees.

#### 1.2 PHILCOMSAT facilities

Since 1967, PHILCOMSAT facilities located in Pinugay, Rizal comprise of two Standard A antennas for international telephone, telegraph, data and television programmes.

A third antenna, Pinugay-3 (non-standard), was established in 1980 to temporarily handle the traffic in the Pacific Ocean region while Pinugay-1 and Pinugay-2 antennas were being upgraded and refurbished for Intelsat V satellite series. It now functions as a back-up antenna to handle contingency and other service requirements in both ocean regions whenever the need arises.

In 1983, PHILCOMSAT established an 11-metre diameter antenna as Television Receive Only (TVRO) earth station for Armed Forces Radio and Television Service (AFRTS) in Clark Air Force Base in Dau, Pampanga. The 11-metre TVRO earth station will receive commercial television programmes, 24-hour daily programming from AFRTS in Los Angeles, USA through Intelsat and US Domsat satellites system. The TVRO station commenced operation in December 1983.

### 1.3 *Role of PHILCOMSAT in international telecommunications*

The franchise of PHILCOMSAT, as a Carrier's carrier, covers its operation of earth stations and the lease of satellite circuits only to international common carriers namely: Philippine Long Distance Telephone Company (PLDT), Eastern Telecommunications Philippines, Inc. (ETPI), ITT-Globe Mackay, Philippines Global Communications (PHILCOM) and Capitol Wireless (CAPWIRE) which in turn serve the public telecommunications requirements.

### 1.4 *Service coverage*

Currently, PHILCOMSAT has direct satellite link with 27 countries via 28 earth stations located in the Pacific and Indian Ocean regions.

### 1.5 *International cooperation*

The Philippines, Indonesia, Malaysia, Singapore and Thailand, through their respective administrations, organized the Association of South East Asia Nations (ASEAN) Group in INTELSAT to represent themselves in the INTELSAT Board of Governors. The governorship is rotated annually among the five members of ASEAN Group.

## **2. Project/future plans on space related activities**

### 2.1 *Maritime satellite services*

The government designated PHILCOMSAT as the Philippine representative to the International Maritime Satellite Organization (INMARSAT). The Philippines became the 35th member of INMARSAT on 30 March 1981.

## 2.2 Program implementation – TDMA/DSI (Digitalization/Computerization)

Project requirement for INTELSAT Indian Ocean region for 1986 operation.

## 2.3 Second Pacific Ocean region (POR-2) antenna

Feasibility studies for a 2nd Pacific Ocean region (POR-2) Standard A antenna for INTELSAT system for 1987/88 time frame.

## 2.4 Uninterruptible Power Supply (UPS) Project

In conjunction with Philippine earth station tie-up with NPC/MERALCO Luzon Grid. Time frame year-end 1986.

2.5 Market/feasibility studies and development of INTELSAT/IBS (International Business Services) and Low Density Telephone Service (VISTA) applications in the Philippines.

---

## PORTUGAL

In 1984, Portugal followed its expansion in the field of spatial communications, mainly providing more telephonic and television traffic through the existing earth stations.

### 1. The progress over the existing installations

#### 1.1 Telephonic service

There has been an increasing of FM/FDMA telephone channels, divided as follows:

- 68 in the international service,
- 54 in the domestic service.

#### 1.2 Television service

During 1984 a total of 747 hours of television transmissions and a total of 1314 hours of television receptions were handled by the portuguese earth stations. Most of this time was dedicated to the domestic service.

## 2. New contracts

Two contracts have been signed with Mitsubishi Electric with the following purpose:

- Making the retrofit of P. Delgada/Azores earth station feed to allow it working in dual polarization with IS-VA serie satellites.
- Supplying a 13 m dish transferable earth station which will temporarily provide the re-routing of Ponta Delgada earth station during traffic and afterwards will do the service in other places.

### **QATAR (STATE OF)**

Doha 2 earth station was successfully commissioned on 23rd February, 1985. This station is linked with satellite group working on the Atlantic Ocean and provides the basic services of the telephone/telex/television and data transmission with the countries having stations working on the same satellite. With the commissioning of the Doha 2 earth station Qatar now have the access to the direct communication facilities with Canada, United States of America, Italy, Germany, U.A.E. and United Kingdom and preparations are under way to extend the facilities to more countries.

Doha 1 earth station is working on Indian Ocean since 1976. With these two earth stations functioning well, Qatar has achieved the land mark along with some of the advanced countries in the field of telecommunications.

Also all plans are completed to implement the setting up of ground earth station to link with Arabsat 1 which has launched in February 1985. Arabsat communication project is dedicated to Arab world with the service of telephony/telex/telegraphy/television and data transmission with the system capacity of 8000 telephone channels, 7 television channels and one community channel. Arabsat system in addition to assisting the member states in design and implementation of their ground earth station, is conducting studies in the field of space science and technology and promoting the establishment of space communication industries in the Arab states.

Our country is making all effort to acquire the latest technology available in the field of radio communication and planning to implement them for the further development of space radio communication in the near future.

---

## **SAUDI ARABIA (KINGDOM OF)**

### **1. International communications**

The public telecommunication facilities in the Kingdom continued to grow and had 2214 circuits at the end of the year. There was a corresponding increase in the international exchange of television programmes covering regular news, VIP visits, national and international events including multiple transmissions during the holy months of Ramadan and Haj.

### **2. Participation in INTELSAT**

The Kingdom maintained its position as one of the largest users of the system and is participating in the deliberations of the Board of Governors, meeting of signatories and assembly of parties in addition to participating in the global traffic and regional operations representatives meeting.

### **3. INMARSAT system**

The Kingdom formally joined INMARSAT organization in October, 1983 and is a member of its council. The setting up of the coast earth station has been delayed. The Kingdom is one of the first to use the INMARSAT facilities for aeronautical use on trial basis.

### **4. ARABSAT**

The ARABSAT TT&C facilities at Riyadh is ready and awaiting the launch of Arabsat I in February 1985. After successful placement followed by extensive in-house tests it is expected to be ready for service immediately thereafter. The Kingdom would start operations via the transportable earth station located in Riyadh to be followed by a regular one later in Jeddah.

### **5. Domestic satellite service**

The Kingdom continued to use INTELSAT leased transponders for its domestic communications for remote areas.

### **6. Meteorological service**

The three non-standard earth stations continued to provide service for the collection of data.

---

## SINGAPORE (REPUBLIC OF)

### 1. INTELSAT

TELECOMS Singapore has been an INTELSAT Signatory since June 1966. To date the two Standard A antennae at the Sentosa satellite earth station working with Intelsat satellites in both the Indian and Pacific Ocean regions, carry about two-thirds of all international traffic and exclusively all international television and high speed data leased circuits. The Indian Ocean region (IOR) antenna is operating 4 FDM carriers together with SCPC circuits to 26 countries while the Pacific Ocean region (POR) antenna is operating 2 FDM carriers and SCPC circuits to 13 countries. The satellite circuits grew from a mere 40 odd telephone channels in 1971 to about 1100 channels today.

To cope with Singapore's projected growth in international telecommunication traffic, a new Standard A antenna will be built at Bukit Timah satellite earth station. This antenna working towards the Indian Ocean primary satellite will be commissioned in early 1986 and Singapore will then join the small group of administrations in employing the new time-division multiple access (TDMA) satellite technique, introduced to the INTELSAT system.

### 2. Maritime satellite communication

Singapore coast earth station became operational on 1st November 1982. The station working to the Inmarsat satellite over the Pacific Ocean region is equipped with 22 automatic telex and 7 automatic telephone satellite channels.

Up to date, Singapore is the INMARSAT 8th largest investment share signatory and as at 31 March 1984, there were 53 Singapore registered ships equipped with a ship earth station. Singapore coast earth station will continue its effort to meet the need of maritime community and enhance its status as a communication centre in this region.

### 3. PALAPA

The Palapa satellite earth station to provide communications to Indonesia border towns was commissioned in October 1983. Initially this antenna system operated only to Pontianak, Pekanbaru and Samarinda but in the next few years, this system will be further extended to 7 more border towns in Indonesia.

## 1. Activities of the Compañía Telefónica Nacional de España (CTNE)

The activities of CTNE in satellite communications continue to develop. They include:

### 1.1 National and international traffic routed via satellite

Traffic in the Atlantic Ocean region via the Intelsat primary satellites and main paths Nos. 1 and 2, using the Buitrago (antennas I, III and V) and Agüimes stations, accounted at the end of 1984 for 842 circuits and, in the Indian Ocean region, for 239 circuits via the primary satellite and Buitrago antenna II.

Television traffic may be broken down as follows:

National television services (mainland Spain and Canary Islands):

- Programmes routed for both television channels via Intelsat transponders amounted to 7486 hours;
- In 1984, CTNE installed two 3 m television receiving antennas which operate with the Eutelsat ECS F-1 satellite to provide a news service from two regional television stations which, since March 1984, have been in operation with a total traffic of more than 300 hours.

International television service:

- The volume of traffic transmitted and received amounted to 607 hours.

### 1.2 Special links

There has been further close collaboration between CTNE and NASA in outer space exploration programmes using its satellite communication system.

### 1.3 On-going projects

- The contract for the introduction of time division multiple access (TDMA) techniques in Buitrago antenna II was awarded and the equipment is expected to be installed in 1985.
- Work on the construction and installation of the new satellite station at Guadalajara, where an antenna to work with the EUTELSAT network is to come into operation in 1985, is now in its final phase.

#### 1.4 *International organizations*

##### *INTELSAT*

CTNE has continued to participate actively in all INTELSAT meetings. It is at present participating in association with Peru.

The Spanish representative to INTELSAT was in 1984 appointed Chairman of the INTELSAT's Board of Governors.

##### *EUTELSAT*

As in the case of INTELSAT, CTNE's active participation in EUTELSAT will certainly be increased by the entry into service of the Guadalajara station which is to operate as a reference station within the European system.

In 1984, the Spanish Parliament ratified the EUTELSAT Agreements and CTNE was designated as Signatory to the Operating Agreement.

##### *INMARSAT*

CTNE participated throughout 1984 in all INMARSAT's meetings and, at the operational level, maritime traffic has been developing satisfactorily since access was given to the three oceanic regions in 1983. By the end of 1984 there were 35 maritime terminals installed aboard Spanish vessels.

---

#### **SWITZERLAND (CONFEDERATION OF)**

##### **1. INTELSAT network**

The two Standard A antennas Leuk 2 and Leuk 3 routed traffic over the Atlantic Ocean with remarkable reliability during 1984.

The Leuk 1 Standard A antenna, which routed traffic over the Atlantic Ocean via the Major Path No. 1 satellite until the beginning of 1984, was modified to route the traffic in the Indian Ocean area.

Work on the modification proceeded according to plan and the antenna was brought into service in May 1984. As a result a number of new fixed links were established and a total of 209 channels were opened with some 20 countries served by the main Indian Ocean satellite.

By the end of 1984, 917 channels were in service with the three antennas, representing an increase of over 35% as against the end of 1983.

The total number of lines routed in transit by earth stations in neighbouring countries dropped from 174 at the end of 1983 to 15 at the end of 1984. This substantial decrease is due to the entry into service of the third Indian Ocean antenna.

At the end of 1984, the number of our partner countries was 52 against 33 at the end of 1983.

## **2. EUTELSAT network**

An ECS antenna, 18 m in diameter and designed for the EUTELSAT network, was ordered at the beginning of 1984. It is scheduled to be brought into service during the second half of 1985. The transmission technique adopted for telephony is based on digital modulation with time division multiple access (TDMA). This antenna will be used to route telephone and data traffic in the EUTELSAT network and to exchange television programmes for the EBU.

In April 1984, a small non-standard earth station (antenna diameter 8 m) was brought into service in Zurich. This station, operated by the PTT, is used for the distribution of a fee television programme via the Eutelsat I (F-1) satellite.

Television programmes transmitted via the Eutelsat I (F-1) satellite have become very popular, and are received by no less than 52 public, mixed and private companies.

## **3. Meteosat/TIROS-N earth station (Radio-Suisse S.A., Colovrex)**

The collection of Meteosat-2 Wefax data and their retransmission to the regional centres of the Institut Suisse de Météorologie (ISM) were continued without any major difficulties during 1984.

Pictures obtained by APT (automatic picture transmission) from the TIROS-N, NOAA 6, 7 and 8 satellites were also received regularly as they became available. These pictures are only sporadically used by the ISM.

A new concept proposed by the Space Meteorology Service of the ISM is being developed. It concerns the possibility of receiving high-resolution data (HRPT) and data from vertical sounders (TOVS) transmitted by satellites of the TIROS-N series. A brief study on this subject was carried out during the past year.

---

## TANZANIA (UNITED REPUBLIC OF)

Satellite communications are being increasingly used to develop international telephone, telex, telegraph and data traffic.

On Mwenge Standard B earth station in service since 1979 and operating with a satellite in the Indian Ocean region, continued to provide high quality telephone, telex and telegraph services. The number of direct links and the volume of traffic continued to increase in 1984. A new direct link was set up with United Arab Emirates (UAE) in May 1984.

By the end of 1984, Tanzania was operating direct satellite circuits via Mwenge earth station to United Kingdom, Italy, India, Japan and United Arab Emirates. Also Tanzania had direct satellite circuits to USA, Canada, Switzerland and West Germany, which are hard-patched through Kenya.

The breakdown of direct satellite circuits as at the end of 1984 is as shown below:

	Telephone	Telex	Telegraph	Data (Leased)
United Kingdom	38	26	1	—
Italy	7	14	1	—
India	6	—	—	—
Japan	4	5	1	—
United Arab Emirates	8	—	—	—
United States	6	20	3	—
Canada	11	—	—	—
Switzerland	—	4	—	—
West Germany	—	—	—	1

---

## THAILAND

### 1. International telecommunications

Up to 1984, the Communications Authority of Thailand (CAT) has two Standard A earth stations for communicating with overseas countries. One of them is Si-Racha I earth station (SR-I) which was built in 1968 for connecting with the countries in Asia and America via the Intelsat satellite over Pacific Ocean region (POR) and another one is Si-Racha II earth station (SR-II) which was built in 1970 for connecting with the countries in Asia and Europe via the Intelsat satellite over Indian Ocean region (IOR).

Both stations are operating in Frequency Division Multiplex system (FDM). In addition, the Si-Racha II is also operating with some countries in the Middle East in single Channel Per Carrier/Pulse Code Modulation/Phase Shift Keying System (SCPC/PCM/PSK). The number of total circuits for overseas countries is at present 246 voice circuits.

The previously mentioned number of circuits based on the traffic forecast will be increased according to the demand of the subscriber in developing countries such as Thailand in the near future, particularly when CAT starts to provide the overseas telephone in the International Subscriber Dialling (ISD) system.

Besides, both stations are also being used to carry television live telecast in quite a big volume each year.

Since SR-I has been operated for more than 15 years which is near to its expected lifetime, CAT considered the construction of a new station (SR-IV) to replace the existing station, SR-I.

The size of antenna of SR-IV is 32 metres. The construction has been started since June 1984 and will be completed in March 1985.

After completion, the new station will be used in place of the existing SR-I in operation. For the SR-I, it may be converted to operate as the master station of DOMSAT network or a standby station for international service in the future.

In 1986, it is anticipated that another yet Standard A earth station namely SR-V will be completed and will replace SR-II earth station. Furthermore new modulation/multiple access technique, TDMA/DSI, will be introduced in this time frame at the new earth stations.

## **2. Domestic telecommunications**

Thailand continues to leased space segment of two satellite systems; a quarter transponder of Intelsat, and one and 3/4 transponders of Indonesian Palapa.

The domestic satellite network of the Communications Authority of Thailand using Intelsat transponder was established to supplement the existing terrestrial network as a transmission medium for handling high-quality telegraph, telex, facsimile and data communications services. This network comprises a master station located at Si-Racha, an off shore terminal on the Union Oil Co., of Thailand's natural gas platform in the Gulf of Thailand and fourteen other local earth stations in the North and South regions of the country. In 1985, this network will be expanded to include another nine local earth stations.

One transponder of the leased PALAPA space segment is used to distribute two television programmes while another 3/4 is for the telecommunications traffic of various governmental agencies. The number of earth stations in television distribution networks has grown to 16 consisting of one 11 metres master station in Bangkok, one mobile and 14 fixed earth stations in the provincial areas, while four more earth stations are being planned. Besides, there are 21 fixed and four transportable earth stations in the government domestic telecommunications network functioning as transmission media for telephone, telex, facsimile, etc.

Due to the extensive uses of satellite communication applications in Thailand, an intensive feasibility study on the possibility of having its own satellite system is being carried out by the Ministry of Communications in collaboration with the Hughes Communications International, Inc. of the United States.

### **3. Meteorological satellite applications**

Since the completion of the national Landsat-Meteosat satellite receiving station in 1982, the Thai Meteorological Department has been routinely acquiring weather satellite data for its operation. The data include measurements from the Very High Resolution Radiometer (AVHRR) of the polar-orbiting satellite NOAA-9 and the Medium Data Utilization Station (MDUS) of the geo-synchronous satellite GMS-3. The data have been used also in research, such as studies of Agricultural Index, fishery and marine science in Thailand.

### **4. Remote sensing activities in Thailand**

In 1984 Thailand Landsat station of Thailand Remote Sensing Centre (TRSC) was upgraded to receive and process MSS data of Landsat 4 and 5, which have different configurations from their predecessors. The station, however, can still process the already in archives Landsat 1, 2 and 3 data. The work on the modification of the station took about six months and it involved the modification of three main system components, i.e. the Receiving and Recording System, the Bulk Processing System (BPS), and the Precision Processing System (PPS). Software packages were also upgraded. A new B & W laser beam film recorder was installed for improvement of the system throughout. This film recorder is shared between the BPS and the PPS, and therefore the film recording capability is considerably enhanced.

On the data archives and distribution aspects, more than 25 000 Landsat scenes are now archived at TRSC. The archives also include some MSS and RBV scenes that were ordered from EROS Data Center.

Products available from TRSC are in the form of CCTs and photographic images, both in colour and in black and white. During 1984 (October 1983-September 1984), 1868 scenes of both photographic products and computer compatible tapes at a total value of over US \$ 120,000 were distributed. About one-third of the products were serviced to foreign users, while over one-half were used by Thai Government agencies.

In the promotion of satellite remote sensing applications, TRSC has funded seven research projects in 1984. TRSC also has its own research work and six other projects.

Other promotional activities of remote sensing have been the organizing/co-organizing of the 9th Remote Sensing Training Course (7 June-5 July) and the Third Asian Agricultural Remote Sensing Symposium (6-11 February) supported by Tokai University of Japan and ESCAP Regional Remote Sensing Programme. Newsletters have also been issued quarterly both in Thai and in English, and distributed free of charge to interested individuals.

---

## UNION OF SOVIET SOCIALIST REPUBLICS

During the past year work continued in the Soviet Union on the development and improvement of the national communication satellite network.

The launching into geostationary orbit of a number of previously notified communication satellites operating in the frequency ranges 1.5-14 GHz has made it possible to increase the volume of information handled and to increase the number of telephone links, television and radio programmes, newspaper pages and other types of information transmitted.

The territory of the Soviet Union is divided into five zones with time differences of two hours. In addition to their local television programmes, all five territorial zones have been provided with two Central Television programmes transmitted via geostationary satellites at 53° E, 80° E and 140° E.

There are more than 5000 receiving stations in the Moskva and Ekran television distributing networks. Together with the Orbita earth station network and with terrestrial links, they have provided television coverage for 92% of the population.

The Soviet Union is active in the INTERSPUTNIK international system, leasing channels to that organization on the Statsionar 4 (14° W) and Statsionar 5 (53° E) satellites as well as the Dubna and Vladimir earth stations for transit links between the Atlantic and Indian regions.

In 1984, a regular weekly exchange of the latest news between the countries of the Atlantic and Indian regions was organized through the INTERSPUTNIK network.

Digital data transmission equipments have been brought into operation at earth stations of the INTERSPUTNIK networks.

The construction of the Centre for International Maritime Satellite Communications (CIMSC-1) in Odessa has been completed, tests have been carried out and commercial operation has begun within the INMARSAT system. The construction of CIMSC-2 in Nakhodka is being continued. In the USSR, ship satellite stations to be installed on naval vessels are manufactured for use in the INMARSAT system. A variant of the Ekran receiving station has been developed for installation on ships operating in the Arctic Ocean.

Work continued on the SARSAT-COSPAS system. Tests to evaluate the characteristics of the system were conducted with the participation of the users – civil aviation, hydrometeorology, the Academy of Sciences of the USSR and others. Improvements were made to the equipment and mathematical facilities of the COSPAS system centre and of the emergency data reception points. Interworking of the centre with the national search-and-rescue services was further developed. Activities were planned for the expansion of the COSPAS system through the launching of the Kosmos 1574 satellite. A Soviet delegation took part in the work of SARSAT-COSPAS Coordination Group.

In Leningrad in October 1984, representatives of the USSR, the United States, France and Canada signed a Document of Mutual Understanding determining the status of the SARSAT-COSPAS system, its purposes, the forms and methods of cooperation and the rights and duties of the parties during the system trial operation stage.

In 1984, the USSR continued to cooperate in research and the uses of outer space with nine socialist countries under the INTERKOSMOS programme and on a bilateral basis with India, Austria, France, Sweden and other countries.

The most important events in the Soviet Union's international cooperation in this field in 1984 were the flight of an international Soviet-Indian crew in the Soviet spacecraft Soyuz-11 and the orbital station Salyut-7 and the launching of two Vega AIS (Automatic Interplanetary Station). The Soviet-Indian flight took place from 3 to 11 April 1984. The crew, consisting of USSR cosmonaut Y.V. Malyshev (commander of the spacecraft), USSR cosmonaut G.M. Strekalov (spacecraft engineer) and a national of the Republic of India, R. Sharma (cosmonaut-researcher), carried out an interesting scientific programme on orbital station Salyut-7, including research and experiments in space medicine, surveys of the natural resources of India and the study of materials in space (a total of 43 experiments).

The AIS Vega 1 and Vega 2, developed under the international Venus-Halley project, were launched in the Soviet Union on 15 and 21 December 1984. These AIS are designed for complex studies of the planet Venus (in June 1985) and Halley's Comet (in March 1986). In addition to Soviet scientists and specialists, experts from Austria, Bulgaria, Hungary, the German Democratic Republic, Poland, France, the Federal Republic of Germany and Czechoslovakia also took part in developing scientific equipment for the Vega AIS.

---

## **UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND**

1. British Telecom International (BTI) have initiated service from several small antennas following completion of trials via the OTS satellite. This service is known as SATSTREAM and provides for business communications to North America and Europe. In addition, the distribution of television programmes is now an operational service using both ECS and Intelsat satellites. This service is being provided by main station facilities in London and many television receive only stations. The London station is a new facility which is situated in the dockland area and is known as the London Teleport.
2. At both its Goonhilly and Madley earth stations BTI has been actively preparing for the introduction of TDMA in INTELSAT and EUTELSAT. Significant progress has been made and service should be initiated in early 1985. BTI now operates seven antennae at Goonhilly, five at Madley and two at the London Teleport, all providing for a very wide range of satellite communications services.
3. Trials were carried out in the ESA PROSAT programme to investigate propagation characteristics and coding using equipment developed by British Industry. Proposals were agreed for a second phase using near operational terminals. The United Kingdom delegation is drawn from the Department of Trade and Industry and the Civil Aviation Authority.

4. British Aerospace is prime contractor for the ESA olympus programme which will result in the launch of a large communications satellite designed to carry payloads for special services such as direct broadcasting, 20/30 GHz communication and propagation studies. British Aerospace was also prime contractor for the MARECS and ECS satellites launched in 1984 by ESA for use by INMARSAT and EUTELSAT.

5. As a follow on to land based trials of the low  $G/T$  ship earth station (SES) reported on in the 1983 review, the assessment of the satellite link performance under the multipath fading conditions which would be experienced whilst at sea was carried out in conjunction with the German Aerospace research Establishment (DFVLR) using their "stored channel method". Using this technique the satellite link performance was assessed, by simulation in the laboratory (using both "synthetic" tape recordings and using "real" tape recordings of signals received by the SES antenna whilst installed unstabilised on the research vessel RV GAUSS as it passed along the Norwegian coast (elevation angles to the satellite varying from  $4^\circ$  to  $25^\circ$ ).

The results from these tests and those from the land based trials at Goonhilly CES are now contained in CCIR Report 921 – System Aspects of low  $G/T$  ship earth stations. Details of the 0.4 m diameter antenna developed for the SES are also contained in CCIR Report 921. The antenna characteristics are contained in CCIR Report 922. Reference Radiation Pattern for Ship Earth Station Antennas.

6. Low elevation angle propagation measurements at 14 and 11 GHz using the Indian Ocean Intelsat V satellite have continued and the results are providing valuable information for system analysis and design. In addition British Telecom Research Laboratories are conducting studies relating to rain scatter, a phenomenon which can introduce inter-system interference, the results of which should be relevant to CCIR activities in this area.

7. The Rutherford Appleton Laboratory of the Science and Research Council (SERC) continued to make low elevation propagation measurements at Chilbolton, Hampshire during 1984. Beacon transmissions at 11.5 GHz from the Indian Ocean Intelsat V satellite were monitored on a path at  $7.1^\circ$  elevation. As this beacon ceased to transmit in December 1984, the experimental earth station (11.2 GHz) was re-pointed to monitor similar transmissions at  $10.6^\circ$  from another Indian Ocean Intelsat V satellite.

8. Several Universities Bradford, Chelsea College, Essex, Loughborough, Manchester, Portsmouth Polytechnic and Surrey coordinated through Rutherford Appleton Laboratory completed a phase A study of the Communications Engineering Research Satellite (CERS). Three payloads were studied, a business-system payload at 11/13 GHz, a mobile payload at 1.5 GHz and a millimetre beacon package transmitting at frequencies of 20, 22, 45 and 85 GHz. Key features of the proposal included:

- 1) the use of on-board processing for regenerative coding and bit stream reformatting,
- 2) the use of narrow band all solid state channels for the business system payload, and
- 3) the exploitation of the unique advantage of highly elliptical Molniya type orbita for mobile applications in moderate latitudes.

The space craft requirements for the mission were studied by British Aerospace, Filton. A modified GIOTTO bus was proposed with a shuttle launch. Antenna requirements were investigated by ERA, Leatherhead.

9. The British Telecom International Training College at Leafield provides residential courses for engineers and technicians on the theory and practice of operating satellite earth stations. Courses on associated techniques covering computers and digital modulation were also provided. All the courses relating to satellite communications have been well subscribed by students from all parts of the world as well as from British Telecom.

10. Mercury Communications Limited has been granted a full international licence to operate telecommunications services. Two earth station terminals have been installed in the London Docklands area. The 8 metre antenna is used as an urban gateway to carry digitalised business traffic and the 13 metre antenna carries analogue public telecommunications. Both antennae work via the Intelsat Atlantic Ocean Region satellites to North America and operate the 14/11 GHz band. Another earth station terminal is being installed in Oxfordshire to carry digitalised public telecommunications via an Intelsat Indian Ocean region satellite, initially to Hong Kong. The antenna is 18 metres in diameter and will operate in the 14/11 GHz band.

---

#### **YEMEN (PEOPLE'S DEMOCRATIC REPUBLIC OF)**

At present, the People's Democratic Republic of Yemen has one Standard B earth station. Established in 1981 for international telecommunications services in telephone, telegram, telex, television reception and leased circuits via Intelsat space communications satellite over the Indian Ocean region.

Yemen has future plans for establishing one earth station in about eighteen months time for telecommunications services via Arabsat space communications satellite and another earth station also in approximately eighteen months time for telecommunications services via INTERSPUTNIK space communications satellite.

---

#### **YUGOSLAVIA (SOCIALIST FEDERAL REPUBLIC OF)**

A new earth station Jugoslaviya-2 with considerably greater capacity than the existing one, started operating by the end of 1984 in the INTELSAT system via satellite over the Atlantic Ocean.

After reconstruction, the existing station Jugoslavija-1 is directed to operate in the INTELSAT system via satellite over the Indian Ocean. Both stations, Ju-1 and Ju-2 satisfy the INTELSAT's Standard A.

During the 14th Winter Olympic Games, held in Sarajevo from 2-20 February 1984, the transportable earth station was operating in the INTELSAT system via satellite over the Atlantic Ocean and was providing an additional capacity for television transmissions to the United States of America. It satisfied the INTELSAT's Standard B.

The review of the use of satellites from Yugoslavia in 1984 is shown in the Table below.

System	Earth station
INTELSAT 5 ATL 1	Ju-2, Ivanjica (transmission, reception)
INTELSAT 5 IND 2	Ju-1, Ivanjica (transmission, reception)
INTELSAT 5 ATL 1	Sarajevo Wog-84,
INTELSAT 5 ATL 4	Sarajevo, 2-20 February 1984 (transmission)

- Booklet No. 25 — Eighteenth Report by the International Telecommunication Union on telecommunication and the peaceful uses of outer space (1979)
- Booklet No. 26 — CCIR 50th Anniversary (1929-1979)
- Booklet No. 27 — Nineteenth Report by the International Telecommunication Union on telecommunication and the peaceful uses of outer space (1980)
- Booklet No. 28 — 1979 ITU Technical Co-operation
- Booklet No. 29 — Twentieth Report by the International Telecommunication Union on telecommunication and the peaceful uses of outer space (1981)
- Booklet No. 30 — Twenty-first Report by the International Telecommunication Union on telecommunication and the peaceful uses of outer space (1982)
- Booklet No. 31 — Twenty-second Report by the International Telecommunication Union on telecommunication and the peaceful uses of outer space (1983)
- Booklet No. 32 — Twenty-third Report by the International Telecommunication Union on telecommunication and the peaceful uses of outer space (1984)



55116



ARCHIVES

ISBN 92-61-02462-9

Price: 10 Swiss francs