The Technological Implications of Emerging Space Programs in Southeast Asian Countries (U)

Editor's Note: (U) This paper won Third Place in the 1993 Cryptologic Literature Award contest. Because the author is currently on a field tour, the information could not be updated in time for publication.

(U) This paper will highlight crucial global trends in the technological developments of satellites and the application of this technology relevant to developing Southeast Asian countries. Worldwide space systems, regional space programs, as well as domestic space programs in certain developing Asian countries, will also be examined. Moreover, examples of configuration designs and technological adaptations, which were carried out in several Asian countries, their relevance, and future possible applications are discussed.

1.0. INTRODUCTION (U)

(U) The potential for satellites to provide communications and scientific services is enormous, yet the use of space technology is still in its infancy in Asian countries. However, in the wake of the sudden evaporation of communism, Asia is adapting to a new world order by poising itself to become the world's economic powerhouse towards the end of this decade. Therefore, there is no doubt that the Asian region will become a major satellite industry marketplace in the 1990s. Moreover, the diversity throughout Asia suggests that there is no single formula for satellite usage. Each nation has its own unique set of market factors, national priorities and indigenous capabilities that will come into play. With this in mind, the successful player will be one who is sensitive to the individual nuances of each Asian country and is able to fine-tune products, tailor services and adopt new technologies to meet the specific demands of each nation.

2.0. GLOBAL TRENDS IN THE TECHNOLOGICAL DEVELOPMENT OF SATELLITES (U)

(U) Space technology and its applications, especially in the areas of communications, meteorology, education, and natural resources, have had a significant impact on the development of nations. As nations continue to strive towards a greater reliance on space, global trends in the areas of telecommunications, remote sensing, and very small aperture terminals (VSAT) applications will continue to influence the life-styles of society as a whole.

2.1. Telecommunications (U)

(U) Space technology has revolutionized the communication process. Telecommunications networks have increasingly become the primary highway for information and data traffic transfer across the globe. Through the use of satellites, the internationalization of military, economic, and political issues is becoming a reality.

(U) Communication satellites are being utilized increasingly for national requirements, because they are able to offer a variety of services, including telephonic communication, television broadcasting, telex, and facsimile. Another added benefit is the ability to overcome land obstacles, such as mountains, to communicate with remote locations.

2.2. Remote Sensing (U)

(U) One of the major uses of space technology has been in the area of remote sensing. It is often considered to be the second most important space technology after telecommunications. Through international cooperation, countries have been able to use this technology to obtain unique solutions to issues ranging from resource management to drug trafficking interdiction.

2.2.1. Defining Remote Sensing (U)

(U) Remote sensing is the collection, via aircraft or satellites, of solar radiation reflected from land and water surfaces or of radiation artificially emitted and reflected from land surfaces.

(U) Remote sensing satellites are equipped with sensor devices capable of picking up different forms of radiation and using them to reconstruct images of the area being reflected. Various sensors are used to respond to different bands of electromagnetic radiation in order to construct different maps based on the conditions of locations. There are two basic types of sensors: optical and microwave.

1. (U) Optical sensors are passive systems. The systems are sensitive to various light conditions such as infrared and visible. Optical sensors include multispectral scanner (MSS) subsystems, the Return Beam Vidicon (RBV) camera, the Thematic Mapper (TM), and the High Resolution Visible (HRV) camera.

2. (U) Microwave sensors can be either active or passive. Active systems transmit signals and then receive the reflected signals. Microwave sensors are found in synthetic aperture radar (SAR), the radar altimeter (RA), and the microwave scanning radiometer (MSR). The primary advantage of the radar systems is their ability to see through clouds and nighttime conditions.

2.2.2. International Cooperation (U)

(U) Remote sensing began in the United States with the introduction of an earth resource satellite. Today, the development of remote sensing programs is considered to be

an important part of space programs in many countries, and the utilization and development of new remote sensing satellites have continued to expand. The primary remote sensing satellites utilized by Southeast Asian countries are owned and operated by the United States, France, Japan, the European Space Agency (ESA), and India.

2.2.2.1. United States (U)

(U) The United States launched the first remote sensing satellites during the 1960s, eventually followed by the civilian, non-meteorological LANDSAT series. The vivid images produced by LANDSATs 1-3 were immediately put into practical use by aiding in the management of the world's food, energy and environment. Subsequently, many countries, including Thailand, built ground stations to receive data from LANDSAT images, while a two-company consortium was formed in the U.S. to sell the images.

Fig. 1. USA's LANDSAT-6 satellite (U)

(U) LANDSAT-4 and LANDSAT-5 were launched in July 1982 and March 1984, respectively, and placed into a sun-synchronous orbit at an inclination of 98.2 degrees. Both satellites are equipped with a 30m resolution Thematic Mapper (TM) and an 80m resolution multispectral scanner (MSS). The satellites are capable of providing up to 100 images a day that are 185 km wide with a 14 percent side overlap at the equator, increasing with altitude. Real-time TM data are transmitted at a rate of 84.9Mb/s on the X-band, while MSS data are transmitted at 15Mb/s on the S-band.

~~(TSCI~~ In mid-April 1993, LANDSAT-6 (fig. 1) was going through its final check-out phase before its shipment to a U.S. testing range, and its launch is expected to occur in July 1993. The satellite will be equipped with an Enhanced Thematic Mapper (ETM) for its primary sensor. The ETM allows for 15m-resolution panchromatic capability, with up to 900 images per day.

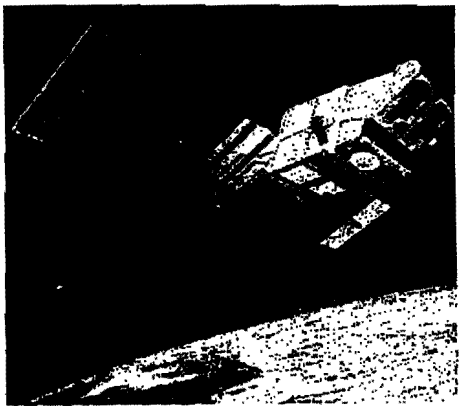

Fig. 2. France's SPOT-1 satellite (U)

2.2.2.2. France (U)

(U) France initiated the SPOT (Experimental Satellite for Earth Observation) program in 1978 and established the firm SPOT Image SA in 1982. The objective of the program is the sale of photographic imagery for studies in the areas of agriculture, forestry, mineral and oil exploration, and mapping.

(U) SPOT-1 was launched on 22 February 1986 on an *Ariane 1* rocket from Kourou, French Guiana. It was the first remote-sensing satellite with potential military applications launched outside of the U.S., USSR, or China. The satellite was launched into a circular, sun-synchronous orbit with a period of 101.4 minutes, and a 26-day/369 orbit repeat cycle. The payload consists of an HRV pushbroom-charged coupled-device imaging system. The SPOT sensing system operates in the visible and near-infrared bands providing black-and-white images with a resolution of 10 meters. Color images are produced from input in three narrow spectral bands. SPOT-1 was intended to have a life-span of two years, but it was operable until the French deactivated it on 31 December 1990, after nearly five years in orbit (figure 2).

(U) SPOT-2 became France's primary remote sensing satellite in January 1990 with the deactivation of SPOT-1. SPOT-2, also launched from French Guiana, was boosted by an Ariane 4 rocket into essentially the same orbit as SPOT-1. SPOT-2's design is similar to that of SPOT-1, with the exception of four charge-coupled device (CCD) arrays combined in each HRV detection unit. It is also equipped with an additional system, designated Doppler Orbitography and Radiopositioning Integrated by Satellite (DORIS), for accurate orbit determination. France is developing another earth observation satellite, SPOT-3, which is scheduled to be launched in 1993.

2.2.2.3. Japan (U)

(U) The Japanese have three remote sensing programs, the Marine Observation Satellite (MOS-1), launched in February 1987, the Earth Resources Satellite (JERS-I), launched in February 1992, and the Advanced Earth Observation Satellite (ADEOS), projected to be launched in February 1996.

(U) The MOS-1, Japan's first domestic earth resources satellite, was launched in February 1987 by a two-stage N-II launch vehicle from Tanegashima Space Center. MOS-1 had a planned operational life span of two years, with MOS-1b providing coverage following its launch in February 1990. Both 740-kg satellites were placed into a sun-synchronous orbit at an altitude of approximately 909 km and an inclination of 99 degrees. Each satellite is equipped with onboard sensors consisting of a multispectral electronic self-scanning radiometer (MESSR), a microwave scanning radiometer (MSR), a visible and thermal infrared radiometer (VTIR), and a data collection system transponder (DCST). Both satellites were developed primarily for monitoring ocean phenomena and establishing common technology for polar-orbiting earth observation satellites.

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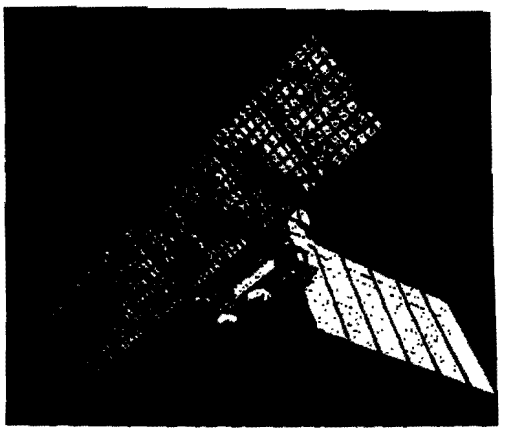

Fig. 3. Japan's JERS-1 satellite (U)

(U) The primary mission of the earth observation satellite is to monitor the earth's surface features primarily for resource exploration, land survey, agriculture, forestry and fishery, environmental protection, disaster prevention, and coastal monitoring. Moreover, in April 1993 the Japanese Natural Resources and Energy Agency will coordinate with the Metal Mining Agency of Japan to begin using the JERS-1 satellite to spot deposits of gold, silver and other valuable metals worldwide. The data obtained by the satellite on ten sites will be analyzed by computers for mineral deposits. Three of the sites are in Latin America and one site each in North America, Australia, Africa, Mongolia, Indonesia, the Russian Far East and Kyushu, Japan. If the data on one of the foreign areas strongly suggest that deposits exist, Japan may begin negotiations with the country involved regarding exploration rights and joint projects.

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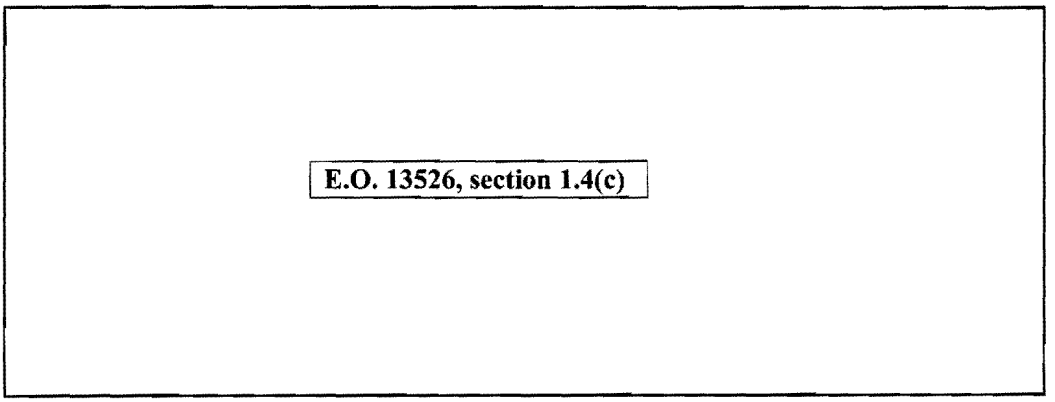
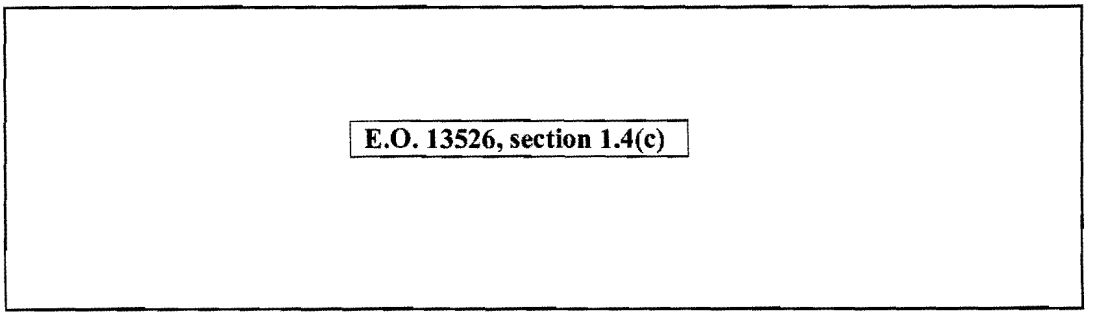


2.2.2.4. European Space Agency (U)



2.2.2.5. India (U)

(U) India began its earth observation program with the launch of two BHASKARA experimental satellites. These satellites, which carried two TV cameras and a microwave radiometer, were Soviet-launched missions to study India's land and water resources.

(U) The BHASKARA satellites were succeeded by the Indian Remote Sensing Satellite (IRS), which was designed and developed by the Indian Space Research Organization (ISRO). The first two satellites of the series, IRS-1A and IRS-1B were launched by Soviet SL-3 boosters from Tyuratam on 17 March 1988 and 29 August 1991, respectively. Both 975-kg satellites were placed into 904-km sun-synchronous polar orbits with 99-degree inclinations. The two satellites are virtually identical, with each satellite having a four-band imaging system with three French-built CCD cameras, called Linear Imaging Self Scanners (LISS), capable of providing 36.25-m and 72.5-m resolution.

(U) The mission of the IRS program is threefold: first, to establish an indigenous capability to design, develop, and deploy a three-axis stabilized sun-synchronous polar-orbiting satellite carrying near-state-of-the-art cameras providing imagery for earth resources application; second, to establish and routinely operate ground-based systems for spacecraft data reception, recording, processing, data product generation, analysis, and archiving, as well as mission control facilities; and, third, to use data from IRS satellites and other sources to properly survey and manage resources in areas such as agriculture, geology, and hydrology.

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2.2.3. Remote Sensing Applications (U)

(U) Environmental satellites are being used in developing countries to aid in the management of Earth's resources. Data provided by the satellites provide scientists with the tools and information necessary in the administration of urban land, the production of agricultural crops, the identification of mineral deposits, and the prediction of population changes. Asian countries are showing an increasing interest in the technology of remote sensing and in the Geographic Information System, a conversion of images into a digital format that can be analyzed on a computer. In India, analysis of satellite data found that nearly twenty-three million potentially cultivable hectares are lying in waste. In Pakistan, nearly ten million hectares have problems being waterlogged with salt accretion. Meanwhile, almost 50 percent of the land in Vietnam has been found to be unproductive. Remote sensing technology has also led to the creation of the Southeast Asia Ministries of Education Organization (SEAMEO) project involving five Southeast Asian countries. The project's goal is to estimate the amount of deforestation that has occurred in the region since 1980 and to present solutions aimed at solving the current situation.

2.3 VSATs (U)

(U) Very small aperture terminals (VSATs) represent a growing aspect of satellite communications by providing reliable transmission of digital information for data, voice and video using very small antennas. VSATs are also capable of providing communication networks that are insensitive to distance and terrain, can be used with encryption devices for greater security, and can be used in conjunction with public telephone service orwork independently.

2.3.1. VSAT Structures (U)

(U) Most VSAT networks are arranged in a star configuration with a central hub earth station. The network typically consists of a satellite, a central hub station or satellite dish with an antenna 6 to 8 meters in diameter, and any number of VSAT terminals using antennas that are 1.2 to 1.8 meters in diameter (figure 4).

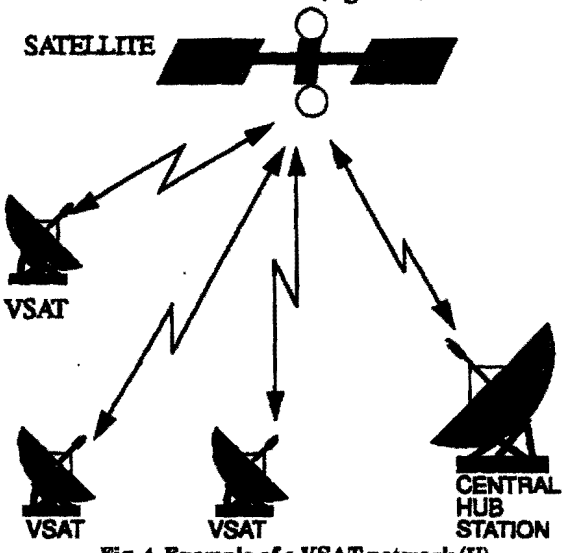

Fig. 4. Example of a VSAT network (U)

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Fig. 5. Primary global baseband usage (U)

2.3.2. *VSAT Benefits (U)*

(U) The reliance upon VSAT networks, both domestically and internationally, has been rapidly increasing. This trend is expected to continue, because VSAT networks have the potential to meet the continually changing growth requirements of communication satellite users at a relatively low cost. Other VSAT benefits include the following:

- Access to remote sites
- High reliability
- Rapid deployment
- Improved bandwidth capability
- Flexible network configuration
- Sophisticated network management
- Lower/stable costs
- End-to-end network control
- One vendor for products and services

(U) In addition, within five years, both domestic and international VSAT services will be developed to support full Integrated Services Digital Network (ISDN) quality and wideband services as satellite capabilities continue to increase. The main advantage will be the ability to deliver digital services directly to customers via a VSAT antenna located on a roof or on a desk. Other VSAT trends include Local Area Network connectivity, hubless VSAT networks, high-quality compressed video, smaller and cheaper VSATs, and value-added services such as electronic mail.

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1. (U) Proprietary VSAT-associated software and algorithms vary from company to company.

2. (U) As transmission frequency increases, signal access becomes more difficult.

3. (U) VSATs are completely digital and can be easily encrypted .

4. (U) Direct sequence spread spectrum (DSSS), normally associated with C-band broadcasts, makes SIGINT detection and collection more difficult.

5. (U) Since VSATs provide private data networks, it is more difficult to identify and collect the smaller, independent networks. However, since all relays in a network are

performed on a single satellite, once the uplink/downlink from the main hub is accessed, all of the signals from the terminals can be accessed.

3.0. GLOBAL SATELLITE PROGRAMS SERVICING SOUTHEAST ASIA (U)

(U) For the past twenty-nine years, INTELSAT and INMARSAT have been the backbone of worldwide communications and have been pioneers in technological advances. They have brought telecommunications to isolated countries, where at one time the distance to the nearest telephone was measured in hundreds of miles, and enabled them to be opened up to the rest of the world.

3.1. INTELSAT (U)

(U) The International Telecommunications Satellite Organization (ITSO), also called INTELSAT, was established in 1964 to provide a worldwide, commercial satellite network. The INTELSAT network comprises many operational satellites located over the Atlantic, Indian, and Pacific Ocean regions. These satellites provide services, including international switched traffic and international television leases, to 120 member countries. In addition, several countries, including Thailand, have either bought or leased transponders from INTELSAT to meet domestic needs.

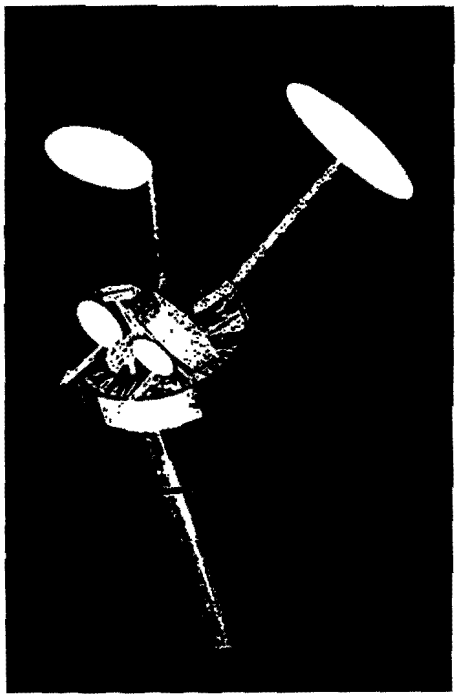

Fig. 6. INTELSAT-VI satellite (U)

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(U) INTELSAT is developing a new series of satellites, INTELSAT-7, for use over the Pacific region. The new satellites are expected to provide broadcast services and would operate from fixed positions over continents. The satellites will feature three independently steerable KU-band spot beams and one independently steerable C-band spot beam which can be steered to accommodate changing traffic patterns and service requirements.

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3.2. *INMARSAT (U)*

~~(SC)~~ The International Maritime Satellite Organization (INMARSAT), established in 1979, is an international partnership of sixty-seven member countries which operates the space segment for the provision of mobile satellite communications to customers at sea, on land and in the air. As of March 1993, the global maritime, aeronautical and land mobile satellite services are being provided through the INMARSAT 2 series of satellites (figure 7) to over 27,000 mobile terminals commissioned in over 135 cities. The primary INMARSAT satellite operating over the Indian Ocean Region is INMARSAT 2-F1 at 64.5 degrees east.

Fig. 7. INMARSAT-2 satellite (U)

~~(SC)~~ INMARSAT provides telephone, telex, data, and facsimile transmissions, and distress and safety communications services to shipping and offshore communities. The provision of these services is accomplished by three key network elements: the Ship Earth

Stations (SES), the space segment, and the Coast Earth Stations (CES). In addition, a representative from INMARSAT has indicated that four third-generation satellites are currently under construction for deployment in 1994–1995. This will allow an expanded range of services to smaller, more portable terminals, before the proposed introduction of INMARSAT-P services near the end of the decade.

4.0. REGIONAL AND DOMESTIC PROGRAMS SERVICING SOUTHEAST ASIA (U)

(U) Since the initial launch of Indonesia's PALAPA series satellites in 1976, the number of regional and domestic programs servicing the Southeast Asia region has grown steadily and will approach seven programs by the year 2000. These programs include six government-backed endeavors and a single commercial endeavor. In addition to the ones described in this section, Thailand, Papua New Guinea, South Korea, and Malaysia are each planning domestic communications satellite programs.

4.1. ASIASAT (U)

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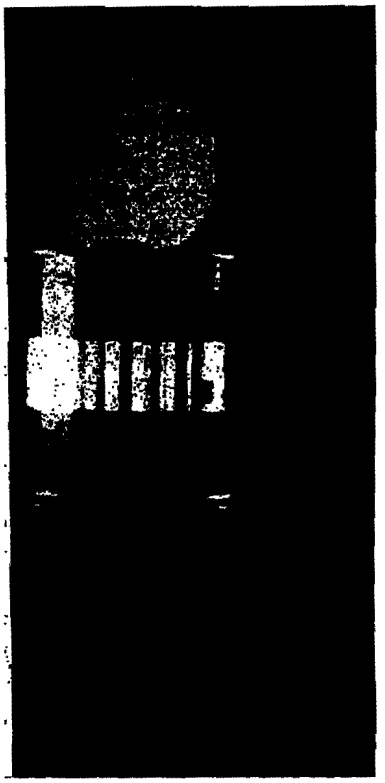

Fig. 8. ASIASAT-I satellite (U)

(U) The satellite, an HS-376 spin-stabilized model with an estimated lifespan of nine to ten years, is equipped with twenty-four C-band transponders. Antenna coverage includes a single zonal beam accommodating almost all of China and a single southern beam covering Southern Asia from Vietnam to Turkey, specifically providing 36dBW to Thailand and Pakistan. The effective isotropic radiated power (EIRP) for the maximum footprint is a minimum of 37dBW. Associated frequencies for the satellite include

- 5 925–6.425 GHz (Uplink)

- 3.700–4.200 GHz (Downlink)

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4.2. PALAPA (U)

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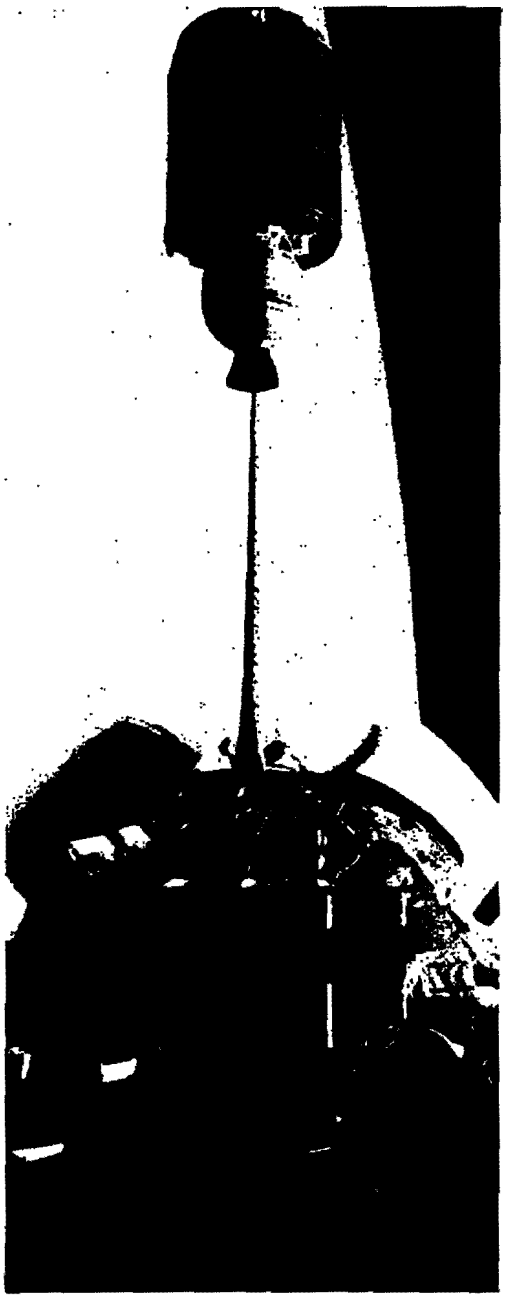

Fig. 9. Indonesia's PALAPA-B satellite (U)

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E.O. 13526, section 1.4(c)(d)

4.3. TONGASAT (U)

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E.O. 13526, section 1.4(c)(d)

5.0. COUNTRY STUDIES (U)

(U) The nations of Southeast Asia, in terms of size, population, culture and economic development, comprise one of the most diverse regions on earth. Despite this, many of these nations share common goals: to build up the basic infrastructure, to develop the domestic sector, to secure a permanent place in the global economy, and, most importantly, to have access to strategic information and to establish a firm base for information technology skills. In the pursuit of these goals, the region is turning to satellite technology for solutions and the key to modernization. With this in mind, the next section of this paper will describe national goals, existing telecommunication infrastructures, international cooperation, and future trends for emerging space programs in Burma, Cambodia, Laos, Thailand, and Vietnam.

6.0. BURMA (MYANMAR) (U)

6.1. Requirements (U)

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E.O. 13526, section 1.4(c)

6.2. Goals (U)

(U) Burma has been implementing various telecommunications development projects since 1975, of which the two most important major ones were the First Telecommunications Development Project (1979–1981) and the Second Telecommunications Development Project (1982–1987). A third project referred to as the "Establishment of a Domestic Satellite Communications System" has been implemented since 1990. This project consisted of the installation of a satellite earth station at Rangoon and twelve remote satellite earth stations in provincial towns, all designed to use transponders on the telecommunications satellite ASIASAT-I. Future telecommunications projects are being initiated under a plan titled "The Planning Support to Telecom Expansion Project-Consultancy Services." The plan is operating under the assistance of the Center for Telecommunications Development, under the International Telecommunications Union (ITU). The development objectives include the following:

- To assist Burma in improving and expanding its telecommunications infrastructure by providing experts to work with local professional staffs
- To establish a Telecommunications Planning Branch within the organization responsible for developing Burma's telecommunications
- To complete a telecommunications development "Master Plan" for Burma

6.3. Organizational Structure (U)

(U) Burma's telecommunications facilities are entirely state owned. Control of this sector has been vested in the Ministry of Communications, Posts & Telegraph. Under the ministry, the Myanmar Posts and Telecommunications (MPT) has the responsibility for the development, operation, and maintenance of all domestic and international services in the country (Appendix B).

6.4. Budget (U)

(U) Burma's 1991 revenues were US $7.2 billion with expenditures of US $9.3 billion, including capital expenditures of US $6 billion. The bulk of financing for MPT's developmental programs has come from the International Development Association (IDA), the Overseas Economic Cooperation Fund (OECF), and assistance from the Organization of Petroleum Exporting Countries (OPEC).

6.5. Industries (U)

(U) Because of a lack of sufficient funds and civil unrest within the country, Burma has no governmental or private industries producing indigenous space materials. All telecommunications equipment is supplied and funded abroad and is highly regulated by the MPT.

6.6. International cooperation (U)

(SC) Access to satellite technology has aided in the improvement of Burma's telecommunications infrastructure. Most international assistance has come from China's willingness to provide Burma with a domestic satellite network. However, firms from various countries, including Pakistan, Thailand, and the United States, have expressed a desire to provide financial and technical assistance.

6.6.1. ASIASAT (U)

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E.O. 13526, section 1.4(c)

6.6.2. China (U)

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6.6.3. INMARSAT (U)

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6.6.4. Pakistan (U)

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E.O. 13526, section 1.4(c)

6.6.5. Singapore (U)

E.O. 13526, section 1.4(c)

6.6.6. South Korea (U)

E.O. 13526, section 1.4(c)

6.6.7. Thailand (U)

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6.6.8. United States (U)

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E.O. 13526, section 1.4(c)

6.7. Launch, Test, and Command & Control Facilities (U)

(U) As a result of a dependence on international monetary assistance, the Burmese government is unable to afford space development and launch facilities. Therefore, the government focuses its space-related resources primarily on upgrading its INTELSAT facility and expanding its current television broadcasting capabilities via its domestic communications satellite (DOMSAT) network.

6.7.1. Fixed Earth Stations (U)

(U) There are currently two main fixed earth stations located in Burma – an INTELSAT station and a master DOMSAT station (Table 1). There are also numerous TVRO stations throughout the countryside.

Table 1
Major Space Facilities in Burma

Facility Location	*Type of Facility*	*BE Number*	*Geographic Coordinate*
Togyaungale	INTELSAT	0677-00738	1651N 09613E
Rangoon	MASTER DOMSAT	0677-01766	1749N 09610E

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(U) All the international telephone and telegraph circuits are operated through a Standard "B" INTELSAT earth station located in Rangoon, which was commissioned since February 1979. As of June 1990, the MPT had twenty-six SCPC/PCM/PSK channels connecting to other countries through Japan, Singapore, Hong Kong, the United Kingdom, India, and Thailand. As a result of the increase in the amount of overseas telephone traffic, the MPT is implementing a project named the "Improvement of International Telecommunications Facilities" under OECF financing. The project involves constructing a Standard "A" earth station with 110 initial channels and 200 International Digital Telephone Exchange lines. This new program is designed to upgrade the Stored Program

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E.O. 13526, section 1.4(c)

6.7.2. Command & Control Facilities (U)

(U) There are no command and control facilities located in Burma.

6.7.3 Launch Facilities (U)

(U) There are no satellite launch facilities located in Burma.

6.7.4. Testing Facilities (U)

(U) There are no satellite testing facilities located in Burma.

6.8. Boosters (U)

(U) The government of Burma does not own or operate any satellite boosters.

6.9. Types of Satellites (U)

(U) The government of Burma does not have the funds or technology necessary to build and operate any type of satellite. Therefore, its use of satellites has been confined to the leasing of transponders on communications satellites. However, Burma's immediate

future may include the expanded use of remote sensing satellites and the use of VSAT technology for civil aviation.

6.9.1. Meteorological and Remote Sensing (U)

(U) The government of Burma does not maintain any type of meteorological or remote sensing programs. However, data from LANDSAT, SPOT, and IRS could provide the Burmese government with an effective tool to combat the drug trafficking problem within the region.

6.9.2. Communications Satellite Program (U)

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6.9.3. VSAT (U)

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6.9.4. Scientific Satellite Program (U)

(U) Burma neither supports nor has participated in any scientific satellite program.

6.9.5. Manned Space Program (U)

(U) Burma neither supports nor has participated in any manned space program.

6.10. Trends (U)

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7.0. CAMBODIA (U)

7.1. Requirements (U)

(U) Cambodia's telecommunications infrastructure has been a casualty of war. The little infrastructure that had been established was destroyed by civil war during the 1970s. Today, guerrilla warfare has rendered much of the country unsafe for any form of development, while resources have been diverted from development to national defense.

7.2. Goals (U)

(U) Cambodia's primary goal is to rebuild its telecommunications throughout the countryside. Government officials have noted that the development of a communications network, allowing access to isolated areas, is necessary before peace can be obtained in the country.

7.3. Organizational Structure (U)

(U) Cambodia's telecommunications are managed by the Ministry of Post, Transport and Communications (MPT). As of April 1993, the minister of the MPT was So Khum. The Directorate of Posts and Telecommunications (DPT) is subordinate to the MPT. However, it is uncertain how the Cambodian elections, held during May 1993, will affect the structure of the telecommunications industry in Cambodia (Appendix C).

7.4. Budget (U)

(U) Cambodia's GNP was estimated at US $890 million in 1989.

7.5. Industries (U)

(U) As a result of Cambodia's civil unrest, there are no governmental industries producing indigenous space materials. Within the private sector, Cambodia's only space-related industry is a joint venture with a Thai firm. Thailand's Samart Telecommunications Corporation signed a joint venture contract with Cambodian authorities for the establishment of Cambodia Samart Co. in Phnom Penh. The Cambodian firm will sell satellite dishes, television antennas, and telecommunications equipment, as well as prepare for various projects. The Thai firm was to provide technical training for the Cambodians as part of its long-term commitment.

7.6. International cooperation (U)

(U) All of Cambodia's telecommunications projects are supplied and funded abroad. While several countries have signed individual agreements with Cambodian authorities,

the majority of international projects are designed to support United Nations' Transitional Authority in Cambodia (UNTAC) operations, whose function is to oversee the May 1993 democratic elections and the rehabilitation of the country. Some UNTAC telecommunications projects, especially the establishment of VSAT terminals, may be absorbed into the Cambodian infrastructure after the withdrawal of the peacekeeping mission.

7.6.1. Australia (U)

(U) A ten-year Business Cooperation Contract (BCC) was signed between an Australian firm and Cambodia's DPT in February 1990 for the development of Cambodia's international telecommunications sector. The first stage in the project included the installation of an INTELSAT Vista earth station in 1990 with subsequent upgrades in 1991. A second agreement between the two parties was signed in November 1992. Under the new agreement, the Australian firm will construct an international telecommunications center, an INTELSAT satellite earth station, and an international gateway for telephone exchange. The facilities are scheduled to be completed in 1993 and will enable Cambodia to meet traffic demand for the next several years.

(U) In addition to the BCC, Australian entities have assisted UNTAC operations by supplying satellite equipment. In August 1992 an Australian entity agreed to supply UNTAC with mobile satellite communications equipment. The entity was to supply a national satellite network, telephone switching facilities, voice and data links, a mobile cellular network, and high-frequency and mobile trunked networks. Earth stations were to be installed at nine primary sites during the first phase, and then the network would gradually be increased by fifteen more stations in provincial towns and district centers. The stations would be able to communicate with each other and be linked through an international gateway in Phnom Penh. The network will probably stay in Cambodia when UNTAC personnel leave.

7.6.2. Indonesia (U)

E.O. 13526, section 1.4(c)(d)

7.6.3. Thailand (U)

E.O. 13526, section 1.4(c)

(U) Thailand's Shinawatra group chairman has signed two concession contracts with the ministers of Cambodia's Communications and Advertising ministries. The twenty-year contracts will permit Shinawatra to operate telephone and television projects in Cambodia on a profit-sharing basis. In addition, Shinawatra will spend approximately US $4 million for the installation of 10,000 telephone lines using a "wireless local loop," and possibly connecting Cambodia to the rest of the world through INTELSAT. The system will be switched over to THAICOM-1, Thailand's first domestic satellite, in 1994.

7.7. Launch, Test, and Command & Control Facilities (U)

(U) Cambodia's entire space infrastructure consists of two satellite earth stations, with a third station under construction. However, temporary SATCOM facilities have been established to support UNTAC operations.

7.7.1. Fixed Earth Stations (U)

E.O. 13526, section 1.4(c)

E.O. 13526, section 1.4(c)

(U) The Cambodian government also maintains an INTELSAT ground station in the capital, Phnom Penh. A 7.5-meter Vista satellite earth station was installed in Phnom Penh in November 1990. The station, supplied by an Australian entity, was upgraded in March 1991 to receive international direct dial (IDD) services. Moreover, the station received an upgrade in October 1991, and is capable of receiving intermediate data rate (IDR) services.

E.O. 13526, section 1.4(c)

(U) A third satellite ground station is being built by an Australian entity at an unspecified location. The planned INTELSAT Standard A station is scheduled to be completed in 1993.

7.7.2. Command & Control Facilities (U)

(U) There are no command and control facilities located in Cambodia.

7.7.3. Launch Facilities (U)

(U) There are no satellite launch facilities located in Cambodia.

7.7.4. Testing Facilities (U)

(U) There are no satellite testing facilities located in Cambodia.

7.7.5. Miscellaneous (U)

E.O. 13526, section 1.4(c)

E.O. 13526, section 1.4(c)

7.8. Boosters (U)

(U) The government of Cambodia does not own or operate any launch boosters.

7.9. Types of Satellites (U)

(U) Cambodia has not acquired the necessary technology to build and operate any type of satellite. Therefore, its use of satellite technology has been confined to communication satellites operated by international organizations. However, remote sensing technology and VSAT communications are currently being utilized by U.N.-sponsored programs within Cambodia, which may make the technology more accessible in the future.

7.9.1. Meteorological and Remote Sensing (U)

(U) Remote sensing applications have been used to assist various peacekeeping efforts in Cambodia, including the effort to return millions of refugees displaced by the Khmer Rouge's reign of terror. The areas of Cambodia's western and northwestern provinces were evaluated for rehabilitating some three million returnees after assessing suitable land use, soil quality, forest cover and agricultural potential using SPOT data.

7.9.2. Communication Satellite Program (U)

E.O. 13526, section 1.4(c)

7.9.3. VSAT (U)

E.O. 13526, section 1.4(c)

(U) In January 1993 an American firm agreed to supply the United Nations with a VSAT network in Cambodia. The network would enable U.N. officials to communicate with each other and the rest of the world during Cambodia's transitional period. The VSAT system will operate via Indonesia's PALAPA-B satellite series and will provide basic telephone, facsimile, data and telex services. It is anticipated that the American system will eventually be turned over to the Cambodian government in hope of rebuilding

the nation's telecommunication infrastructure. The major concern with implementing the system is that it could possibly fall into the hands of the Khmer Rouge. Despite this, analysts predict that Cambodia will be a prime market for low-cost VSAT technology, because the country lacks adequate telephone service and VSATs are more affordable than alternative land line systems.

7.9.4. Scientific Satellite Program (U)

(U) Cambodia neither supports nor has participated in any scientific satellite program.

7.9.5. Manned Space Program (U)

(U) Cambodia neither supports nor has participated in any manned space program.

7.10. Trends (U)

(U) Much of Cambodia's future depends on the outcome of the May 1993 democratic elections and the implementation of a new constitution. If peace is maintained in the country, Cambodia may be able to use the technology left behind by UNTAC units and begin to rebuild its telecommunications infrastructure. Moreover, the lack of adequate telecommunications in Cambodia makes it a prime marketplace for future investment. However, the likelihood of Cambodian involvement in nontelecommunications space endeavors before the year 2000 is nearly nonexistent.

8.0. LAOS (U)

8.1. Requirements (U)

(U) Laos has one of poorest communications structures in the Southeast Asian region, leaving many regions of the country isolated. The combination of the varied terrain and signal strengths from surrounding countries has precluded the effective use of most non-satellite means of communications. Improvements in the communications system, especially an increasing reliance on satellite communications, would permit isolated areas to benefit from foreign investments.

8.2. Goals (U)

(U) The government is trying to improve its telecommunications networks with the implementation of several projects. The projects have been designed to achieve the following objectives:

- To improve the quality of telecommunications, introduce new technology, and increase access to telecommunications

- To develop a national telecommunications network connecting at least the major provincial cities with the capital
- To place a substantially expanded communications ministry on a sound financial footing to enable it to generate sufficient revenues to cover its operating costs and increasingly meet its own need for sustaining growth.

E.O. 13526, section 1.4(c)

8.3. Organizational Structure (U)

(U) Laos' telecommunications development program is managed by the Ministry of Communications, Transport, Post & Construction, also called the Enterprise D'Etat Des Postes Et Telecommunications Lao (EPTL). As of April 1993, the minister of EPTL was Mr. Bouathong (Appendix D).

8.4. Budget (U)

(U) Laos' 1990 revenues were US $83 million with expenditures of US $188.5 million, including capital expenditures of US $94 million.

Withheld from public release Pub. L. 86-36

8.5. Industries (U)

(U) As a result of a lack of expertise and resources, Laos has no governmental or private industries producing indigenous space materials. All telecommunications equipment is supplied and funded abroad.

8.6. International cooperation (U)

(U) Access to international satellite technology has aided in the improvement of Laos' telecommunications infrastructure. Most international assistance to Laos is derived from grants awarded to governments and/or firms by the United Nations Development Program (UNDP).

8.6.1. Australia (U)

(U) A Vista earth station (INTELSAT Standard D1) was completed in May 1990 with funding from an Australian entity. In July 1991, the Australian entity signed a five-year contract with EPTL to upgrade the earth station with intermediate data rate (IDR) capability and international direct dial (IDD) access. IDD access for incoming calls was completed on 14 March 1992, while IDD for outgoing calls was scheduled to be completed in June 1992. The value of the contract is estimated to be $4 million (probably Australian dollars). The completion of this effort cannot been confirmed at this time.

8.6.2. China (U)

E.O. 13526, section 1.4(c)(d)

E.O. 13526, section 1.4(c)(d)

8.6.3. Commonwealth of Independent States (U)

E.O. 13526, section 1.4(c)(d)

8.6.4. Germany (U)

E.O. 13526, section 1.4(c)(d)

8.6.5. Japan (U)

E.O. 13526, section 1.4(c)(d)

8.6.6. Sweden (U)

E.O. 13526, section 1.4(c)(d)

8.6.7. Thailand (U)

E.O. 13526, section 1.4(c)(d)

E.O. 13526, section 1.4(c)

8.6.8. Vietnam (U)

E.O. 13526, section 1.4(c)

8.7. Launch, Test, and Command & Control Facilities (U)

(U) Laos' entire space infrastructure consists of two satellite earth stations.

8.7.1. Fixed Earth Stations (U)

E.O. 13526, section 1.4(c)

E.O. 13526, section 1.4(c)

8.7.2. Command & Control Facilities (U)

(U) There are no satellite command and control facilities in Laos.

8.7.3 Launch Facilities (U)

(U) There are no satellite launching facilities in Laos.

8.7.4. Testing Facilities (U)

(U) There are no satellite testing facilities in Laos.

8.8. Boosters (U)

(U) The government of Laos does not own or operate any launch boosters.

8.9. Types of Satellites (U)

E.O. 13526, section 1.4(c)

8.9.1. Meteorological and Remote Sensing (U)

E.O. 13526, section 1.4(c)

E.O. 13526, section 1.4(c)

8.9.2. Communication Satellite Program (U)

E.O. 13526, section 1.4(c)

8.9.3. VSAT (U)

(U) There are no VSAT networks operating in Laos.

8.9.4. Scientific Satellite Program (U)

(U) Laos neither supports nor has participated in any scientific satellite program.

8.9.5. Manned Space Program (U)

(U) Laos neither supports nor has participated in any manned space program.

8.9.6. Miscellaneous(U)

E.O. 13526, section 1.4(c)

8.10. Trends (U)

(U) Infrastructure projects, including telecommunications, provide an attractive avenue for U.S. business investment in Laos, especially as development assistance by multilateral agencies, specifically the UN, the World Bank, and the Asian Development Bank, have increased to help resolve the infrastructure problems.

9.0. THAILAND (U)

9.1. Requirements (U)

(U) Thailand has one of the fastest growing economies in the world, and it is quickly positioning itself to become a financial and telecommunications hub within Asia. However, the telecommunications network within Thailand's borders serves a mere fraction of the Thai population. The growth of telecommunications services has been limited primarily to the industrial and business sectors, while growth in the rural parts of the country has been negligible. Therefore, despite the continued efforts to improve Thailand's market centers, it is the rural areas that require the greatest amount of work.

9.2. Goals (U)

(U) In April 1991 the government of Thailand announced its plans to spend approximately US $2 billion a year on projects designed to improve its inadequate telecommunications networks. These projects have been developed to achieve the following objectives:

- To meet the telecommunications demand over the next ten years by installing a modern international telephone switching center
- To continue the development of the communications network (TELEPORT) in designated industrial areas
- To facilitate better communications capabilities within the region by installing an optical fiber submarine cable, use of which will be interrelated with the satellite communications network

- To improve upon the INMARSAT mobile communications system to enable officials and passengers in aircraft, ships, buses, trains and private vehicles to communicate effectively by way of telephone, facsimile and data services

(U) In addition to the programs mentioned above, Thailand is actively pursuing its desire to build and launch a communications satellite network, referred to as THAICOM, by late 1993.

9.3. Organizational Structure (U)

(U) The organization of space activity in Thailand has been separated into two ministries – the Ministry of Transport and Communications and the Ministry of Science, Technology and Energy (Appendix E).

9.3.1. Ministry of Transport and Communications (U)

(U) All of Thailand's telecommunications services fall under the jurisdiction of the Ministry of Transport and Communications (MOTC). The MOTC is composed of the Space Activities Commission, the Space Development Agency, and the Post and Telegraph Department (PTD). Telecommunications services are divided further into two groups – domestic and international. Domestic services are managed by the Telephone Organization of Thailand (TOT), while international services are managed by Communications Authority of Thailand (CAT). Both are state-owned enterprises and controlled by the MOTC.

E.O. 13526, section 1.4(c)

(U) The CAT, established in 1974, is responsible for international telephone service to countries not served by TOT. CAT also regulates all international lease circuits for telegraph and telex services. Furthermore, it is the INTELSAT signatory for Thailand.

9.3.2. Ministry of Science, Technology and Energy (U)

(U) The Ministry of Science, Technology and Energy is primarily responsible for regulating all research and development programs within Thailand. Among the space-related entities within the ministry is the National Research Council of Thailand (NRCT), responsible for remote sensing programs.

9.4. Budget (U)

(U) Thailand's revenues for fiscal year 1992 were US $17.9 billion with expenditures of US $17.9 billion, including capital expenditures of US $5 billion. Thailand spent a "mere" US $94 million on telecommunications equipment in 1986, of which more than half was spent on switching and transmission equipment. During 1990, Thailand's telecommunications expenditures ballooned to US $443 million, an unprecedented growth of 371 percent over the five-year period. Meanwhile, spending of US $774 million is projected for the period from 1991 to 1995, demonstrating growth of approximately 75 percent.

9.5. Industries (U)

(U) Faced with remarkable economic growth during the last several years, the government of Thailand has loosened restrictions on business in an attempt to improve its underdeveloped business communications and keep pace with the rest of Asia. Deregulation has been the critical factor for the growth of telecommunications industries in Thailand, especially in the VSAT market. A number of private companies are now permitted to operate specialized telecom services on a concessionary basis with the Thai government.

9.5.1. Satellite Television & Radio Broadcasters (U)

E.O. 13526, section 1.4(c)

(U) Thailand has a radio broadcasting network, Radio Thailand, that provides four SCPC audio channels and uses PALAPA-B2P. There are also five television channels in Thailand that operate via an IOR INTELSAT V and an Indonesian PALAPA satellite (Table 6).

Table 6
Thailand's Television Network

Channel	*Broadcasting Company*	*Satellite*
3	Thai Television	INTELSAT V (IOR)
5	Army Television (HSA-TV)	PALAPA-B2P
7	Bangkok Broadcasting & TV Co. Ltd. (BBTV)	PALAPA-B2P
9	Mass Communications Organization of Thailand	INTELSAT V (IOR)
11	Television of Thailand	National Thai TV Network

9.5.2. Home Satellite Television (U)

(U) There are approximately 6,000 home TVRO systems in Thailand and four Thai companies dedicated to providing home satellite services. These companies include Spa Communications Co. Ltd., a TVRO retailer, Thai Vasco Ltd., a TVRO manufacturer and satellite consultant, Jebsen & Jessen Thailand Ltd., a TVRO distributor, and Loxley Bangkok Ltd., a TVRO manufacturer.

9.5.3. Telephony (U)

(U) Acumen Co., a private concessionaire authorized by the Telephone Organization of Thailand (TOT), operates a ten-station digital domestic satellite network with INTELSAT IBS access. The system operates on PALAPA and was purchased from an American firm.

9.5.4. VSAT Communications Companies (U)

E.O. 13526, section 1.4(c)

9.6. International Cooperation (U)

(U) Through transponder lease agreements and joint ventures with foreign companies, Thailand has been able to acquire advanced telecommunications technology. Access to this technology has aided in the improvement of Thailand's telecommunications infrastructure and strengthened its economic position within Southeast Asia.

9.6.1. ASIASAT (U)

E.O. 13526, section 1.4(c)(d)

9.6.2. Australia (U)

(U) Thailand's Samart Telcoms formed a joint venture with an Australian firm for the provision of a high-speed digital satellite data network for the Thai business community. The Australian firm was to provide network engineering, network operations, and marketing support to Samart Telcoms.

9.6.3. France (U)

E.O. 13526, section 1.4(c)(d)

9.6.4. Indonesia (U)

E.O. 13526, section 1.4(c)(d)

E.O. 13526, section 1.4(c)(d)

9.6.5. Japan (U)

E.O. 13526, section 1.4(c)(d)

E.O. 13526, section 1.4(c)

(U) Japan's Nippon Electric Co., Ltd. (NEC) has supplied Thailand with a telecommunications network intended to provide service for television distribution via a leased transponder on the PALAPA satellite. The network consists of a master earth station with an 11-meter antenna, located in Bangkok, sixteen local stations with 7.5-meter antennas, one local station with a 10-meter antenna, and three mobile stations with 4.5-meter antennas.

9.6.6. United States (U)

(U) At the present time, Thailand's SC&C is receiving technical assistance from a U.S. firm. The U.S. firm has agreed to construct both THAICOM-1 and THAICOM-2 satellites for approximately US $100 million (see Section 9.9.2).

9.7. Launch, Test, and Command & Control Facilities (U)

(U) Thailand's space program is still in its infancy, so the government has been focusing its space-related resources on improving its telecommunications infrastructure, including its remote sensing and INTELSAT ground stations. However, through international monetary and technical assistance, the Thai government has begun to implement plans which will provide for space development and launch facilities in the future.

9.7.1. Fixed Earth Stations (U)

(U) There are currently two main fixed earth stations located in Thailand – a remote sensing station and an INTELSAT station (Table 7). There are also numerous ground stations throughout the country which are used for Thailand's business network.

Table 7
Major Space Facilities in Thailand

Facility Location	*Type of Facility*	*BE Number*	*Geographic Coordinate*
Bangkhen	LANDSAT/ SPOT/MOS	Unknown	vic 1349N 10030E
Si Racha	INTELSAT	Unknown	1306N 10056E

E.O. 13526, section 1.4(c)

E.O. 13526, section 1.4(c)

(U) A new satellite ground station near Bangkok has begun acquiring images from the ERS-1 environmental satellite. The US $1.5 million station became operational in early 1993 and will provide images of Southeast Asia. Meanwhile, a facility to process the images is also being built and will be ready in late 1993 or early 1994.

E.O. 13526, section 1.4(c)

E.O. 13526, section 1.4(c)

(U) On 21 August 1992 Thaisat, a joint venture between Loxley Bangkok and a Hong Kong firm, expressed interest in establishing an earth station in Chiang Mai. The station would relay primarily television transmission signals from ASIASAT and serve as a back-up control station. SC&C has protested the Thaisat plan, arguing that its exclusive right of the THAICOM project will be affected by what it perceives as competition from Thaisat. If the station is not approved by the Thai government, the Thaisat station could be located in Singapore.

Table 8
ISBN Ground Stations in Thailand

FacilityLocation	*Geographic Coordinate*
Bangkok (Master station)	1345N 10031E
Chiang Mai	1847N 09859E
Chiang Rai	1954N 09950E
Phitsanuloke	1650N 10015E
Nakhon Ratchasima	1458N 10207E
Khon Kaen	1627N 10247E
Rayong	1239N 10116E
Phuket	0753N 09824E
Hat Yai	0701N 10028E
Surat Thani	0907N 09921E

9.7.2. Command & Control Facilities (U)

(U) No command and control facilities have been identified in Thailand. However, with the upcoming launch of Thailand's first communications satellite, the country may move to upgrade an existing station, possibly Si Racha, or construct a new facility.

9.7.3. Launch Facilities (U)

(U) There are no satellite launch facilities located in Thailand. Thailand's first satellite will be launched from French Guiana in South America.

9.7.4. Testing Facilities (U)

(U) There are no satellite testing facilities located in Thailand.

9.8. Boosters (U)

(U) The government of Thailand does not own or operate any launch boosters. Shinawatra will rely on a French rocket booster, Ariane-44L, to place its future Thai satellite in orbit.

9.9. Types of Satellites (U)

E.O. 13526, section 1.4(c)

9.9.1. Meteorological and Remote Sensing (U)

E.O. 13526, section 1.4(c)

(U) According to a report issued by the Indian Space Research Organization, the TRSC's major issues include deforestation and erosion, while major remote sensing activities involve disaster assessment, watershed, coastal zoning, and the environment. The TRSC has also been using LANDSAT data to map its tropical forest in an attempt to preserve its diverse flora and fauna.

(U) According to Vibulsresth, Thailand is in need of three types of remote sensing data. The first type of data is optical sensor and infrared sensor, similar to what they are currently receiving from LANDSAT TM and SPOT. the resolution of which should be improved to about 25 meters and be from a sixteen- or eighteen-day cycle. The second type of data is the microwave sensor, or SAR data, that will become available through the ERS-1, JERS-1, and RADARSAT satellites. Finally, Thailand would like to receive wide area coverage data with a 1-km resolution.

9.9.2. Communication Satellite Program (U)

E.O. 13526, section 1.4(c)

E.O. 13526, section 1.4(c)

E.O. 13526, section 1.4(c)

(U) The BUS system of THAICOM is a lightweight, spin-stabilized, model HS-376 (Appendix F). The system has dimensions of 2.16 X 6.6 meters and an initial on-station weight of 629kg. Each THAICOM satellite has a mission lifetime expectancy of thirteen to fifteen years and will be equipped with ten C-band and two Ku-band transponders. The C-band transponders, with bandwidths of 36 MHz, will use the following frequencies:

- RX: 5.925 - 6.425 GHz
- TX: 3.700 - 4.200 GHz

The C-bands will be powered by 11-watt solid-state power amplifiers (SSPAs) and will produce a minimum EIRP of 37 dBw over Thailand and 35 dBw at the edge of the beam over the North Pacific. The C-band footprint will include Thailand and neighboring countries including Malaysia, Singapore, Indonesia, Laos, Cambodia, Vietnam, Burma, China, Taiwan, Korea, and Japan (figure 11).

(U) The two Ku-band transponders, with bandwidths of 54 MHz, will use the following frequencies:

- RX: 14.3159 - 14.4951 GHz
- TX: 12.5679 - 12.7471 GHz

The Ku-bands will be powered by 50-watt travelling wave tube amplifiers (TWTAs), and will produce a minimum EIRP of 51 dBw at beam center. Its footprint will include all of Southeast Asia (figure 12). The operational control and management of the THAICOM satellites, including station keeping, mission analysis, and ranging and network management, will be set up at an unspecified location. Ground communication for domestic communications will be composed of various functional divisions such as a gateway station, VSATs and mobile stations.

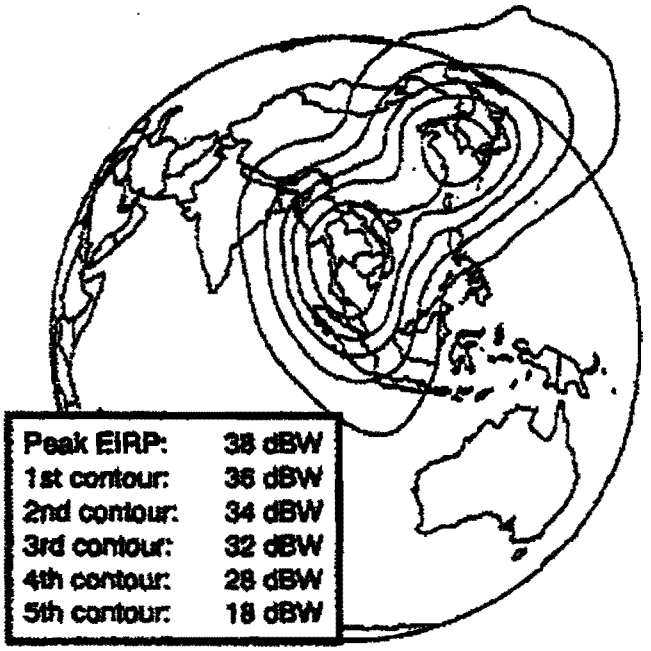


Fig. 11. THAICOM's C-band satellite coverage (U)

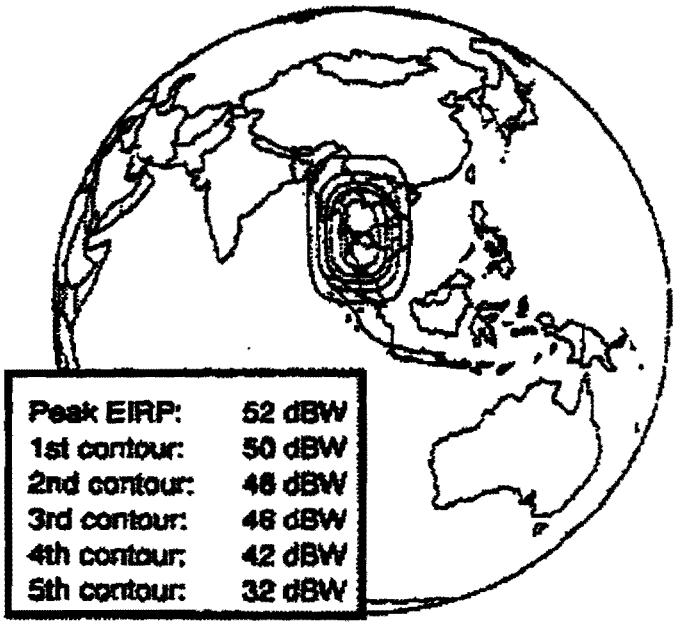


Fig.12. THAICOM's KU-band satellite coverage (U)

E.O. 13526, section 1.4(c)

(U) Around October 1992, THAICOM-1 was to be launched into geosynchronous orbit on an Ariane-44L (figure 13) space launch vehicle from Kourou, French Guiana. The satellite is a Spelda Dedicated Satellite (SDS), allowing it to be integrated in a Spelda compartment (dual launch external carrier structure) inside the Ariane nose fairing, and placed in orbit under extremely economical dual-launch conditions. THAICOM-1 will be "roomed" with the Mexican-owned Solidaridad-1A satellite and placed into its assigned orbital location of 101.5 degrees east, 35,000 km above Bangkok. On 31 July 1992 Thailand signed an agreement with Arianespace to launch its US $35 million second telecommunications satellite, THAICOM-2, into its assigned orbit of 78.5 degrees

Fig. 13. ARAINE-44L rocket booster (U)

east at the end of 1994. The geostationary satellite will also be launched from a pad in French Guiana.

(U) Shinawatra has won a government commitment that public sector users with leases to other satellites will switch to its satellite when contracts expire. This commitment includes the five national Thai television networks, Radio Thailand, and the VSAT networks of Compunet and Samart. The company will also use its satellites for its other operations, including mobile phone, cable television, data communications and paging services for private businesses and communications links for the Thai government and military. In addition, Shinawatra intends to use the satellites to transmit numerous entertainment channels directly to Thai homes. The channels are presently transmitted terrestrially in major urban areas using multichannel multipoint distribution service (MMDS) frequencies. Compulsory use of Thai satellites is seen as crucial to the economic viability of the costly private investment scheme.

E.O. 13526, section 1.4(c)

9.9.3. VSAT (U)

E.O. 13526, section 1.4(c)

(U) On 11 January 1993, a U.S. company agreed to provide a US $4 million VSAT network to Thai SkyCom Ltd. The network will provide satellite-based data, voice, facsimile, and video communications services to businesses and governments throughout the Asia-Pacific region. The network will operate via ASIASAT and PALAPA-B4 satellites. Moreover, it will be able to hook into Thailand's public network, operated by CAT, to offer communications across national borders. The first stage of the network

consists of a turnkey 11-meter satellite hub, a 4.5-meter minihub, fifty VSAT terminals, and ten digital MCPC terminals. The VSAT network is expected to be fully operational by July 1993.

9.9.4. Scientific Satellite Program (U)

(U) Thailand does not participate in any scientific satellite program.

9.9.5. Manned Space Program (U)

(U) Thailand neither supports nor has participate in any manned space program.

9.10. Trends (U)

(U) Thailand is rapidly improving and expanding on its telecommunications abilities and is positioning itself to become a technological and financial leader within Southeast Asia. The country has access to the technology and foreign resources necessary to develop a domestic space program capable of meeting the country's communications requirements well into the next century, as evidenced by their committment to THAICOM-1 and THAICOM-2. Moreover, the Thai government is broadening its use of remote sensing technology in an attempt to solve domestic and regional problems.

10.0. VIETNAM (U)

10.1. Requirements (U)

(U) In recent years, Vietnam has developed its telecommunications networks remarkably, enabling major Vietnamese cities to communicate via satellite to almost any part of the world. However, in remote rural areas of the country, the development, installation, and use of mobile domestic small satellite communication systems, including VSATs, are still required for both rural telecommunications and public broadcasting. The primary obstacle hindering the continued development is the lack of hard currency necessary to attract foreign telecommunications projects.

10.2. Goals (U)

(U) The government of Vietnam has mapped out a strategic plan for the modernization of its telecommunications networks through the year 2000. The first phase of the plan, implemented during 1990–1992, was designed to achieve the following objectives:

- To establish an optical fiber cable link from Hanoi to Ho Chi Minh City with the capacity of 140 Mb/s. The purpose will be to carry all telecommunications services, including color television and radio broadcasting.
- To establish an optical fiber cable link with the capacity of 34 Mb/s for the country's southern provinces.

- To establish microwave links with the capacity of 2 Mb/s, 4 Mb/s and 8 Mb/s for the northern provinces and the Cuu Long River Delta.
- To cooperate with foreign countries to assemble and manufacture narrow-band microwave equipment, data transmission modems, and electronic exchanges of small capacity.
- To research and develop ISDN in some areas, and gain experience to develop it during the next phase of the modernization plan.
- To cooperate with other countries to upgrade Vietnam's national training centers to provide the experts with sufficient knowledge and capabilities to manage, operate, and maintain the telecommunication networks.

10.3. Organizational Structure (U)

E.O. 13526, section 1.4(c)

(U) In addition, each city/town has its own Post and Telephone company/organization which falls under the jurisdiction of the DGPT. These entities are responsible for providing and distributing non-infrastructure equipment (e.g., telephones, pagers, facsimile equipment, etc.). Ho Chi Minh City's Post and Telephone company is the most highly developed communications distribution entity on the local level.

10.4. Budget (U)

E.O. 13526, section 1.4(c)

E.O. 13526, section 1.4(c)

10.5. Industries (U)

E.O. 13526, section 1.4(c)

10.6. International cooperation (U)

(U) Since the end of the Vietnam War, U.S. companies have been prohibited from dealing with Vietnam, the single exception being the lifting of restrictions on telephone communications in late 1992. This has spurred a recent influx of foreign firms into Vietnam, with each firm trying to secure an upper hand in the country before the U.S. lifts its sanctions. However, despite Vietnam's attempt at loosening restrictions for foreign

firms to conduct business in the country, all telecommunications companies must still work with and through the DGPT.

10.6.1. ASIASAT (U)

(U) In April 1991, the Vietnamese government signed a memorandum of understanding (MOU) with the Hong Kong-based consortium running the ASIASAT-1 telecommunications satellite. The MOU was seen as a means of boosting Vietnam's international telecommunications capacity.

10.6.2. Australia (U)

E.O. 13526, section 1.4(c)

10.6.3. China (U)

(U) Vietnam and China officially reopened direct telephone links on 22 September 1991 in an attempt to improve relations between the two countries. Furthermore, a new communication line through an INTELSAT satellite between the Vietnam News Agency and China's News Agency was put into commission in Hanoi on 1 February 1992. In the past, communications between the two agencies was carried out through high frequency transmission.

10.6.4. Commonwealth of Independent States (U)

E.O. 13526, section 1.4(c)

E.O. 13526, section 1.4(c)

10.6.5. France (U)

(U) Vietnam and France signed a series of accords in Hanoi on 10 February 1993. The French firm Alcatel and Vietnam's DGPT agreed to form a Hanoi-based joint venture firm, Alcatel Network Systems Vietnam, to manufacture, market and service Alcatel's 1000 E10 digital switching system. The joint venture will also have an international service center employing Vietnamese engineers to work on Alcatel's switching sites outside Vietnam. The new venture is part of a cooperation which Alcatel began with Vietnam in 1987.

10.6.6. India (U)

E.O. 13526, section 1.4(c)

10.6.7. Indonesia (U)

E.O. 13526, section 1.4(c)

E.O. 13526, section 1.4(c)

10.6.8. Japan (U)

E.O. 13526, section 1.4(c)

E.O. 13526, section 1.4(c)

10.6.9. Thailand (U)

E.O. 13526, section 1.4(c)

(U) Chatichai Choonhavan, former prime minister of Thailand, travelled to Vietnam from 20 to 22 December 1992 to propose a joint telecommunications satellite project. Stating "the Indochina battlefield must be turned into a marketplace," Choonhavan noted that the project would allow the countries to collaborate and develop their economies.

10.6.10. United States (U)

E.O. 13526, section 1.4(c)

10.7. Launch, Test, and Command & Control Facilities (U)

(U) As a result of a dependence on international monetary assistance, the Vietnamese government is unable to afford space development and launch facilities. Therefore, the government focuses its space-related resources primarily on improving its telecommunications infrastructure.

10.7.1. Fixed Earth Stations (U)

E.O. 13526, section 1.4(c)

E.O. 13526, section 1.4(c)

E.O. 13526, section 1.4(c)

E.O. 13526, section 1.4(c)

10.7.2. Command & Control Facilities

(U) There are no command and control facilities located in Vietnam.

10.7.3. Launch Facilities (U)

(U) There are no satellite launch facilities located in Vietnam.

10.7.4. Testing Facilities (U)

(U) There are no satellite testing facilities located in Vietnam.

10.7.5. Miscellaneous (U)

E.O. 13526, section 1.4(c)

10.8. Boosters (U)

(U) The government of Vietnam does not own or operate any launch boosters.

10.9. Types of Satellites (U)

E.O. 13526, section 1.4(c)

10.9.1. Meteorological and Remote Sensing (U)

E.O. 13526, section 1.4(c)

(U) Vietnam's National Center for Scientific Research (NCSR) receives data from LANDSAT. Major remote sensing activities involve coastal studies, forestry, land use, and crop inventory.

E.O. 13526, section 1.4(c)

10.9.2. Communication Satellite Program (U)

E.O. 13526, section 1.4(c)

10.9.3. VSAT (U)

E.O. 13526, section 1.4(c)

E.O. 13526, section 1.4(c)

10.9.4. Scientific Satellite Program (U)

(U) Vietnam neither supports nor has participated in any scientific satellite program.

10.9.5. Manned Space Program (U)

(U) Vietnam does not maintain a manned space program, but the government has sent a cosmonaut into space with the assistance of the former Soviet Union. Vietnam had one cosmonaut, Air Force colonel Pham Tuan, who flew to the SALYuT-6 space station as the cosmonaut-researcher on SOYuZ-37 in July 1980. Colonel Tuan and his Soviet colleagues performed a series of medical, earth resources, and materials sciences experiments designed by Vietnamese scientists. Colonel Tuan stayed seven days and flew down in SOYuZ-36.

10.9.6. Miscellaneous (U)

E.O. 13526, section 1.4(c)

10.10. Trends (U)

E.O. 13526, section 1.4(c)

(U) Despite the recent attempts to modernize the country's telecommunications services, Vietnam's lack of hard currency will probably restrict its space-related endeavors during the next several years.

11.0. CONCLUSION AND APPENDICES

(U) As strong economic growth in Southeast Asia continues, the use of satellite technology is being seen as a necessity towards both political and economic development. Additionally, countries with inadequate telecommunications can now bypass the painful and expensive periods of development, benefiting from the decreasing costs of satellite technology.

(U) These new technologies may open the door to future applications by permitting satellite equipment suppliers and manufacturers to benefit from the largely untapped basin, while providing a new source of economic growth for the region. Moreover, regional television programming broadcast via satellites may provide the opportunity to influence an enormous audience that has been both isolated and possibly misunderstood.

Notes (U)

E.O. 13526, section 1.4(c)(d)

E.O. 13526, section 1.4(c)(d)

E.O. 13526, section 1.4(c)(d)

Withheld from public release Pub. L. 86-36

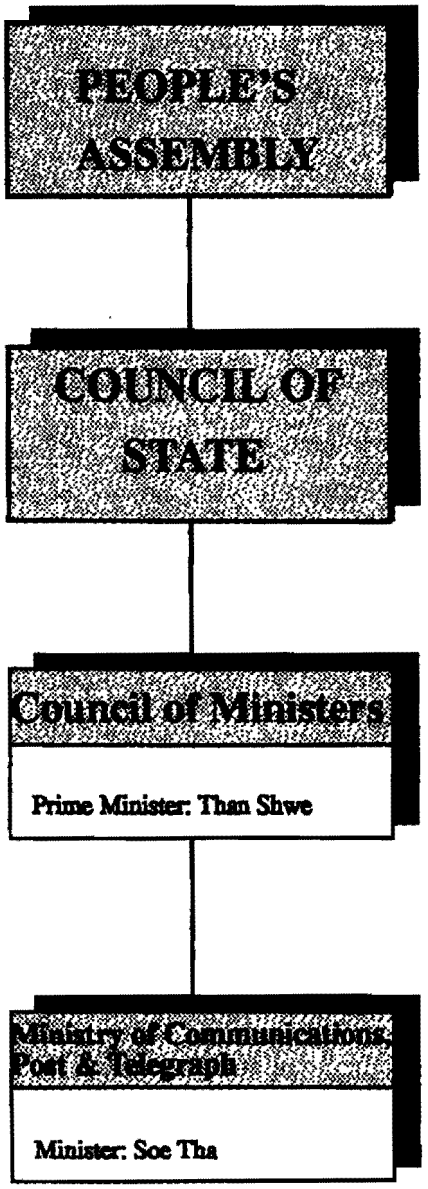
Appendix A

INTELSAT Standard Earth Stations (U)

Standard	*Antenna size (meters)*	*Service range*	*Frequency band (GHz)*
A	15–18	International voice, data, and TV, IBS, and IDR	6/4
B	10–13	International voice, data, and TV, IBS, and IDR	6/4
C	11–14	International voice, data, and TV, IBS, and IDR	14/11
D1	4.5–6	Vista	6/4
D2	11	Vista	6/4
E1	3.5–4.5	IBS	14/11, 14/12
E2	5.5–7	IBS, IDR	14/11, 14/12
E3	8–10	IBS, IDR	14/11, 14/12
F1	4.5–5	IBS, IDR	6/4
F2	5.5–7	IBS, IDR	6/4
F3	9-10	International voice and data, IBS and IDR	6/4
G	All sizes	International lease	6/4, 14/11, 14/12
Z	All sizes	Domestic lease	6/4, 14/11, 14/12

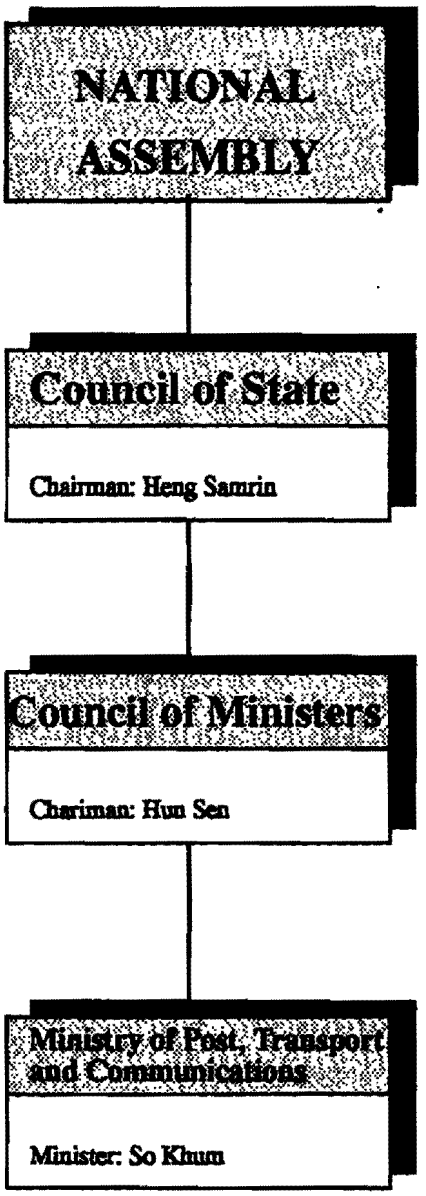
Appendix B

Organization of Space Activities in Burma (U)



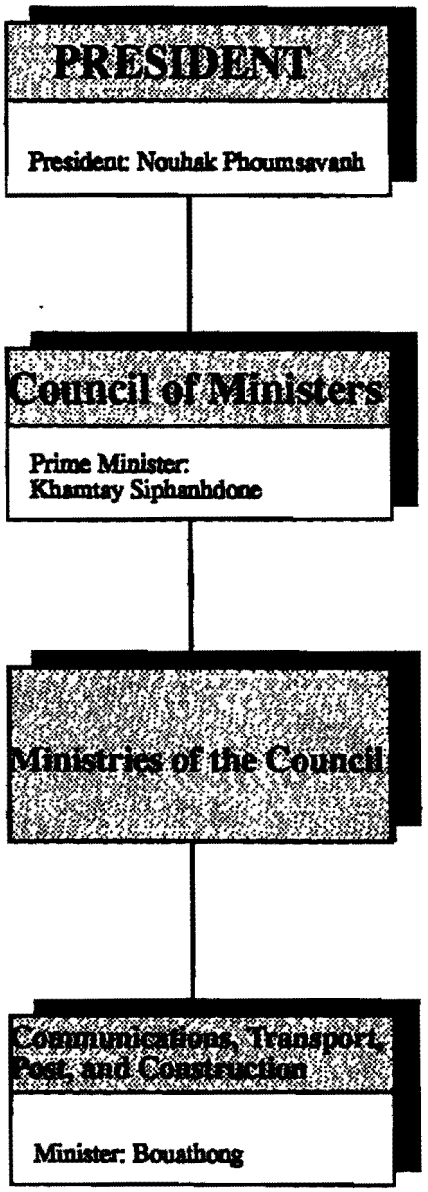
Appendix C

Organization of Space Activities in Cambodia (U)



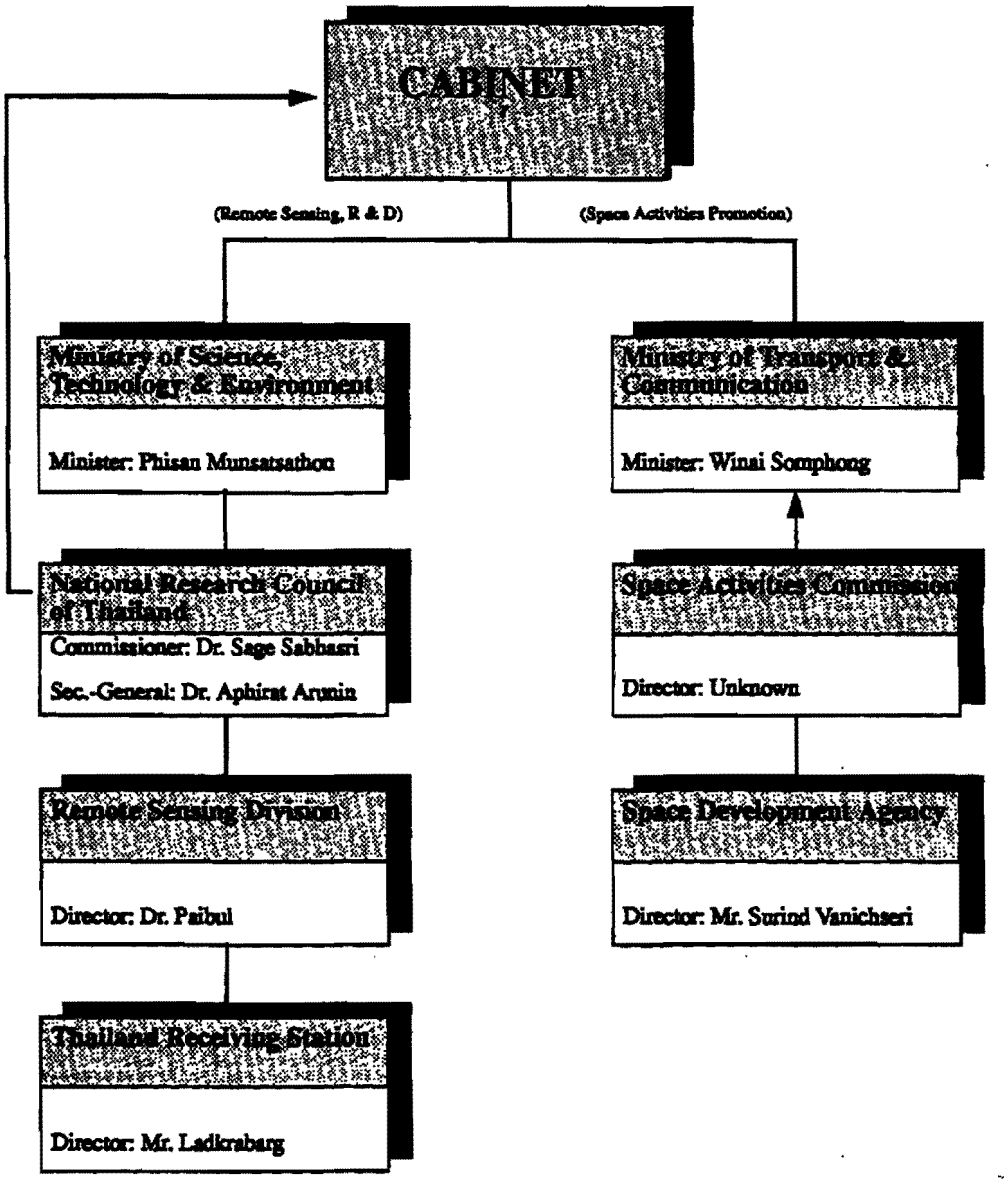
Appendix D

Organization of Space Activities in Laos (U)



Appendix E

Organization of Space Activities in Thailand (U)



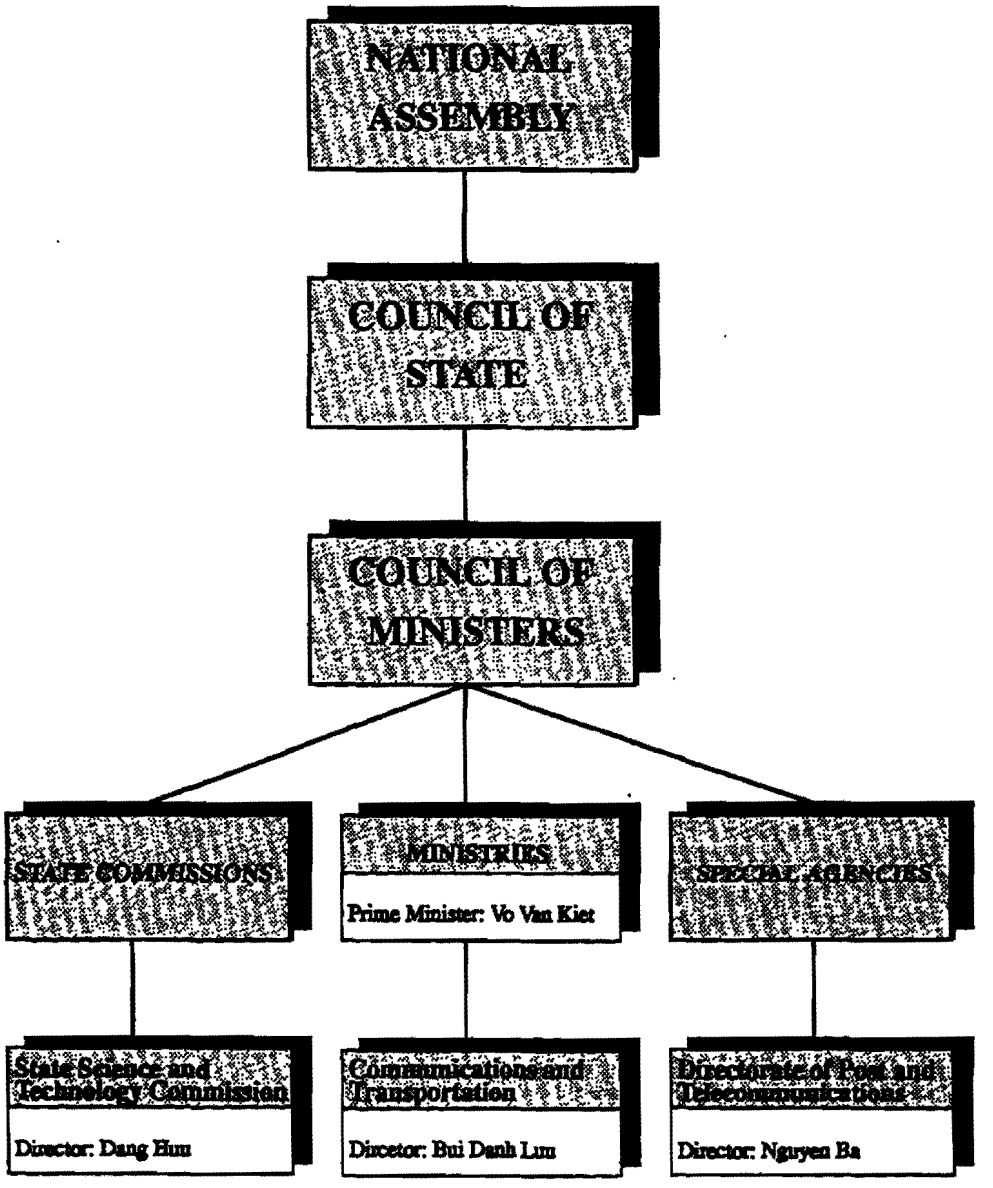
Appendix F

THAICOM-1 and THAICOM-2 at a Glance (U)

Operational History	
Orbital Assignment:	101.5 and 78.5 degrees East Longitude
Launch Dates(s):	December 1993 and mid-1994
Launch Vehicle:	THAICOM-1: Ariane-4 THAICOM-2: To be determined
Status:	Under construction
Design Life:	13–15 years
Communications Payload	
Frequency Band(s):	Receive: 14.3159~14.495 and 5.925~6.425 GHz Transmit: 12.5679~12.7471 and 3.7~4.2 GHz
Active Channels:	2 Ku-band channels (27 or 54 MHz wide) Plus 1 back-up channel K1 – 12.549 GHz; K2 – 12.6575 GHz K3 – 12.7201 GHz 10 C-band channels (36 MHz wide) Plus 2 back-up channels C01 – 3.720 GHz; Co2 – 3.760 GHz C03 – 3.800 GHz; C04 – 3.760 GHz C05 – 3.880 GHz; C06 – 3.920 GHz C07 – 3.960 GHz; C08 – 4.000 GHz C09 – 4.040 GHz; C10 – 4.080 GHz C11 – 4.120 GHz; C12 – 4.160 GHz
Polarization:	Ku-band: horizontal on downlink C-band: Vertical on downlink
Signal Power (EIRP):	Ku-band: 51dBW at beam center C-band: 37 dBW over Thailand 35 dBW over North Pacific
Uplink G/T:	Ku-band: 8 dB/K C-band: 5 dB/K
Coverage Area:	Ku-band: Southeast Asia C-band: Thailand, Malaysia, Singapore, Indonesia, Laos, Cambodia, Vietnam, Burma, China, Taiwan, Korea, and Japan
TWTA Power:	Ku-band: 47 watts
SSPA Power:	C-band: 11 watts
Capacity:	14 television channels
Spacecraft	
Satellite Type:	Ligtweight version of HS-376
Manufacturer:	American company
Initial On-Station Weight:	629 kg (1,383.8 lbs) on station
Dimensions:	2.16m diameter, 6.6m height
Electrical Power:	700 watts at beginning of life

Appendix G

Organization of Space Activities in Vietnam (U)



Appendix H

Reports Referenced (U)

E.O. 13526, section 1.4(c)(d)

E.O. 13526, section 1.4(c)(d)

E.O. 13526, section 1.4(c)(d)

E.O. 13526, section 1.4(c)(d)