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International regulation of civilian remote sensing satellites, 1972–1991: The role of domestic policy, marketplace, and technology

Nchia, David Achuo, Ph.D.
The Ohio State University, 1991

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DISSERTATION

Presented in Partial Fulfillment of the Requirements for the Degree of Doctor of Philosophy in the Graduate School of The Ohio State University

By

David A. Nchia, B.Sc., M.A.

*****

The Ohio State University

1991

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1991
ACKNOWLEDGEMENTS

Completion of this study would not have been possible without the generous help and encouragement that I have received from various sources. At Ohio State, my sincere thanks and appreciation are extended to all three members of my advisory committee, for their helpful comments and suggestions throughout my course work and dissertation study. I am particularly indebted to my adviser, Professor Joseph Foley and my co-adviser, Dr. Rohan Samarajiva, whose kindness and continuous counsel guided my dissertation. I am also appreciative of the constructive criticism and perceptive comments of Dr. James Hikins. I am grateful to Dr. David Bossier, Director of the Center for Mapping at the Ohio State University and Dr. James Bracken, Head of the English, Theater, and Communication Library for providing various documents for this study.

I am especially appreciative of the administrative assistance provided by Dr. Nandasiri Jasentuliyana, Director of the Outer Space Affairs Division at the United Nations headquarters in New York, and his staff, particularly Dr. Adigun Abiodun and Mr. Ralph Chipman. I am also deeply indebted to the UN delegates on the Committee for the
Peaceful Uses of Outer Space and remote sensing industry officials who were interviewed for this study. Appendix A is a complete list of officials interviewed. However, it is my responsibility to account for the substance of that which follows.
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PREFACE

You, Sir . . . will easily conceive with what pleasure a philosopher, furnished with wings, and hovering in the sky would see the earth, to him successively, by it diurnal motion, all the countries within the same parallel. How it must amuse the pendant spectator to see the moving scene of land and ocean, cities and deserts!

To survey with equal security the marts of trade, . . . mountains infested by barbarians and fruitful regions gladdened by plenty. How easily shall we then examine the face of nature from one extremity of the earth to the other.

Samuel Johnson, (1759). History of Rasselas

The vantage point of space allows remote sensing satellites to view all of the environment in which we live. It is both the global and the informational aspects that give remote sensing activity its value. It is also these characteristics that provide the basis for the legal issues being raised and disputed in international fora. The above paragraph from Dr. Samuel Johnson's book, written more than 200 years before the advent of space-based remote sensing, captures the essence of the international debate on remote sensing. Nonetheless, the following personal experience will help the reader understand the impact of remote sensing in a clear and graphic way.
In July 1981, I was driving across the Sahara desert, alone, returning to West Africa from France. It was the first of two trips I was to make across the Sahara to raise money to attend college abroad.

During the day, the desert is unbearably hot. The only signs of human activity can be found in oases, essentially "watering holes", where small groups of people settle permanently. After two days of driving, with nothing in sight but endless sand dunes, I finally saw a group of tents erected in the heart of the desert and thought it might be a settlement where I could get fresh drinking water.

To my horror, I was received by three soldiers, their rifles raised and pointing straight at me. I was later told that I had strayed into a "restricted military area" and let go, but not before my car had been thoroughly searched, to make sure I was not some kind of "spy" with hidden cameras. Whatever was being protected there I was so stunned by the sight of guns pointed in my direction that I did not care to ask. I was given a fresh supply of water and bread, shown the way to the right trail and was glad to be on my way.

In 1987, thousands of miles from Africa and six years after my first trip across the Sahara, I was watching the nightly news on television. I had just moved to Columbus, Ohio to begin work on my doctoral program. My attention was caught by a report on a technology that could provide the media with pictures of virtually any location on earth, especially in cases where inhospitable geographic conditions or local authorities prevented news reporters from
traveling to the sight of an important news event. Remote sensing from outer space was the technology described in the report.

In 1986, I had seen television pictures (obtained from remote sensing satellite data) of a melting nuclear reactor in the Soviet Union, following a disaster that occurred in Chernobyl. However, I did not quite understand the significance of remote sensing at that time. The report I saw in 1987 was significant for the following reason: In the report a photo interpreter at SPOT Image Corporation in Reston, Virginia, displayed a satellite image of a military facility in North Africa and proceeded to point out military tanks, air-strips, etc. There was no doubt that I was watching pictures of the facility I had strayed into in 1981. This time, no one was pointing a gun at me!

It was fascinating to look at these pictures, and I instinctively knew that some person(s) somewhere was/were not amused by this display of pictures. This early experiences was just the beginning of this study.
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<tr>
<td>BMEWS</td>
<td>Ballistic Missile Early Warning System</td>
</tr>
<tr>
<td>CCT</td>
<td>Computer Compatible Tape</td>
</tr>
<tr>
<td>CIA</td>
<td>Central Intelligence Agency (USA)</td>
</tr>
<tr>
<td>CNES</td>
<td>Centre National d'Etudes Spatiales (France)</td>
</tr>
<tr>
<td>COMSAT</td>
<td>Communications Satellite Organization (USA)</td>
</tr>
<tr>
<td>COPUOS</td>
<td>Committee On the Peaceful Uses of Outer Space</td>
</tr>
<tr>
<td>COSPAR</td>
<td>Committee on Space Research</td>
</tr>
<tr>
<td>ECOSOC</td>
<td>Economic and Social Council (United Nations)</td>
</tr>
<tr>
<td>ELV</td>
<td>Expendable Launch Vehicle</td>
</tr>
<tr>
<td>EOSAT</td>
<td>Earth Observation Satellite Company (USA)</td>
</tr>
<tr>
<td>ERTS</td>
<td>Earth Resources Technology Satellite</td>
</tr>
<tr>
<td>ESA</td>
<td>European Space Agency</td>
</tr>
<tr>
<td>FAO</td>
<td>Food and Agriculture Organization (UN)</td>
</tr>
<tr>
<td>FCC</td>
<td>Federal Communications Commission (USA)</td>
</tr>
<tr>
<td>FRC</td>
<td>Federal Radio Commission (USA)</td>
</tr>
<tr>
<td>HRV</td>
<td>High Resolution Visible.</td>
</tr>
<tr>
<td>IAEA</td>
<td>International Atomic Energy Agency</td>
</tr>
<tr>
<td>IAF</td>
<td>International Astronautical Federation</td>
</tr>
<tr>
<td>ICBM</td>
<td>Inter-Continental Ballistic Missile</td>
</tr>
<tr>
<td>ILO</td>
<td>International Labor Organization</td>
</tr>
<tr>
<td>INMARSAT</td>
<td>International Maritime Satellite Organization</td>
</tr>
<tr>
<td>INTELSAT</td>
<td>International Telecommunications Satellite Organization</td>
</tr>
<tr>
<td>INTERCOSMOS</td>
<td>Council on International Co-operation in the Study and Utilization of Outer Space</td>
</tr>
<tr>
<td>IRS</td>
<td>Indian Remote Sensing Satellite</td>
</tr>
<tr>
<td>ISDN</td>
<td>Integrated Services Digital Network</td>
</tr>
<tr>
<td>ISRO</td>
<td>Indian Space Research Organization</td>
</tr>
<tr>
<td>ITU</td>
<td>International Telecommunications Union</td>
</tr>
<tr>
<td>MOS</td>
<td>Marine Observation Satellite</td>
</tr>
<tr>
<td>MSR</td>
<td>Microwave Scanning Radiometer.</td>
</tr>
<tr>
<td>MSS</td>
<td>Multispectral Scanner Subsystem.</td>
</tr>
<tr>
<td>NASA</td>
<td>National Aeronautics and Space Administration (USA)</td>
</tr>
<tr>
<td>Acronym</td>
<td>Full Name</td>
</tr>
<tr>
<td>---------</td>
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<tr>
<td>NOAA</td>
<td>National Oceanic and Atmospheric Administration (USA)</td>
</tr>
<tr>
<td>NRSA</td>
<td>National Remote Sensing Agency (India)</td>
</tr>
<tr>
<td>OECD</td>
<td>Organization for Economic Cooperation and Development</td>
</tr>
<tr>
<td>NSDA</td>
<td>National Space Development Agency (Japan)</td>
</tr>
<tr>
<td>RBV</td>
<td>Return Beam Vidicon.</td>
</tr>
<tr>
<td>RESTEC</td>
<td>Remote Sensing Technology Center (Japan)</td>
</tr>
<tr>
<td>TM</td>
<td>Thematic Mapper.</td>
</tr>
<tr>
<td>SAR</td>
<td>Synthetic Aperture Radar.</td>
</tr>
<tr>
<td>SDI</td>
<td>Strategic Defense Initiative</td>
</tr>
<tr>
<td>SNSB</td>
<td>Swedish National Space Board</td>
</tr>
<tr>
<td>SPOT</td>
<td>Satellite Pour l'OBServation de la Terre (Earth Observation Satellite) (France)</td>
</tr>
<tr>
<td>UN</td>
<td>United Nations</td>
</tr>
<tr>
<td>UN COPUOS</td>
<td>United Nations Committee On the Peaceful Uses of Outer Space</td>
</tr>
<tr>
<td>UNDP</td>
<td>United Nations Development Program</td>
</tr>
<tr>
<td>UNESCO</td>
<td>United Nations Educational, Scientific, and Cultural Organization</td>
</tr>
<tr>
<td>UNGA</td>
<td>United Nations General Assembly</td>
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<td>WMO</td>
<td>World Meteorological Organization</td>
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CHAPTER I
INTRODUCTION

Background and Objective.

During the past few years, the flow of data across national boundaries has given rise to a broad range of issues, including questions pertaining to privacy protection, the growth of trade in data and data services, access to the international data market, the developmental impact of transborder data flows, i.e. the flow of computerized data across national, political boundaries, and the use of earth resource sensing satellites for the exploration, development and management of resources. (UN Center on Transnational Corporations, 1984).

Remote sensing is a unique form of transborder data flow because it not only permits the transmission of data between countries, but it also makes it possible to generate new data about particular countries and disseminate such data to other countries. Given the wide range of purposes for which remote sensing data can be employed, their usefulness and application was -- and continues to be -- the subject of intense debate on appropriate policy guidelines at the United Nations Committee on the Peaceful Uses of Outer Space (COPUOS). Applications for which remote sensing satellite data are useful are discussed in detail in chapter five. The role of COPUOS in
the drafting and implementation of international policy guidelines is discussed in chapter four.

The need for international discussions on remote sensing first came up at the UN in the early 1970s. The UN General Assembly immediately referred the matter to COPUOS, a committee established by General Assembly in 1959 to review international cooperation in the peaceful uses of outer space and to advise and/or make recommendations to the General Assembly on problems that arise from the exploration and use of outer space. A set of international "principles", not a treaty, on remote sensing was adopted in 1986 after more than 15 years of debate on the subject. COPUOS, its structure, function, and as a setting for the discussion of remote sensing issues is discussed in detail in chapter four. The debate and adoption of the UN principles on remote sensing as well as significant developments in remote sensing, outside the UN, are the subjects of this study.

Remote sensing refers to the examination, study, exploration or monitoring of the earth and its resources 'remotely', or from a distance. A formal definition of remote sensing will be provided later in this chapter. It is an important communication topic that represents a particularly interesting study to illuminate the broader issues of communication policy formation for several reasons.

First, the so-called "marriage" between traditional mass communication technologies such as radio, television, satellites, etc. and other communication technologies such as telephone, telegraph, etc., facilitated by computers, has resulted in the provision of new
communication services or communication facilitated services.
Remote sensing is similar to these new technologies in that it raises
some of the same communication policy issues that have been raised
by the types of information flowing through these technologies. To
sort out the types of policy issues that arise from information flows
across national borders, Branscomb (1986) provides the following
taxonomy of 11 types of information: "Personal; Political; Scientific
and Technical; Strategic and Military; Health, Safety, and
Environmental; Economic; Financial; Management; Educational;
Religious and Moral; News and Entertainment" (p. 4). While a
technology such as direct broadcasting by satellite (DBS), for example,
raises a relatively limited number of issues because of fewer types of
information flowing through DBS, remote sensing provides about two-
thirds or more of information types from the above list. Consequently,
communication policy issues raised by remote sensing are more
complex and more challenging. These issues, to name but a few,
include challenges to national sovereignty, national security, privacy,
copyrights, rights of access to information, rights to restrict the flow
of information, etc.

Second, remote sensing issues require truly global agreements,
i.e., the issues cannot be addressed effectively by individual nations, or
by bilateral or multilateral agreements. Broadcasting, for example,
raises issues such as broadcast signals spilling across national
boundaries into a country or countries where the signals are not
intended and/or received by those who do not want to receive the
signals. Such issues can be settled through bilateral or multilateral
agreements between the countries concerned. On the other hand, virtually every nation is affected by remote sensing activity either as the sensor, the sensed, as a consumer of remote sensing data, or any combination thereof. Consequently, remote sensing is clearly a communication technology that requires global agreements to implement any meaningful policy.

Third, it is an important case study of balancing communication rights because the fundamental rights of various parties are directly contradictory to each other. The right of the sensed nation to control information about itself is in conflict with the right of the sensor to gather whatever information it has the technology to obtain, and subsequently the right of third parties to have open access to information.

It could be argued that if the purpose of information in the overall process of human communication -- whether spoken, handwritten, printed with ink, recorded on film or magnetic tape -- is to convey it to someone for social, informative, entertainment, educational, political, military ends, etc., then remote sensing satellites, or any other communication/information technology, does not change anything. People have transported data from one location to the other in many forms and by many means for centuries. Branscomb (1986) notes that while the idea of information travelling by the fastest or most convenient means for communicating has not changed, "the immediacy, bulk, and complexity of the information that modern 'messengers' can carry across national boundaries ... has changed" (p. 5).
The establishment of the Universal Postal Union, in 1878, to negotiate and establish acceptable protocols for the post was one of the earliest governmental responses to the increasing complexity of information flow. The International Telegraph Union, created in 1865, and the accompanying treaty, granted participating nations the right to correspond by telegraph, provided for the protection of the secrecy of transmissions, and established uniformity in tariffs and regulations. Interestingly, the treaty also reserved the right of nations to stop any telegram they considered dangerous to national security or contrary to the law, public order, or good morals of the receiving country (Branscomb, 1986). Since then the introduction of subsequent communication/information technologies that extend beyond national boundaries have required some degree of international harmony and uniformity in rules.

In a comprehensive review of scholarly contributions to the subject of the changing global communications environment, McDonnell (1986) notes that the world of international telecommunications has been disrupted over the past ten years by three major forces. The first, technological change, has brought new products and services, as well as new firms into once closed and stable telecommunications markets. The second force is fierce competition in telecommunications markets "as Western industrialized countries seek to cope with disruptions in world trade and economic recession by promoting economic growth in the services and information sector" (p. 1). The third factor is national and international efforts to develop a new regulatory structure that will cope with technological change,
promote economic growth, and reconcile the interests of business and consumers.

Researchers continue to examine this changing environment from economic, political and legal perspectives, to name but a few. The questions increasingly addressed by communication scholars include the following:

- Who are the key players in international telecommunications?
- What roles in determining policy are played by governments, by telecommunications authorities, by business users, by the military, and by consumers?
- Which countries and which social groups are likely to benefit from current trends in telecommunications?
- Will the needs of developing countries be met?
- What are the possibilities of building a more equitable international telecommunications system?

McDonnell (1986) notes that each scholar or group of scholars addressing any of the above questions, adopts a specific approach. Snow (1986) and the scholars contributing to his volume, for example, adopt a predominantly economic approach. Bruce, Cunard and Director (1986) consider the regulatory and legal aspects, while Dyson and Humphreys (1986) and Hills (1986) focus on the political issues and arguments. While most of the above approaches, legal, economic, political, etc. can contribute to our understanding of the international debate on remote sensing, this study takes an eclectic approach. The intent is to draw from the contributions of scholars who have chosen to specialize in particular aspects of
communication, as well as from the works of scholars in related disciplines, in order to see patterns and generalizations that may not be apparent from narrower perspectives.

Carter (1986) defines remote sensing as "the observation and measurement of the attributes of objects, independent of direct physical contact" but he quickly acknowledges that this is a "comprehensive and literal" definition (p. 15). This broad definition embraces fields of investigation as diverse as radio astronomy and forensic medicine. In the environmental sciences, remote sensing is understood as "the acquisition, recording, processing and classification of data obtained through the use of electromagnetic radiation sensors" (Carter, 1986 p. 15). While remote sensing, in present-day popular imagination, is often equated with space-borne measurements of the Earth's atmosphere, land and water surfaces; it is worth noting that electromagnetic sensors may be fixed or mobile ground-based systems; or the sensors may be accommodated in aircraft, helicopters, rockets, spacecraft, or orbiting Earth satellites.

Hyatt (1988) traces the development of remote sensing back 2,300 years ago to Aristotle's experiment with a 'camera obscura'. However, within the bounds of photographic images from the air, the first aerial photograph was reportedly taken in 1859. It was an image taken from a balloon over the village of Petit Bicetre near Paris, France, ostensibly for mapping purposes (Hyatt, 1988). A substantial number of scholars and observers generally divide the development of contemporary remote sensing into two areas of interest -- pre-1960 and post-1960. Prior to 1960 aerial photography was the only
operational imaging system, which itself developed in conjunction with advances made in photographic film, camera, and platform technology.

The next real strides taken in remote sensing after 1960 are generally attributed to experiences gained from reconnaissance activities during the First and Second World Wars and the increased demand for military intelligence during the Cold War that followed the end of the Second World War. The main advances in remote sensing after World War II include the following:

- the ability to observe in wavelengths beyond the visible regions of the spectrum;
- the ability to observe from platforms located at increasingly higher altitudes, and
- the ability to observe increasingly larger areas of the earth's surface. Today, the whole earth can be observed by a single remote sensing system.

Prior to the refinement of the airplane, for example, a variety of platforms had been used, ranging from balloons and kites to a 70 grams camera strapped to a pigeon's chest (Hyatt, 1988). Chapter Two provides a more detailed discussion of the development of remote sensing from early views of the technology as primarily an intelligence gathering tool for the military to the transfer of the technology to the civilian sector in the 1970s and the development of multiple applications for remote sensing data.

Contemporary remote sensing, i.e., using electromagnetic sensors to detect objects, is possible because of scientific observations
that, at any temperature above absolute zero (-273 degrees centigrade), all objects emit electromagnetic energy. All objects also absorb and reflect a certain amount of impinging energy as a function of their composition and surface conditions. For any object to be remotely measured or detected, it must meet at least two of the following three criteria:

1) It must have a distinguishable size, shape, texture or pattern.
2) It must emit, reflect or absorb energy in amounts different from its background in one or more portions of the energy (electromagnetic) spectrum.
3) It must change its appearance, configuration or location with time.

The manner in which an object reacts in each of these three parameters (bands) constitutes its "characteristic signature". The detection and identification of any particular target, then, becomes a direct function of the degree to which this signature can be reliably resolved and accurately measured by electromagnetic sensors. The technical parameters of remote sensing are described in greater detail in Chapter Two.

Note that, although these sensors can be mounted on a variety of platforms, (balloons, planes, etc.), the principal advantage of sensing from satellites in outer space, rotating around the Earth about every 90 minutes, is their ability to collect data rapidly over very large areas. A typical remote sensing satellite is able to provide complete coverage of the earth in just about three weeks. The data acquired by these satellites is transmitted to various ground receiving stations around the world where it is processed by a variety of specialists, using
powerful computers. The various applications for remote sensing data are discussed in detail in Chapter Two.

Until the early 1970s, remote sensing from outer space was used primarily by the US and Soviet governments for gathering military intelligence. Widespread international concerns about the technology and its applications developed when the US announced at the UN, in 1969, that it was transferring the technology to the public sector (UN COPUOS, 1969; 1970a). Since then the number of actual and potential applications of remote sensing data has continued to increase, so too have international concerns for the socio-economic impacts of the technology.

The following two reasons are often stated as justification for the need for international policy guidelines:

1) Remote sensing is an activity that extends beyond national territorial borders, hence, as in the case of commerce at sea and in the airspace over national territories, consistency, if not absolute uniformity in rules, is desirable with the "extraterritorial (or extraterrestrial) extension of domestic law" (DeSaussure, 1989).

2) All nations are affected by remote sensing activities either as operators of remote sensing satellites, users of the various data derived from the activity, or they are subjects of remote sensing activity, hence, there is need for an international regime.

Although the question of an international regime for remote sensing activities has been under consideration at the United Nations since the early 1970s, the primary concern that precluded agreement revolved around two inter-related issues:
1) The right to "sense", i.e. gather data about the world, and
2) The right to disseminate these data to third parties freely.

Stated another way, the UN debate revolved around the following two questions:
1) Should any individual, entity, or state have the right to obtain data about other nations?
2) Under what conditions, if any, should data about any nation and its territory be disseminated to third parties?

The United States launched the first civilian remote sensing satellite, Earth Resources Technology Satellite (ERTS-1) in 1972. In 1986, after about 15 years of debate, a set of UN principles embodying guidelines on remote sensing was approved. However, a number of observers have criticized these principles for not addressing the key issues adequately and for providing too little guidance toward stabilizing the international situation. They charge that the UN guidelines are so vague that each state is essentially free to establish and implement its own remote sensing policies; uniform regulation is not mandated (Ambrosetti, 1980, 1984; Biondo, 1985; Christol, 1980, 1984, 1988; DeSaussure, 1989; Greensburg, 1983; Lazarus, 1983; Magdelenat, 1981; Meyers, 1984; Morgan, 1982; Mossinghoff & Fuqua, 1980; Szasz, 1986).

The launch of ERTS-1 in 1972 initiated various proposals for an international regime. However, three trends that began developing in the mid-1980s have contributed to a major qualitative change in the policy making process at the UN. These three factors are:
1) The drafting and implementation of various, and sometimes conflicting, domestic policies by a steadily increasing list of nations involved in remote sensing. Various domestic policies and practices are discussed in Chapter Five. Major remote sensing programs are discussed in Chapter Two.

2) A shift occurred in the global market for remote sensing data from the small group of users, mostly government agencies, that comprised the remote sensing market in the 1970s, to a broader market, increasingly dominated by users with commercial interests and an increasingly wider range of activities that include surveillance, law enforcement, and international newsgathering, to name but a few. The remote sensing market is analyzed, in detail, in Chapter Five.

3) Advances in remote sensing technology is the third factor that has contributed to the qualitative change in the policymaking process at the UN. The most significant change in remote sensing technology since 1972 is a result of marketplace demands for increased "resolution", which refers to the ability to discern or identify objects of smaller and smaller sizes, various shapes, textures, and other characteristics that are important to specific groups of users.

This study assumes that UN actions and/or inactions on remote sensing can be understood by relating UN activities to these three factors, outside the control of the UN: domestic policies, marketplace development, and technical developments. UN actions on remote sensing are discussed in detail in Chapter Four. Events outside the
UN, i.e. the above mentioned three factors, are discussed in Chapter Five. UN actions and events outside the UN are assumed to be intrinsically intertwined. This study aims to demonstrate the utility of this approach for understanding remote sensing and international communication policy issues in general.

It is usually acknowledged that current developments in communication/information technology are generating a wide range of policy problems of increasing importance and difficulty. Scholars such as Robinson (1987, 1990) and DeSaussure (1989) agree that the issues raised by these developments are being transferred from the national to the international level. Robinson (1987) attributes this trend to the increasing flow of data among nations, partly as a result of increasing international integration of industries and industrial operations, thus, the transfer of domestic communication/information policy problems to the international arena.

Communication policy scholars generally acknowledge that despite an increase in the ability of humans to gather information, propelled partially by advances in new communication/information technologies, there appears to be an ever increasing gap between the information that is available for ready use and its use by some of those in need of it. Indeed, Schiller (1983), in answer to the question whether new communication/information technologies can provide a restoration of the general systemic growth and stability approximating the situation in the two decades after World War II observes that the international information revolution is proceeding much like the industrial revolution - the burdens unequally shared, the profits
unequally divided. Dizard (1989) cautions that, given the momentum with which we appear to be moving into the "information age", it is important that we understand the converging technological, economic, and political forces that are propelling us into this new era so as to develop appropriate strategies for managing these changes.

On a broader and more abstract level, the process of drafting an international regime on remote sensing satellites has to do with sovereign states, with significant political, economic, cultural, social, etc. differences among them, who, nonetheless, find it necessary to seek cooperation on issues of mutual concern. Consequently, a careful analysis of the issues on remote sensing could provide a framework that would be useful in determining the possibilities of success for any international regime. Thus, a broader and more challenging question would be something like: Under what conditions is an international regime likely to succeed? The specific phenomenon being discussed would not necessarily be remote sensing. It could be some of the emerging issues such as the current negotiations on trade in services or international concerns about the environment.
Research Questions

This study addresses the following questions:

1). How can UN actions and/or inactions on remote sensing be understood by relating UN activities to developments outside the control of the UN?

2). How has the nature of remote sensing technology, the development of an international market for remote sensing products, and various domestic approaches to remote sensing shaped UN attempts to implement international guidelines?

3). How effective is the UN as a forum for communication policy issues?

4). Is remote sensing a technology that requires global agreements (as opposed to bilateral or multilateral agreements) to implement a meaningful policy?

5). How is remote sensing similar or different from other communication technologies?

6). To what extent is remote sensing just another communication technology or to what extent does it raise some unique issues?

7). How important are remote sensing issues in broadening our understanding of other communication issues?

8). How do fundamental concepts such as free flow of information and sovereignty interact in remote sensing?

9). What is the balance of rights between sensing and sensed nations?

10). Are global agreements on remote sensing issues possible?
Sources of Information.

Data for this study were collected primarily from three sources:

1) Documents - United Nations documents and scholarly journals.

2) Interviews - with UN delegates of nine nations (representing different views), COPUOS staff, and designated spokespeople of eight remote sensing satellite operators and/or data processors from different countries.


Documents and Records: A complete record of the UN remote sensing debate, from the early 1970s to the present, exists at the United Nations library in New York. A list of UN documents that are repeatedly cited in scholarly articles on remote sensing was drawn up. This list was extended when a complete record of the documents was studied at the UN library in New York from June 4-15, 1990. Particular attention was paid to verbatim records of the annual sessions of COPUOS.

While documents such as annual summaries of COPUOS submitted to the UN General Assembly, as well as scholarly analyses of the remote sensing debate in a variety of journals, were all important sources of data for this study; COPUOS' verbatim records were of special significance for several reasons. First, they represent an accurate and up-to-date record of the remote sensing policymaking process as it has unfolded at COPUOS over the years. Second, the documents represent a steady source of information, both in the sense that they accurately reflect what occurred at COPUOS in the past, and
can thus be analyzed and reanalyzed without undergoing changes in the interim. Third, the verbatim records are a contextually rich source of information in that they appear in the natural language of that setting. Finally, these documents, especially the verbatim records, represent formal statements that satisfy accountability requirements.

In the United States, remote sensing has been the subject of intense congressional debates, especially since the early 1980s when the US government proposed the transfer of its remote sensing system to the private sector. Very often, remote sensing specialists and other representatives from different countries have been invited to give their views on the subject before various Congressional committees. Records of these hearings were also sought and included as data for this study.

**Interviews:** UN delegates, representing the 53 nations that are COPUOS members, meet once a year for about two weeks to discuss issues that are on the committee's agenda. (In 1990 they met from June 4 through June 15 at UN headquarters in New York.) Members of each delegation are appointed by their individual home governments. COPUOS does not have criteria regarding issues such as who may or may not be a member of a delegation or how many people may be on each delegation. Consequently, the various delegations are made up of individuals with various backgrounds and specialties such as lawyers, space experts, politicians, administrators, etc., in their respective countries. The common denominator is that they are
presumed competent by their individual governments to represent them in the discussion of outer space affairs. Further, some countries are represented at COPUOS by as many as five or more individuals while others have just one individual.

Although COPUOS meets only once a year the Outer Space Affairs Division is at the UN headquarters, with a permanent staff of about 10 people who handle the day-to-day affairs of the committee, i.e., coordinating correspondence between delegations, setting agendas, preparing reports, etc.

A preliminary review of UN literature identified the delegates that have been very active in advancing various proposals for an international remote sensing regime. Personal correspondence with the staff at the Outer Space Affairs Division has confirmed that the policy proposals of six delegations, identified in the literature, were representative of the different and conflicting views expressed in COPUOS over the years. Three more delegations were identified as having played significant roles in the policy making process.

In early 1990, the following nine delegations were contacted with requests that they indicate the most appropriate individual(s) that would be available for an interview during the annual meeting of COPUOS, June 4-15, 1990, at the UN headquarters in New York: the United States, the Soviet Union, France, Chile, India, China, Austria, Sweden, and Germany. All nine delegations provided the name of a delegate that would be available for an interview.

Similar arrangements were made to interview officials of the two leading (commercial) remote sensing operators, the US Earth
Observation Satellite Company (EOSAT) in Landham, Maryland and France's SPOT Image Corporation (Satellite Pour l'Observation de la Terre) in Reston, Virginia. SPOT's world headquarters is located in Toulouse, France. Unlike the case of the US and France, where remote sensing is a commercial venture carried out by the private sector, note that a majority of the world's remote sensing operators and/or data processors are owned and operated by national governments. Thus, some of the nine COPUOS delegates interviewed spoke both as representatives of their governments at COPUOS and in the capacity of remote sensing operators in their respective countries. Government owned and operated remote sensing programs include those of India, China, Germany, and Sweden. Appendix A is a list of all subjects interviewed and their affiliations. All interviews were recorded on audio cassettes with the consent of each subject, and later transcribed.

Interview questions were drawn mainly from issues raised in UN literature and from scholarly journals. The questions sought to clarify and/or provide answers to remote sensing issues that have been raised but for which there appears to be no clear answers. Appendix B is a list of the interview questions. The interviews were structured but the questions were open-ended, enabling the interviewer to define the situation, while at the same time encouraging each respondent to structure the account of the situation and introduce his or her own notions of what he or she regards as relevant. The purpose of the interviews was to determine:
- how the policy positions of key players in remote sensing have changed or remain unchanged over the years,
- the principal cause(s) of these changes,
- whether there is a link between these changes and the introduction of competition and privatization into the remote sensing market,
- whether changes in remote sensing technology have affected changes in policy and markets, and
- current views about the UN remote sensing principles that were adopted in 1986.

Observation Notes: Arrangements were made through the Outer Space Affairs Division at the UN to observe the proceedings of COPUOS' annual meeting from June 4-15, 1990 in person. The thinking was that observing the proceedings of the committee would enhance the researcher's ability to grasp the motives, beliefs, concerns, and interests of participants, which would be helpful in analyzing the other data.

In summary, copies of the documents obtained at the UN, together with other scholarly literature, transcripts of the interviews with remote sensing industry representatives and policymakers at the UN, and observational notes from the committee meeting comprise the principal data sources for this study. Chapter Two is a descriptive analysis of the development or remote sensing technology from its origin as an intelligence gathering tool for the military to its transfer
to the civilian sector and, subsequently, the trend toward privatization and commercialization.
CHAPTER II
DEVELOPMENT OF REMOTE SENSING TECHNOLOGY

Remote Sensing and the Military

In August 1990, Iraqi troops invaded and occupied Kuwait. Following several diplomatic efforts to solve the crisis, a coalition of 28 nations, led by the US, initiated a war with Iraq in January 1991 -- in accordance with a UN Resolution issued in 1990. "Operation Desert Shield", as US officials named it was a brief and extremely violent war. The Iraqi Army surrendered one month later (February 1991) after suffering devastating losses of troops and equipment as a result of severe bombing raids and missile attacks. Because of the accuracy with which US bombs and missiles hit their Iraqi targets, the media called them "smart bombs". What most television viewers do not know is that those missiles were "smart" in part because remote sensing satellites provided data that was used to pre-program the missiles to hit specific targets inside Iraq.

The literature on military intelligence is vast. A comprehensive review of the literature on the development of the techniques and tools of military reconnaissance is beyond the scope of this study. However, remote sensing from outer space developed primarily as a tool for gathering military intelligence. This chapter reviews the development and significance of remote sensing technology in military
activities as a point of entry toward a better understanding of the concern and hope that various national delegations at COPUOS continue to express about civilian remote sensing.

Most scholars who study developments in military reconnaissance techniques agree that spying, i.e. using the view from a high ground to gain an edge over an enemy, has been practiced throughout history (see for example, Burrows, 1986; Oberg, 1988; Pebbles, 1987; Turner, 1985). During the Civil War, in the United States, the Union Army tested balloons and cameras for aerial reconnaissance, but as the narrator of a television program on military reconnaissance put it, "dodging Confederate bullets (aloft in a balloon, with a camera) made for blurred photography" (NOVA, 1987). Thus, there was a clear understanding that the "sensed nation" had a right to shoot down the balloon of the sensing organization. As shall be discussed later in this chapter, the same principles applied later to sensing from aircraft.

However, with satellites, there appears to be reason to think that a sensed nation may not have the right to destroy another organization's satellite. Why? What has changed? To what extent does the "you-may-shoot-it-down-if-you-can" thinking still apply? In using balloon observation as a historic model it is worth noting that in models even older than balloons -- people observing from high hills or the tops of trees -- the sensed nation did not have the right to shoot the sensor as long as the hill/tree was outside the territory of the sensed nation.
All of the above highlight the fundamental space issue involved: who controls space over a country? At what point does space come under international control rather than national control? One of the difficulties faced by nations which want to restrict sensing is -- as discussed in detail in Chapter Four -- that they may have to argue that space itself (at least at the altitudes used for space orbits) should be under national control. Attempts to deal with these difficulties include an ongoing debate to distinguish between "air space", which is considered to be under national control, and "outer space", which is under international control. The debate on issues over "air space" and "outer space" are discussed in Chapter Seven. However, even if both air space and outer space were to come under national control, current space technology may make it impossible to exercise that control. For example, assuming international agreements permitted shooting down civilian satellites, in the case of remote sensing, the only countries with the technology to destroy satellites are themselves involved in remote sensing. Further, it is technologically impossible to steer a satellite's orbit around the borders of a country that does not wish to be sensed. Turning off the sensors over countries that do not wish to be sensed would be a technical challenge to implement and a practical impossibility to enforce. Thus, while most countries cannot possible exert national control over the space that extends above their territories, the ability to control this space, as Branscomb (1986) puts it, "might lead to greater wealth if space explorers are able to mine the resources of planets light years away" (p. 10).
It is important to note that there is a distinction between military intelligence -- a practice that appears to be acceptable, except when military activities become public -- and commercial intelligence, which is the subject of the debate on remote sensing at the UN. Even balloons have not been just military. Balloons have also provided (and still do) "entertainment" for their passengers who wish to view cities from higher altitudes. There have been commercial prints published of "balloon views" of many major cities. In this sense, balloon sensing has been commercial as well. But remote sensing from space today provides far more than pictures of cities. The products and market of today's remote sensing industry are discussed in Chapter Five.

The need for getting above the battlefield was substantially greater during the trench warfare of World War I. However, the balloon was an easy target, especially for another invention in the sky, the airplane. Although it later became famous for aerial dogfights, the first mission of the airplane was reconnaissance. Many war planes carried bulky, heavy cameras that were sometimes held by hand, but the results were worth the effort. According to scholars such as Barnaby (1986), Beschloss (1986), Peebles (1987), to name but a few, military planners in the United States called for more and more photos and by the war's end millions of images were available. But it was not until the outbreak of World War II that aerial reconnaissance came to the forefront of the US military. Military scholars in the US generally acknowledge that the US was woefully lacking in the reconnaissance techniques, when they got involved in the Second World War. The US military knew little about aerial reconnaissance
techniques and technologies of that time. They learned it all from the British Royal Air Force.

During the battle for the skies of Great Britain in 1940, British pilots were badly outnumbered by their German counterparts. But the British had a new weapon, then considered a technological breakthrough: radar, an electronic means of gathering intelligence that revealed the precise location of incoming German planes. The British also had forewarning of many of Hitler's war plans, thanks to other machines that were able to decipher German military command messages. United States code breakers proved as resourceful in the Pacific by painstakingly building a copy of a Japanese decoder that they had never even seen.

Some military historians consider the Japanese attack of Pearl Harbor in December 1941, as one of America's greatest intelligence failures. They believe that American leaders had intelligence warnings of a possible Japanese attack somewhere in the Pacific, but that they failed to warn military leaders in the Pacific.

World War II ended with the atomic bomb, however, intelligence played a decisive role in some of the battles and the military became increasingly interested in intelligence gathering technologies. But as the war ended, relations between former allies grew cold. The Soviet Union was soon perceived in the US as the new enemy. The US knew little about military events in the Soviet Union and the Soviets knew little of the US.

According to author and national security analyst, Richelson (1987), at the end of World War II, the United States military,
knowing little about military events within the Soviet Union, wanted
two types of information:
1) Information about military facilities inside the Soviet Union
(targeting information).
2) Early warning information (the ability to detect Soviet military
moves that indicate an attack on Europe or the United States).

Since the Soviet Union was shrouded in secrecy, obtaining
information became a major effort of the newly created Central
Intelligence Agency (CIA). When US reconnaissance missions over the
Sea of Japan brought back air samples containing evidence that the
Soviets had exploded their first atomic bomb, until then a US
monopoly, the CIA was in a rush for information. For example, when
one of the CIA's first employees, a World War II aerial photographer,
was hired and asked to create files of industrial installations within the
Soviet Union, he feared that he was going to be parachuted into the
Soviet Union to gather information for his files. However, the CIA
wanted him to supervise America's expanding photo interpretation
efforts. Using a combination of millions of photos that had been seized
from the Germans, who had flown reconnaissance missions over the
Soviet Union, and new photographs of the Soviet Union that were
being taken by slow moving planes of World War II vintage, the CIA
began to compile various files of America's new enemy (NOVA, 1987).

The shift from sensing in balloons to high-flying aircraft raised
some new issues. These planes flew at higher speeds than balloons,
making it difficult to track them and find out what they were sensing
or shoot them down as easily as balloons. Further, because of their
speeds and the distances they could cover, they were able to sense relatively larger territories than was possible with balloons. However, the US and the Soviet governments had the option of shooting down each other's military reconnaissance planes. Civilian remote sensing from space, for commercial purposes, clearly presents more complex communication and policy issues than aerial photography for military intelligence. Most nations, especially those without the technology, are not even capable of knowing when their territories are being sensed or what is being sensed within them.

All through the 1950s the US used its World War II planes to fly reconnaissance missions along Soviet borders, while the planes would try to get away before they could be shot down. Occasionally, some planes were shot down, making big headlines. However, the major Soviet industries that the CIA was looking for were not along Soviet borders, but located inside Soviet territory. If the CIA's intelligence gathering program was to succeed, the agency had to find a way to go deep inside Soviet territory. It is generally assumed that the Soviets were making similar attempts to gather military intelligence about the United States.

Desperate for information, the CIA resorted to the use of balloons, a technique used during the America Civil War. Balloons were set aloft to drift across the Soviet Union, randomly taking pictures along the way. Most were shot down or lost, and the few that were recovered brought meager results.

In the Summer of 1953, US military intelligence suggested that the Soviets had exploded their first hydrogen bomb. In July 1955,
worried about the possibility of a thermonuclear war, President Dwight Eisenhower proposed "open skies" to Soviet Premier Nikita Khrushchev. This proposal called for the US and the Soviet Union to exchange blueprints of their military facilities and to allow each to inspect the armaments of the other from the air. According to Yost (1985), "some felt Open Skies was a remarkable step toward peace, while others suspected it was just an American ploy to get better targeting information. Khrushchev dismissed Open Skies out of hand, calling it 'nothing more than a bald espionage plot' " (p. 26).

Eisenhower's motives for suggesting Open Skies, are still a matter of speculation. But when Khrushchev, in 1961, supposedly called for a halt to on-site inspection of nuclear tests, between the United States and the Soviet Union, saying that satellites could now assume that function; when three years later he supposedly told visiting US senators in Moscow that he (Khrushchev) could show them photos of US military bases taken from outer space; and finally, when in 1963, the Soviets stopped calling for an end to American satellite reconnaissance, some scholars suggest that this indicated that a de facto Open Skies relationship between the two super powers was in effect (Yost, 1985). But the route to Open Skies was not an easy one. The technology upon which such a relationship depended was still in the process of development.

In the United States, the spy machine that was to take the pictures upon which Open Skies depended was being built. Tucked away in a remote corner of the Lockheed Aircraft company factory, a new reconnaissance aircraft, called the U-2, was being built. Part jet
and part glider, it was like no other aircraft. Beschloss (1986) suggests that, since World War II, the need for intelligence has been enormously important in creating new forms of technology. He cites the U-2 as an example. While it was thought that you could not get a plane to fly above 70,000 feet in the 1950s, Beschloss (1986) states that it was believed that it would take ten years or more to develop and build such a plane, if it was ever possible.

In 1956, less than one year after the go-ahead had been given to build the U-2, the aircraft was shattering altitude and distance records. Its payload was a massive camera with a specially designed telescopic lens. New thinner film allowed for many more pictures to be taken over a single flight than had been possible during World War II and the U-2's pictures were clearer. Some military observers believe that the U-2 was capable of mapping the entire land mass of the United States in less than a dozen flights.

On July 4, 1956, the U-2 took off on its first attempt to penetrate the Soviet Union - a daring flight over Moscow and Leningrad. When Allen Dulles, CIA director 1953-61, was told that the U-2 had taken off and its very first mission was over two of the largest cities, and presumably the most sensitive locations in the Soviet Union, Dulles replied, "My God. Do you think that's wise, for the first time?" (Yost, 1985, p. 27). He was told that the first mission was almost certainly the safest flight. But there was much more for the CIA to worry about.

The first U-2 mission into Soviet territory revealed that Soviet radar technology was more advanced than had been anticipated.
Although the U-2 flew at altitudes beyond the range of Soviet surface-to-air missiles, contrary to the American belief that Soviet radar was not able to pick up the U-2's presence, the Soviets had tracked the U-2 as it flew over their territory. According to Yost (1985) the Soviets were furious but made no public statement, "possibly fearing embarrassment (if) it was revealed that (they had tracked the plane) but could do nothing to stop it" (p. 27).

According to Yost (1985), by the early 1960s the U-2 was providing more than 90% of US intelligence on the Soviet Union. For example, the U-2 did not find evidence of an operational force of intercontinental nuclear missiles in the Soviet Union, as some in the Eisenhower administration had feared. Armed with this knowledge, President Eisenhower was able to face Americans who feared alleged US military inferiority against the Soviets and were urging the administration to spend wildly on defense. On the other hand, the Soviets had much to fear from the overflights of the U-2s. Besides unmasking Khrushchev's boasts, the U-2s were also providing the US Airforce with targeting information, in the event of war.

On May 1, 1960, two weeks before a Paris Summit Conference where Eisenhower and Khrushchev were scheduled to discuss ways to prevent an arms race, the first U-2 went down in Soviet territory. Whether the plane was shot down by the Soviets or crashed is still disputed. What is undisputed is that the White House, assuming that the U-2 pilot, Francis Gary Powers, could not have survived a crash (or shoot down), announced that the National Aeronautics and Space Administration (NASA), had lost a "high altitude research plane".
However, Khrushchev put, first, the wreckage of the U-2 and later the pilot, very much alive, on display in Moscow. At a news conference that followed, he charged America with deliberate aggression and threatened to attack any allied bases from which U-2 jets flew over Russia. Powers' flight had taken off from Peshawar in northern Pakistan and was scheduled to pass over three possible Soviet missile sites and land some 4,000 miles later in Bodo, Norway.

Political disaster followed at the Paris Summit. Khrushchev demanded a public apology from Eisenhower. Eisenhower refused. The summit collapsed. Although the information provided by the U-2 missions had helped Eisenhower to assess the extent of alleged Soviet missile build-up, as well as to resist pressure for increased military spending, critics now blamed the U-2 incident for spoiling the first hope for international arms control (Barnaby, 1986; Beschloss, 1986; Oberg, 1988; Peebles, 1987; Richelson, 1987, Yost, 1985).

According to Peebles (1987) although the U-2 program had proved its worth by showing just how much could be learned from aerial photos, "...what the U-2 had not provided was critical. It had not shown how many ICBMs (intercontinental ballistic missiles) the Soviets had. To settle this question, the US would have to go into space" (p. 40).

But the desire to know if and/or how many ICBMs the Soviets possessed may not have been the only reason that propelled the US into space. On October 4, 1957, the Soviet Union launched Sputnik, generally acknowledged as the world's first satellite. Khrushchev
allegedly boasted that Russia would soon have a guided missile, capable of delivering a hydrogen bomb, anywhere in the world (NOVA, 1987).

According to Peebles (1987) "for the past 40 years, much of US military thought and planning has been dominated by the events of one Saturday morning - the destruction of the US Pacific fleet at Pearl Harbor" (p. 305). Supposedly in response to the perceived Soviet threat, the US began work on the Ballistic Missile Early Warning System (BMEWS), a collection of radar stations designed to detect incoming Soviet missiles after launch. But BMEWS could only detect missiles after launch and would give the US only about a 15 minute warning. However, if a satellite, equipped with an infrared detector, could be put into orbit, it would pick up the infrared energy given off by the very hot exhaust gases of a rocket, as it climbs into space, and radio a warning to the ground. According to Peebles (1987), a major advantage of a satellite warning system over radar is that the satellite would double the warning time to 30 minutes. Furthermore, satellite aerial coverage, compared to ground-based radar, is enormous. Thus began a series of early warning satellite programs in the United States.

Although most military analysts admit that the history of the development of similar warning systems in the Soviet Union is obscure, they generally attribute the development of Soviet satellite warning systems to a professed fear of a Western attack. For instance, Peebles (1987) states that:

Like the US, the Soviet Union was also the victim of a surprise attack in World War II. Circumstances, however, were different. ... Stalin ignored repeated warning, even one from a German deserter who gave the date and exact time of the attack. From their experiences ... the Soviets
have come to place great emphasis on surprise and initiative (p. 325).

Since the Soviets would have known about various US early warning satellite programs from a variety of sources, for example, from US press reports in the 1950s, it is believed that the Soviets built their own equivalent of BMEWS in the early 1960s.

Capra (1986) compiled a list and description of satellites so far launched into Earth's orbit by various nations or international consortiums, such as Intelsat. He described his encyclopedia as "the first attempt at describing, on an international basis, all types of unmanned satellites sent into orbit around the Earth since October 4, 1957" (p. 7).

In describing the development of military satellites, Capra (1986) notes how the military establishments of spacefaring nations, particularly the US and the Soviet Union, often launch satellites whose destinations remain undefined, how the use of satellites for civilian and military purposes is often unclear, and how the term "research satellite" is loosely used to describe satellites intended for genuine scientific research but indirectly associated with defense needs. Thus, it is generally acknowledged that most of the more advanced space technology that is available today was tested and initially used in the military field and subsequently transferred to the civilian sector. Public knowledge of the capabilities of these "spy satellites", as they are often called, is limited by the fact that political as well as military leaders generally refuse to acknowledge the existence of these satellites, let alone discuss their capabilities.
President Jimmy Carter was presumably the first US leader to confirm officially the existence of spy satellites when he announced to the public that reconnaissance satellites have become an important stabilizing factor in world affairs, in monitoring arms control agreements. However, to construe President Carter's statement as a violation of an official code of silence about spy satellites may be misleading. This public admission may have been intended to assure the American public that the second Strategic Arms Limitation Treaty (SALT II) that he was about to sign with the Soviets in 1978 was verifiable. SALT I, signed in 1972, states in part that "... each party shall use national technical means of verification at its disposal" to verify the treaty (Yost, 1985, p. 153).

If the US Senate was to ratify SALT II, this meant that the Senate must be convinced that the US had the technical means to confirm that the Soviets were abiding by the terms of the agreement. Although the treaty was never ratified, it was generally observed by both sides; but controversy over verification and the suspicion that one side may cheat continued. Ironically, the US and the Soviet Union both agree that reconnaissance satellites can provide only hard technical data. What satellites cannot do is tell you the intentions of your enemy. But the United States and the Soviet Union are not the only nations that are interested in spy satellites.

According to Yost (1985) "France, long a nuclear power, has made noises to the effect that it might like to have its own reconnaissance capability" (p. 155). China has been launching its own spy satellites since 1975. The UN proposed an International Satellite
Monitoring Agency, but the superpowers, apparently guarding their virtual monopoly in that arena, have not considered the proposal seriously.

In the United States, there has been a great deal of discussion concerning the secrecy that surrounds spying from space. Historically, US government officials argued that the true capabilities of American spy satellites were of great interest to the Soviets, thus US national security would be severely compromised if the Soviets were to gain access to this information. On the other hand, those who criticized this point of view argued that if the veil of secrecy on reconnaissance satellites were raised, there could be significant public benefits. For example, the satellites could be used for scientific research on natural resources. Perhaps partially in response to this criticism, the US, in the early 1970s, proposed a gradual transfer of some of this technology from the military to the civilian sector, igniting the UN debate that is the focus of this study.

The preceding review of the uses of remote sensing for gathering military intelligence reveals several inconsistencies in how nations deal with the threat (or promises) of military intelligence versus how they deal with commercial intelligence. It is apparently acceptable for the military to shoot down satellites and other intelligence gathering apparatus that are perceived to pose a military threat. On the other hand, it is apparently unacceptable to shoot down satellites used for gathering commercial intelligence, even though it has been demonstrated that the lack of commercial intelligence could
place less well-informed parties at a serious disadvantage in trade negotiations, for example.

Branscomb (1986) and Lazarus (1983) suggest that the potential of remote sensing data must be viewed in the broad context of the importance of information for negotiations between transnational corporations and countries, especially developing countries. Since remote sensing satellites are increasingly used for the prospecting and exploration of mineral resources, as well as the management of agricultural resources and intervention in agricultural commodity markets, differential access to information and differential ability to utilize it constitutes important elements of bargaining power. Stated another way, if transnational corporations have better reconnaissance data than developing countries, they (corporations) are in a better position to bargain more knowledgeably for resource exploration and project-development privileges.

The development of remote sensing in the military also suggests that asymmetries in military intelligence gathering capabilities are unacceptable. For example, President Eisenhower's proposal for an "open skies" policy in 1955 was initially rejected by the Soviets as an espionage plot. It was not until 1961 that Khrushchev agreed to a halt to on-site inspection of nuclear tests. Presumably, Soviet spy satellites could now perform the same reconnaissance functions that US satellites were capable of performing.

In announcing the intention to transfer the US remote sensing program to the public sector in 1969, President Nixon again included the provision for "open skies" and "non-discriminatory" distribution of
data (UN COPUOS 1969, 1970a). However, benefiting from remote sensing activity involves more than the ability to capture data transmitted from space. Equal access to remote sensing data does not necessarily include equal ability to utilize it. An insufficient capacity to interpret and make use of data still puts the concerned party at a considerable disadvantage.

It is apparent that remote sensing issues raised by use of the technology by civilians will not be as easy to resolve as between competing military establishments. After all, the use of violence to resolve issues has historically been a monopoly reserved for the state. Nonetheless, the intense UN debate on civilian remote sensing activities make the significance of commercial intelligence apparent.

The Advent of Civilian Remote Sensing

The preceding section described the military origins of remote sensing technology as it is known today. It is worth noting that military observers generally agree that the capabilities of civilian remote sensing satellites are inferior to those of military satellites. When the technology was transferred to the public sector it was now referred to as "Earth Observation", not "reconnaissance" technology. According to Capra (1986), transfer of the technology to the public sector was prompted in part by the recognition that a detailed survey of land and sea, from altitudes far higher than was possible from any aircraft, afforded a more global view and could furnish valuable information helpful for economic purposes.
This section presents a brief precis of civilian spaceborne remote sensing systems that have been launched since the early 1970s. Chapter five presents a detailed description and analysis of those remote sensing systems whose operations have played a significant role in the evolution of an international remote sensing market, the drafting and implementation of various domestic remote sensing policy guidelines, change in remote sensing technology, and, of course, the various policy proposals at COPUOS.

**USA (LANDSAT 1-5):** Around 1968, after seeing the dramatic views of countries, continents, and oceans taken from high altitude aircraft, Gemini and Apollo spacecraft and the weather satellites, scientists at NASA began formulating new applications and uses of the potential imagery that these space missions provided. These uses included agriculture, mapping, and geological exploration. A group of scientists at NASA urged and eventually convinced the US Government to fund the development of the first Earth Resources Technology Satellite or ERTS-1 (Williams, 1989).

Thus, with the launch of ERTS-1 in 1972, global remote sensing was initiated. ERTS-1 was renamed Landsat-1, upon the launch of Landsat-2 in 1975. Three Landsats were subsequently launched, the last, Landsat-5, in 1984. Only Landsats 4 and 5 are currently functioning.

NASA operated the Landsat system, as an experimental system, until 1979. In 1979, an executive order declared that Landsat was operational and transferred it from NASA to the National Oceanic and
Atmospheric Administration (NOAA), a component of the Department of Commerce (Williams & Mroczynski, 1989).

According to Williams and Mroczynski (1989) "NOAA was selected as an operator because it was already in charge of operating the US meteorological satellite programs, and because, unlike NASA, it has a mandate of service and was empowered to recover costs" (p. 17). Besides operational control, the executive order also gave NOAA a mandate to develop a phased approach to commercialization of the Landsat program.

The first clear policy statement regarding the commercialization of Landsat was made by the administration of President Jimmy Carter in 1979. The administration of President Reagan decided early in its tenure to accelerate the process of transferring Landsat to the private sector. In March 1983, President Reagan announced his intent to commercialize Landsat and Metsat (the weather satellites) to the private sector. However, Congress responded by including a provision in the NASA authorization for fiscal year 1984 stating that the administration could not transfer Landsat or Metsat to the private sector without prior approval from the US Congress (US Congress, 1984).

Early in 1983, serious questions about the wisdom of the proposal to sell Landsat prompted the US Congress to conduct several investigations of the possible ramifications abroad of such an action. There was concern that the goals that would be pursued by a private, commercial operator may be incompatible with US foreign policy goals. For example, some in Congress considered the government's
policy of making Landsat data available to everyone on an equal basis as a key ingredient in maintaining the "open skies" policy which allowed US spacecraft to circle the globe without restriction. They feared that commercial operations could lead to discriminatory data distribution policies which could adversely affect US relations with other countries as well as future operations of a government or privately owned Landsat system. The hearings resulted in several recommendations including the continuation of the non-discriminatory data distribution policy, regardless of Landsat's ownership (US Congress, 1984).

Transfer of the Landsat program from the public to the private sector was completed in 1984. The Earth Observation Satellite Company (EOSAT) was awarded a 10-year contract, in September 1985, to commercialize the Landsat program. EOSAT is a joint venture of Hughes Aircraft Company and the General Electric Company, Inc. The contract requires EOSAT to develop the next generation of spacecraft, sensors, and ground processing facilities, and to market Landsat data products (US Congress, 1984). While the US was finalizing arrangements to embark on commercialization, other countries were making commitments to conduct their own remote sensing activities.

France (SPOT 1-2): SPOT is the acronym for Satellite Pour l'Observation de la Terre, originally, Systeme Probatoire d'Observation de la Terre. Like EOSAT, SPOT is co-owned by several private companies who distributes data from the French remote sensing program in over 40 countries, commercially.
According to Harr and Kohli (1990), "France bases its space program on a policy of cooperation. In commercial utilization the French government will act as the pacesetter to demonstrate the potential of space for commercial applications" (p. 38). France's Ministries of Industry and Research and of Industrial Reconstruction and Foreign Trade are responsible for French space programs.

The Centre National d'Etudes Spatiales (CNES), the equivalent of America's NASA, is the national agency that manages most of the French space program. The mandate of CNES excludes the agency from the marketing of civilian space products and the opening of new markets. The marketing of space products is conducted by SPOT Image (Pisani, 1990).

The SPOT remote sensing program was initiated in 1977 by the French government, in cooperation with the government of Belgium and the Swedish Space Corporation. As of 1990, Belgium and Sweden, together, own about 10% shares in the SPOT program. CNES is the largest shareholder with 39% shares while the rest of the shares belong to various French institutions (Harr and Kohli, 1990). In 1982, SPOT Image S.A. was formed in Toulouse, France, for worldwide marketing of SPOT data. One year later, SPOT Image Corporation was formed to market SPOT data in North America. Its headquarters and processing facility is currently located in Reston, Virginia (USA). SPOT's international headquarters is in Toulouse, France (Pisani, 1990).

The first French remote sensing satellite, SPOT-1, was launched on February 21, 1986. On May 1, 1986, just ten days after it was
launched, while it was still undergoing in-orbit testing, the general public was introduced to remote sensing when SPOT-1 acquired imagery of a burning nuclear power plant in Chernobyl, over Soviet territory, following a melt-down that had occurred a few days earlier. These images were used throughout the world by the news media to cover the event, apparently embarrassing Soviet officials who, until then, had maintained secrecy about the extent of the damage and the danger of radiation to neighboring countries.

Like EOSAT, SPOT too is still dependent on government subsidies for its continued presence in space. The French government is responsible for research, construction, and launching of new remote sensing satellites. SPOT's primary responsibility is to market the data gathered by these satellites. SPOT-2 was launched in January 1990.

Today, SPOT and EOSAT are generally acknowledged to be the leading suppliers of commercially available remote sensing data. An in-depth analysis of the remote sensing industry is presented in Chapter Five, with emphasis on the activities of EOSAT and SPOT.

**USSR (SOYUZKARTA):** The Soviet Union operates a range of remote sensing satellites as part of its Cosmos series. However, since the remote sensing industry of the Soviet Union is government-controlled and little is known of Soviet launches, it is difficult to say whether the Soviets actually have a civilian remote sensing program. Soyuzkarta is the agency, responsible for marketing Soviet satellite
imagery. The imagery is obtained from a Soviet government organization called Piroda.

In 1989, William Broad supposedly obtained a Soyuzkarta catalog that listed all images of the US that were available for sale to the public. When he plotted the corresponding areas onto a map of the US, it revealed that most of Soyuzkarta's imagery of the US was of sensitive US military installations. Thus, he concluded that the images were old images that had been made by Soviet spy satellites (Broad, 1989a).

Although a much more detailed description of advances in remote sensing technology is presented in Chapter Five, several aspects of Soviet satellites are worth noting. First, according to Hyatt (1988), most of the remote sensing satellites launched by the Soviet Union still use photographic sensors to obtain Earth resources data, thus, the sensed data from the Soviet Union has only been made available as photographic images. On the other hand, the remote sensing satellites of the US and France, for example, have onboard digital processing capabilities and their data is transmitted by radio waves to ground receiving stations and can be made available to the public as computer compatible tapes. The distinction between fixed photographic images and computer compatible tapes (CCTs) is important. Photographic images are just that, fixed images of any specified location on Earth, while a single CCT of the same location can be computer-manipulated to reveal a variety of specific data about the same territory. It is widely believed that Soyuzkarta's
photographic, as opposed to digital, format will have a limited impact on the emerging international market for satellite data.

Second, while the satellites launched by the US and France remain in space and are able to function for years -- Landsat-5, for example, has been in orbit since 1984 -- Soviet satellites are said to have particularly short life spans. Earlier models remained in orbit for as little as two weeks then jettisoned their film pods, for mid-air or seaborne retrieval, before burning up upon re-entering the atmosphere. But the limited life spans of Soviet satellites should not imply a limited Soviet presence in space. To keep up with the need for satellite imagery, the Soviet Union launches up to 100 satellites each year (Hyatt, 1988).

According to Piskulin (1989), a Soyuzkarta official, Soviet efforts in remote sensing have been directed largely toward providing assistance to socialist and developing countries, offering an extensive list of products and services, as well as training personnel. Observers in the West generally acknowledge the superior resolution of Soviet imagery that, so far, appears to be unmatched by other remote sensing systems.

Currently, the shortcomings of the Soviet remote sensing program appear to be that its images are only available as photographic plates (as opposed to computer compatible tapes) and the lack of an effective marketing/distribution network. The superior quality of Soviet imagery is generally acknowledged by the industry. If Soyuzkarta began producing computer compatible tapes and developed
effective marketing strategies, it can be assumed that the agency would become as commercially competitive as EOSAT or SPOT.

India (IRS): The Indian Remote Sensing Satellite (IRS) was designed and developed by the Indian Space Research Organization (ISRO). IRS was put into orbit in March 1988 by the Soviet launcher Vostok.

According to Chandrasekhar (1990, 1989), scientific secretary at the ISRO, the primary purpose of the IRS is to provide India with its own remote sensing capability. The data obtained is used domestically for the survey and management of India's natural resources.

India has a ground station and facilities to process satellite imagery in Hyderabad. The station receives both IRS and Landsat data. Landsat data is received for an annual fee of $600,000. The National Remote Sensing Agency (NRSA) is responsible for the reception, processing, and dissemination of all IRS data. The data is distributed to government agencies directly from NRSA. As part of sharing its experiences and capabilities in space with other nations, India makes IRS data available to countries falling within the coverage zone of its ground station. Additionally, because IRS is a non-commercial venture, the prices for its data are not intended to recoup the cost of production. According to Chandrasekhar (1990) India's policy is to bill each ministry only for the cost of processing data requested by the ministry. In other words, the cost of launching, operating the satellite, and data reception are not included in their data prices.
Japan (MOS): Japan's Marine Observation Satellite (MOS), geared towards oceanographic observation, was launched in May 1987. The National Space Development Agency (NSDA) of Japan is responsible for the Japanese remote sensing industry. In addition to data from MOS-1, Japan also receives and distributes both Landsat and SPOT data. Annual ground receiving station fees are paid for the reception of Landsat and SPOT data.

According to Maruo (1989) of the Remote Sensing Technology Center (RESTEC) of Japan, RESTEC was established as a non-profit foundation. Guided by the NSDA, the objective of RESTEC is "to promote environmental protection, social economy and national welfare through the development and dissemination of remote sensing technology for the monitoring of global resources and environmental phenomena" (p. 395). The functions of RESTEC include research and development of remote sensing technology, acquisition, processing, and dissemination of data, training of remote sensing personnel, and seeking international cooperation in advancing remote sensing technology.

Like India, remote sensing activities in Japan do not appear to be geared toward commercialization.

Other Remote Sensing Programs: The remote sensing programs described so far are those of the five countries that currently own and operate satellites, but there are a number of countries that are at different stages of planning or actually building their own satellites.
A number of European countries are carrying out a substantial number of their space activities within projects administered by the European Space Agency (ESA). The ESA was formed about 14 years ago as a multinational space agency to integrate individual European space programs and for multinational management of large projects. However, labor is divided such that a single country, under ESA management, takes the lead in a specific project (Harr and Kohli, 1990).

The ESA has developed a remote sensing program for scientific research and applications. The ESA currently receives, processes, and distributes data from other satellites, through a ground receiving station in Fucino, Italy, under the auspices of the Earthnet Program. There are plans to launch a European Remote Sensing satellite in the near future.

Although Sweden owns only about 5% of SPOT shares, Swedish interest and competence in space activities appear to be very high. According to Silja Stromberg of the Swedish National Space Broad (SNSB), decisive factors for Swedish investment in remote sensing and space activities in general, include awareness of the fact that space technology has a crucial and permanent role to play in areas such as basic scientific research, communications, the inventory of natural resources, peace surveillance (arms control verification and surveillance of crisis areas), to name but a few; as well as the need for increased industrial competence and competitiveness (Stromberg, 1990).
The SNSB, under the Ministry of Industry, is the central government agency responsible for space activities in Sweden including all aspects of remote sensing. A ground receiving station in the town of Kiruna, north of the Arctic circle, is able to receive data from SPOT, Landsat, and Japan's MOS-1. The Swedish corporation, SATIMAGE, has been responsible for image processing, distribution, and related research and training, since 1984.

Brazil plans to launch its own satellite in the next few years, as does Canada. But a country does not necessarily need to launch satellites to have a remote sensing program.

Shortly after the launch of Landsat-1, the US encouraged and assisted several countries to build their own ground receiving stations. As of May 1990, about 17 earth receiving stations, located in various countries, receive Landsat data. About 13 stations receive SPOT data. However, this does not mean that there are 30 receiving stations. Appendix D is a list of receiving stations with Landsat and/or SPOT receiving capabilities as well as stations under construction or negotiation. Appendix C is a map of EOSAT receiving stations as of 1990. With a few exceptions, the same stations are listed as SPOT receiving stations (see Appendix D). The general practice has been to encourage countries to make the necessary technical changes to enable their stations to receive data from both Landsat and SPOT satellites. The receiving stations pay a fixed annual fee to EOSAT. The arrangements with SPOT are a bit more complicated than a fixed annual fee since SPOT claims property rights to all products derived
from its data. Ground station receiving fees are discussed in detail in Chapter Five.

Thus, without necessarily owning or operating remote sensing satellites, some countries, with ground receiving stations, have established remote sensing programs that serve their needs adequately. China, for example, has maintained a very active presence in remote sensing since 1986. Landsat data is received in the Miyun County of Beijing and processed 100km away in the city of Haidian. Like India, China views remote sensing more as a tool for national development and less as a commercial venture, and is willing to cooperate and provide assistance to interested countries (Lizhong, 1990).

Germany also has a very strong interest in remote sensing. Its interests in the technology mirror those of Sweden. However, while Germany is willing to cooperate with other countries and provide assistance to developing countries, the Germans appear to be skeptical about the definition of a "developing country". For instance, Marietta Benko of the Institute of Air and Space Law in Cologne believes that India, for example, possesses more advanced remote sensing capabilities than Germany. Consequently, if need be, it should be Germany that should seek assistance from India and not vice versa (Benko, 1990). Put another way, Germany appears to prefer a more context specific definition of developing countries which in turn should determine what assistance a country seeks and/or is provided. The demands of developing countries at the UN are discussed in detail in Chapter Four.
While a number of countries plan to build their own satellites in the next few years, some simply build receiving stations and make the necessary technical and financial arrangements with satellite operators to receive and process their own data.

It is worth noting that some remote sensing operators such as SPOT and EOSAT maintain archives of data about virtually all regions of the world. This is possible because their satellites are equipped with on-board recorders. However, ground receiving stations in foreign countries are only able to receive data from territories within their own immediate surroundings. SPOT ground stations can receive data from a radius of about 2,500 miles or less. India's satellite does not have an on-board recorder, thus, even though their satellite may fly over the United States, for example, the satellite cannot transmit data about the US back to the ground receiving station in India. The circles surrounding individual receiving stations in Appendix C indicate the surrounding region whose data is downloaded to that particular station. For example, while data about Australia, China, Brazil, etc. is available from the EOSAT-owned Goddard Space Flight Center in Maryland (USA), to obtain data beyond their receiving footprint, the stations in Australia, Brazil, China, etc. must order it from EOSAT headquarters or SPOT.

In summary, less than two decades after the US launched the first civilian remote sensing satellite, there has been a proliferation of remote sensing activities around the world. The trend towards privatization and commercialization, introduced by the US in the mid 1980s was quickly countered by France. Today, EOSAT and SPOT are
the leading commercial suppliers of remote sensing data. However, a majority of countries currently involved in different stages in remote sensing intend to continue to provide data on a non-profit basis.

In a general sense, the political philosophies that have guided the development of remote sensing are similar to the development of broadcasting. Like broadcasting, remote sensing's ability to ignore national boundaries makes it essentially an international medium. The amount and kind of controls that nations impose on their remote sensing systems mirrors three political orientations that have guided the development of broadcasting: permissive, paternalistic, and authoritarian orientations. Just as is the case with broadcasting, the development of remote sensing appears to be influenced by each country's economics, history, geography, etc., but always with political overtones.

According to Head and Sterling (1990) broadcasting, operating within the permissive framework of the free enterprise economic system "... displays the qualities of pragmatism, materialism, expansionism, and aggressive competitiveness" (p. 489). The remote sensing programs of the US and France appear to be guided by the permissive philosophy. In the case of broadcasting, while American commercialism, for example, has achieved more lively, popular, and slickly broadcast services, critics charge that extreme permissiveness "... pays attention almost exclusively to what people want rather than what (some) think they need" (Head and Sterling, 1990, p. 489).

The paternalistic orientation, often equated with broadcasting in countries such as Britain, Canada, Australia, and Japan -- where it is
felt that broadcasting should play a positive role in the preservation and enhancement of national cultures — attempts to insulate broadcasting from direct and total dependence on either political or commercial interests. In the case of remote sensing, the dependence of the Landsat and SPOT programs on government subsidies as well as sale of data may appear to be efforts to achieve such a balance, but there is ample evidence that both programs would like to be completely free of the dependence on government subsidies. At this moment the paternalistic orientation seems to apply more appropriately to the remote sensing programs of countries such as India, Sweden, Germany, and China. According to Head and Sterling (1990) the US-inspired deregulatory theory that swept the telecommunications world in the 1980s threatened the very existence of traditional paternalistic broadcast models and led to greater tolerance for commercialism. It may be too early to say whether the remote sensing programs of India, Sweden, and Germany will follow the same route but it is worth noting that none of them is opposed to the idea of selling satellite data to support their programs.

The third orientation is the authoritarian approach. In this case, the state itself finances and operates its broadcasting system, along with other telecommunication services, using broadcasting to implement government policy. The Soviet Union (along with many developing countries) is often held up as a leading exemplar of this approach. According to Head and Sterling (1990), since the authoritarian orientation stresses the importance of the media in mass political education, programs are chosen and production techniques
used with little regard for popular taste. In the case of remote sensing in the Soviet Union, it is important to remember that Soyuzkarta was created to market Soviet satellite data, commercially. As opposed to Soviet broadcast programs that, from a production standpoint, are considered stiff and constrained -- compared with American programs -- the resolution of Soviet data is far superior than that of any civilian program. Consequently, it can be said that Soyuzkarta's success as a commercial venture will depend more on political decisions within the Soviet government and less on the quality of its data (assuming a transition is made from photographic images to computer-readable data).

None of the three orientations just described exists anywhere in pure form. The common problem that all three orientations face is the lack of a balance between competition interests. Head and Sterling (1990) describe the shortcomings of all three orientations as follows:

[With broadcasting] commercially motivated programmers imitate success, avoid controversy, concentrate on audience segments with the most buying power, and aim at the lowest common denominator of audience tastes. Authoritarian motives alone cannot succeed because they run counter to the inherently democratic nature of broadcasting -- a medium that relies on uncoerced audience participation, in terms if both time and money. Paternalistic motives alone tend toward bureaucratic complacency, preference for the status quo, and contempt for popular tastes. (p. 493)

The same complaints and/or praises that have been voiced about the different broadcast orientations are mirrored in the debates about remote sensing. After about 75 years of broadcasting, "pluralism" -- a
mix of commercialism and public-service -- is being talked about as an orientation that offers the best chance of optimal development of broadcasting while minimizing the less desirable effects. In the case of remote sensing, different groups of nations participating in the policy making process at the UN appear to be convinced that their proposals are the best, thus, what orientation remote sensing as whole will take is unclear.

A few years after the debate on remote sensing was first introduced at the UN, most nations that were opposed to the idea of civilian remote sensing were apparently willing to live with the idea that data about their territories were being collected and distributed by other nations. This was apparently the case, because the US, the only nation operating a civilian remote sensing program until 1986, had insisted on a policy of non-discriminatory access to data. However, the trend toward privatization and commercialization, initiated by the transfer of the Landsat program to a private company in 1984, has apparently raised new concerns.

Many developing countries view remote sensing (information, in general) as a "public good" and a tool for national development. In industrialized countries, information is increasingly seen as a "commodity" (that must be sold) to enhance national economic growth. Consequently, commercialization threatens the concept of "non-discriminatory access" to data that appears to have been a key factor in determining acceptance of civilian remote sensing activity by the international community. This is because the primary providers of satellite data see the data as a commodity and there is a real incentive
to restrict the availability of data to all users while making it available to users who can pay the highest prices. Ironically, current revenues from the sale of data are not enough to cover the total cost of operating a remote sensing system on a commercial basis.

The development of the remote sensing industry and the trend toward commercialization and privatization are discussed in detail in Chapter Five. The different national views that emerged at the UN on the subject of civilian remote sensing and their evolution into a set of international principles are discussed in Chapter Four. Chapter Six is a detailed analysis of the UN principles with attention to difficulties that both remote sensing operators and users of satellite data may have in interpreting these principles into less abstract rules to guide their daily practices.
Scholarly Views on Communication Technologies and Society

As demonstrated in Chapter One, remote sensing is important in human communication because it provides various types of information that are useful in a wide variety of applications, i.e., it is a multi-purpose technology. Most communication technologies are single-purpose technologies in that the information that flows through them is destined for a single and often predetermined purpose. For example, any specific broadcast program provided by DBS across national boundaries can be identified as intended for a specific purpose such as entertainment, information (news), sports, etc. However, remote sensing data on any specific part of the Earth is computer-manipulable and, depending on the specific request of the user, can provide an array of information that is useful for numerous unrelated tasks. In essence, remote sensing is comparable to a photographer in space, equipped with a camera that is able to take pictures of various objects beyond what is immediately visible to the human eye.

This distinction is important because technology-based comparisons, as opposed to looking at the content of what goes through the hardware, may lead the casual observer to mistakenly
compare remote sensing to DBS, for example, because both are in space. Consequently, Branscomb (1986), for example, appropriately sees more similarities between communication policy issues raised by remote sensing and those raised by flow of computerized data across national boundaries. However, very few contemporary communication scholars write about remote sensing.

Currently, the scholarly literature on remote sensing is concentrated in two areas: engineering and legal journals. Perhaps because remote sensing technology is still evolving, engineering journals contain complex technical articles that describe research progressing in scientific laboratories. The legal issues raised by remote sensing's many applications have also proven to be fertile ground for legal scholars. However, a number of communication scholars, interested in the effects of communication/information technologies upon society, increasingly mention remote sensing in their literature. Generally, the trend is to mention, briefly, remote sensing issues in the context of discussions about issues raised by the increasing flow of data across national boundaries.

Garnham (1985) points out that "...when considering the debate on the impact of new communication technologies and the appropriate policy responses to them, we find ourselves faced with two polarized views, one the mirror image of the other" (p. 66). What Garnham seems to be referring to is the tendency of some scholars to adopt one of two positions.

On one side are scholars, such as Hamelink (1983), Mosco (1982), and Schiller (1981, 1984, 1985), who are critical of the
introduction of new technologies. They suggest that new communication technologies have "... generally widened the existing gaps, mainly through the privatization, concentration, and exploitation of information resources by transnational corporations". Further, they argue that "... the developing world is well advised to pursue a strategy of dissociation [from industrialized countries], national self-sufficiency, and collective self-reliance." (Tehranian, 1989, p. 215).

In the case of remote sensing and the international community, as a whole, they see the potential benefits of the technology accruing primarily to one segment of society - developed countries. Thus, they question the view of remote sensing as a technology that will benefit all nations.

On the other hand, some scholars such as Toffler (1970, 1980) and (Naisbitt (1982) see new communication technologies as representing the dawn of a second Industrial Revolution, i.e. "Technologies of Freedom", as Pool (1983) calls them. According to these scholars, the second Industrial Revolution is "... characterized by the application of information technologies to production, distribution, and consumption process, thereby transforming the old industrial social and economic structures, eliminating the need for routine and repetitive jobs, providing greater opportunities for leisure and cultural creativity, and breaking down sociocultural differences and inequalities" (Tehranian, 1989, p. 213). This group of scholars recommend encouraging the proliferation of communication technologies, preferably, with little or no interference of policy guidelines. Further, they urge the developing world, which missed out
on the first Industrial Revolution, to embrace these technologies and use them to bridge the gap between them and more technologically advanced nations.

Note that this second group of scholars do not reject the idea that the benefits and burdens of technological change have unequal impacts on different segments of society. Their assumption is that it is difficult to determine the impact of these changes, hence, the preferred option is to let new technologies develop and deal with whatever social problems they create, later. However, both views may be only partially true.

Slack (1985) suggests that when these extreme points of view are adopted the result is usually that the technology in question is allowed to develop with little or no regard to its impact on society. Hence, by the time policy makers begin considering appropriate responses, the said technology's impact on society is already a fait accompli, thus, there may be little that can be done by way of policy to correct the deficiencies of the marketplace.

There is a third, and perhaps larger, group of scholars who do not approach these technologies as all good or all bad, instead they recognize that the same technology often has different effects on different social groups. For instance, Branscomb (1986) discusses remote sensing in the context of "global networks of transborder data flow" and points out, not only the potential benefits to developing and developed countries, but also the strengths and weaknesses of the policy proposals of both groups of countries. While the views of scholars like Schiller and Pool cannot be ignored, scholars such as
Branscomb acknowledge the need for policy intervention long before the potentials of a technology are fully exploited, at which time it may be too late to do anything for the group(s) of people in society that are disadvantaged by the technology. According to Parker (1973a, 1973b), the sooner researchers study each new information technology, the greater the chances that research results will be used to influence policy in a meaningful way.

The different scholarly approaches on communication/information technologies and their effects on society are helpful in understanding remote sensing for two reasons. First, the different scholarly approaches provide a framework that is useful not only in analyzing the remote sensing debate at the UN, but also to illuminate the broader issues of communication policy formation. Secondly, the different scholarly approaches, in a real sense, mirror the contradictory remote sensing policy proposals advanced by various nations at COPUOS.

Evolution of the Concept of Sovereignty

The United Nations Charter was drawn up by the representatives of fifty countries at the United Nations Conference on International Organization, which met in San Francisco from April 25 to June 26, 1945. The UN officially came into existence on October 24, 1945 when the Charter had been ratified by China, France, the USSR, the United Kingdom and the United States, and by a majority of other signatories. Perceptions of the appropriate role of the UN in living up to its stated purposes and principles apparently revolved around
concerns for national sovereignty. The purposes and principles of the UN state in part that the organization is based on the sovereign equality of all its member states. However, the issues which are relevant for conceptualizing sovereignty are not static.

It would appear that the greatest threat to a nation's sovereignty at the end of World War II was the threat of a military invasion. During the war such threats came, for example, from military ships, anchored about 15 miles off-shore, but still capable of launching attacks inland. In the air, planes flying a few thousand feet overhead were considered potential threats to national sovereignty because of bombing raids experienced during the war. Consequently, UN guidelines on sovereignty considered it a violation of sovereign rights for foreign ships to sail towards a nation's coasts, within a certain distance, without permission from the host nation. Similarly, aviation guidelines also required planes to seek permission from host nations before flying into their airspace.

However, while the issues relevant for conceptualizing sovereignty were relevant at that time, the difficulties faced today appear to be a result of the fact that the concept of sovereignty has been held static, despite rapid technological changes. For example, in the military arena, the fact that an increasing number of nations are now able to launch missiles at each other from hundreds, even thousands, of miles, renders the 15 mile ocean limit obsolete as a definition of what constitutes violation of sovereign rights.

According to Nordenstreng and Schiller (1979), "... while new flags and frontiers have proliferated (since 1945), less visible but
powerful forces have been trespassing over national boundaries on an unprecedented scale" (p. ix). Furthermore, this new form of boarder-crossing has been organized primarily by the business system, not the military, relying more on investment flows than armed forces to achieve its ends. Thus, one of the issues raised by remote sensing is whether the technology has rendered traditional concepts of sovereignty obsolete. Another way to view the issue is whether remote sensing simply allows us to understand sovereignty better.

Even a casual review of the records of the UN debate on remote sensing suggests that whatever avowed principles or analytic formulas are used, the debates reflect the drive to preserve independence and protect national interests. According to Powell (1985), UN debates on communication policy issues often reflect an urge to translate domestic policy into international standards.

In reviewing the verbatim records of the UN debates on remote sensing, one notices that participants in the policy making process, particularly developing countries, have emphasized the sovereignty of their countries as justification for their policy proposals. Yet year after year, they have gathered at COPUOS, apparently willing to bargain away some of their sovereign rights in exchange for international cooperation. Given the apparent significance of sovereignty in international cooperation, it is useful to seek some understanding of just what sovereignty is, or at least what the concept signifies. The key to determining when international cooperation is possible may partially lie in our understanding of sovereignty.
The meaning of sovereignty has been debated for centuries and there appears to be no consensus on what it means. The meaning of sovereignty appears to be forever changing. Klein (1974) attributes the introduction of the words 'sovereign equality' into the UN Charter to Latin American diplomats whose fancies were caught by the term at inter-American and early international conferences. The term was subsequently picked up by US Department of State officials and, through their efforts, it was introduced into the UN Charter.

In today's world of superpowers, Klein (1974) sums up his view of the concept as follows:

The concept of sovereign equality lies at the core of man's failure to devise a more trustworthy political system. It reflects a distorted view of sovereign entities engaged in international relations. Like you and me, whatever entities call themselves 'nation-states' are projected as persons possessing a unified will capable of being expressed and acted upon. From this anthropomorphic tendency to regard them as persons of flesh and bone, and to transfer to national conduct political and moral principles associated with the conduct of individual liberal democrats (p. 166).

According to Nordenstreng and Schiller (1979), the concept of nation and the related problems of national sovereignty originated in the Western hemisphere, where it was conceived as comprising primarily the domestic issues of the 'established' European-North American world. However, as an increasing number of colonies negotiated or fought and gained their political freedom, the industrialized world's concept of sovereignty has been gradually replaced by a more global appreciation of other peoples and different socio-economic systems. Nordenstreng and Schiller suggest that "... this new appreciation
arises not from voluntary Western reappraisals, but from the continuing struggle for social change by disadvantaged peoples around the world" (p. 3).

Klein (1974) suggests that we can only talk of sovereign entities, great and small, who, nonetheless, enjoy equal weight, if it is possible to imagine each state made up of a community of people so closely bound by common ties and single-minded purpose that, on any issue, their voices will unfailingly represent the united will of the entire population.

It is safe to assume that the type of community that Klein is talking about does not exist today. Obviously, the author is concerned about the super-power structure of the 1970s and the threat of war. Even if it were up to the total population of each nation-state to determine what was in their interest, obviously there would be some who think, for example, that nuclear weapons are a deterrent to war just as others would hold the opposite view.

Political scientists generally agree that the word 'sovereignty' originated in France and was raised to the dignity of the fundamental idea of public or constitutional law by French philosopher and political writer, Jean Bodin (1529-1596). Since Bodin's time the concept has exercised great influence on the entire development of the constitutions of modern states as well as on politics.

According to Bluntschli (1899), sovereignty was used during the Middle Ages in a wider sense to define every board or authority that was considered competent to give a final decision such that an appeal to a higher authority was not possible. Such a board was called a
sovereign board. Thus, there were a great number of sovereign offices and corporations within the state. With the passage of time, the name ceased to be given to mere offices and positions in different branches of the administration, and it was finally given only to the highest power in the state. Hence, the idea of sovereignty came to signify the concentrated fullness of the power of the state.

In the sixteenth century, as French kings struggled for absolute power, sovereignty was controlled completely by the centralizing tendency of French politics. According to Miller (1987), Bodin had defined sovereignty as "the untrammeled and undivided power to make general laws. Without such a power a state cannot properly exist and it is the locus of this supreme legislative power which determines whether the state acquires a monarchial, aristocratic, or democratic character" (p. 43).

Besides Bodin, the writers that are generally considered the most important writers on the subject of sovereignty since the Renaissance include: English jurist and legal philosopher, John Austin (1790-1859); English philosopher, Thomas Hobbes (1588-1679), and Swiss-born writer and philosopher, Jean-Jacques Rousseau (1712-1778).

Miller (1987) states that despite the vast literature on the subject of sovereignty, three questions are asked consistently:
- what is the nature of political rule?
- who (in any system) does rule?, and
- who ought to rule?
These writers differ over these questions. However, they are consistent on the nature or attributes of sovereign rule in that they argue for a concentration of absolute power at a given center. For instance, Hobbes allowed that a group, as well as an individual may be sovereign, though some political scientists argue that he really preferred a monarchical government to a democratic one. Austin was more alive to the viability of collective sovereigns, while Rousseau argued for a democratic sovereign. But like the others, Rousseau argued that sovereign power must be absolute, total, unlimited and indivisible.

The theory of sovereignty proposed by these thinkers may be explained, at least partially, by some understanding of the conditions of the time. According to Ionescu (1974), Hobbes, for example, was writing under the immediate impact of a civil war. For Hobbes, war was the worst evil. He believed that disorder in one place would lead to further involvement elsewhere. Thus, his purpose was to achieve cohesion, order and stability. He saw a monarchical government, to be a genuine guarantee of peace and unity.

By the late 1800s, sovereignty was being viewed differently, Bluntschli (1989) states:

The modern representative state knows nothing of absolute political power; and absolute independence does not exist anywhere on earth. Neither political freedom, nor the rights of other organs and component parts of the state are compatible with such unlimited sovereignty and whenever men have sought to exercise it, history has condemned such usurpation. The state itself, as a whole, does not possess such omnipotence, for even the state is limited externally by the right of other states, and
internally by its own nature, by the rights of its members, and those of the individuals within the state (p. 763).

Thus the idea of sovereignty representing an all-powerful state was challenged at least a century ago. More recently, scholars have generally acknowledged that the status of sovereignty implies the recognition that a sovereign state is not subordinate to any other state, and should be accorded equality of treatment with other sovereign states, irrespective of its power. However, the capacity of a state to exercise these rights raises many different issues.

Drawing from observed trends and political practices in the twentieth century, Walker and Mendlovitz (1990) advance the following claim about sovereignty today:

The claim that profound structural transformations are undermining the principle of state sovereignty has been advanced by many analysts from quite different theoretical traditions. No longer ... can states pretend to be autonomous or to exercise a monopoly on the legitimate uses of violence in a specific territory. The most important forces that affect people's lives are global in scale and consequence. Even the most powerful states recognize serious global constraints on their capacity to affirm their own national interest above all else. In view of the capacities for nuclear destruction, the global mobility of capital, and a new awareness of the fragility of the planetary ecology, the organization of political life within a fragmented system of states appears to be increasingly inconsistent with emerging realities (p. 1).

In its definition of 'sovereignty', Black's Law Dictionary (1979) includes the phrase, "the international independence of a state, combined with the right and power of regulating its internal affairs without foreign dictation". The definition goes on to note that "the necessary existence of the state and that right and power which follow is sovereignty" (p. 1252).
Powell (1985) suggests that according to this definition, sovereignty, can be expressed as having three traits, any one of which may be pre-eminent depending upon the circumstances. The first trait highlights a nation's capacity to act independently, free of outside forces. The second involves international recognition of the legal right that grants equality to all nations to act independently without outside interference or intervention. The third involves the actual performance of an act internally, free of outside influence.

In the first case, a nation may be sovereign chiefly because it possess the power (military, economic, etc.) to act independently. In the second instance, other nations would act to abide by the legal definitions of sovereignty because of reciprocal recognition in the international community. In the last instance, a nation would take internal, independent action which it perceived to be the right of sovereignty.

Even if we assume that the preceding definitions of sovereignty and Powell's analysis are adequate and generally acceptable, there are occasions when it is difficult to determine whether or not specific actions by states are in accordance with this definition. For example, what happens when a state acts internally because it has the power to do so but does not have the approval of other states, even though they presumably espouse the same principle of sovereign equality?

The preceding discussion suggests that sovereignty is a recognized right in the world community. There appears to be general agreement that the concept refers to the right of a state to act internally, free of external forces. However, the critical issues revolve
around questions regarding how sovereignty will be recognized and under what circumstances. According to Powell (1985) "while the narrowest interpretation of the concept of sovereignty might include only the right of a nation to protect its borders from military aggression, the broadest interpretation recognizes a state's right to control the physical, economic, social and information environment within those borders" (p. 143-144).

While it may be relatively easy to convince the international community that the navy vessels of X nation, anchored off the shores of Y nation, threaten the sovereignty of Y nation, it will be relatively difficult to make the same argument about remote sensing satellites and other forms of communication across national borders. This is true because the issues raised by transborder communication often involve value judgements. Furthermore, challenges to transborder communication on the basis of sovereign rights, are often countered with other international agreements such as guidelines on "freedom of information" and "free flow in information".

In the case of value judgements, take, for example, some of the questions that Pool (1983) asks about direct broadcasting by satellite. Do the sovereign rights of South Africa include the right to protect itself from foreign broadcasts against apartheid? Should Soviet Jews be able to listen to Israeli radio broadcasts? Should Saudi Arabians be subjected to Christian missionary broadcasts? Should advertisers be able to promote their products in foreign countries?

Few people would answer all these questions in the same way. Obviously different people will answer these questions in different
ways for different times and places. Whatever one's position, the fact is that transborder communication often involves social, economic, political, and other forms of international intrusion. Besides conflicting value judgements, international information law contains rules that challenge the formulation of international communication policy on the basis of sovereign rights alone. According to Ploman (1982), there is no generally recognized or agreed category known as "information law" in international law. "This expression is used to cover diverse subject matters. Often it designates rules concerning freedom of information and media regulation but in other cases the same concept refers to computerized information systems and transborder data flows" (p. 125).

According to Ploman (1982) information law in its traditional formulation is mainly associated with human rights and comprises both freedom of information and free flow of information. The distinction between these two concepts is to some extent arbitrary since they are often seen as not only overlapping but inseparable. However, this distinction has provided for the traditional division of work between the UN and UNESCO. The UN under the heading of 'freedom of information' has mainly dealt with the politico-juridical aspects while UNESCO's mandate has been related to practical measures to promote the flow of information.

Freedom of information in the modern context appears to have its origin in the UN Universal Declaration of Human Rights of 1948. Following the adoption of the general standards laid down in the Universal Declaration of Human Rights, work proceeded in the UN
context on more specific agreements concerning freedom of information. In 1948 the UN convened a conference on freedom of information in Geneva which drafted proposals for three conventions:

- on freedom of information,
- on access to information and its transmission from country to country and
- on the international right of correction.

After further discussion in the Economic and Social Council (ECOSOC) and other UN organs, agreement could be reached in the UN General Assembly only on the right of correction (Ploman, 1982, pp. 125-138). It is worth noting that these agreements were drafted with the intention of applying them to the process of gathering and disseminating news by the media. Freedom of information implies the right to gather, transmit, and publish news without fetters. However, it also includes the obligation to seek facts without prejudice and to spread knowledge without malicious intent. The right of correction was conceived as a means for states directly affected by a report, which they consider false or distorted, the possibility of securing commensurate publicity for their corrections.

An international convention on the right of correction was opened for signature in 1952. Adhesion was slow and the convention did not enter into force until 1962 and has so far been ratified by only a few countries. A convention on Freedom of Information has for a long time been the subject of debate within different organs of the UN. However, only the preamble and a few articles have been adopted by the General Assembly (Ploman, 1982).
International guidelines on freedom of information are clearly related to those concerning the free flow of information. International agreements concerning the flow of information mainly seem to be of two kinds:
- agreements designed to further specific kinds of exchanges such as artistic exhibitions, official documents, literary publications, etc.
- agreements designed to prohibit the circulation of certain materials. For example, an agreement for the suppression of the circulation of obscene publications was originally signed in Paris in 1910 and later amended and signed in New York in 1949 (Ploman, 1982, p. 143).

Whether arguments on free flow focus on sovereignty or cultural imperialism, non-intervention or ideological differences, signals spillover or prior consent, the basic issues ultimately rest upon fundamental differences over what constitutes acceptable information and how or whether such information should be controlled. In recent years the traditional concept of free flow of information has been questioned particularly by the developing countries which have proposed new approaches such as the 'free and balanced' flow or the 'free and equitable' flow of information.

The preceding discussion suggests that "sovereignty" is a concept that, with the passage of time and inevitable change, is increasingly complex to define. With regard to telecommunication, modern technology has enlarged communication policy issues to global proportions. The overlapping dimensions of sovereignty, be they
military, political, technological, economic, etc., make it difficult to
differentiate clearly which are more or most important. This is
especially true since international agreements so often combine these
elements in a single set of rules or guidelines. Furthermore,
distinctions are blurred when nations willingly share or modify these
sovereign dimensions for mutual advantage.

According to Powell (1985), one acceptable commonality of
principle -- one reason for sharing or giving up sovereignty -- may be
found in the concept of "common heritage". Whether the focus in UN
deliberations on the law of the sea, the use of outer space, the
environment, etc. the concept of "common heritage" appears to have
gained wide acceptance and found a place in international law. Article
I of the Outer Space Treaty of 1967, for example, states that
exploration and use of outer space "... shall be the province of all
mankind". Thus,

Although the right of sovereignty has been reaffirmed as
"common to all nations, it continues to be limited to the
degree that each is willing to recognize and share that
right under the pressures of politics, technology, and
economics. It appears that in the exploration and use of
space, nations have had to reassess the role of sovereignty.
In the instances of international space agreements, the
concept of sovereignty has been expanded into a broader
and more unifying principle which identifies all humanity
at once by the term "mankind". When this occurs, be it
only a phrase or sentence, national sovereignty is
momentarily overshadowed by the sovereignty of mankind
(Powell, 1985, p. 233).

Despite the fact that remote sensing, indeed, the use of outer
space, appears to have been accepted as a resource of common
heritage, several questions remain. Has the international community
truly accepted the expressed principle of sharing as part of the privilege to use space? Is it possible for any single power or technology to make all mankind adopt the same outlook? Or, can people learn to accommodate each other?

By reaching out into space to conduct remote sensing -- the legal definition of space remains illusive -- an activity that has significant implications on human activities, nations have forged another link and another powerful reason for seeking accommodation among all fellow humans. To resolve the resulting conflict peacefully, which appears to be the expressed desire of all nations, will require that nations learn to trust each other in ways never before experienced. The alternative is to embark on ventures similar to the arms race between superpowers. In the case of remote sensing, when a majority of competing nations have similar remote sensing capabilities, agreements similar to the occasional arms limitation treaties between superpowers may be easier to implement than the current remote sensing guidelines. In this case, national sovereignty will appear to be dependent more on a nation's capability to assert its rights than the general recognition of a set of components that embody the concept.

Granted, remote sensing and other communication technologies, such as direct broadcast satellites, have rendered traditional concepts of sovereignty obsolete. It is clear that national sovereignty is more than freedom from foreign military aggression. The tendency to hold the concept of sovereignty static, despite rapid
technological changes, makes it difficult to resolve issues that present themselves in new and unexpected forms.

According to Edward Ploman, the debates generated by these issues often resemble "... a dialogue of the deaf or a series of disconnected monologues, without the parties in the debate really listening to what others have been saying" (Nordenstreng and Schiller, 1979, p. 155). When parties holding different views do not genuinely state their attitudes and opinions with respect to the issues they are faced with, the tendency to accuse each other of having ulterior motives -- even bad intentions -- should come as no surprise.

**International Regime Theory**

Regime theory is a body of literature in International Relations that seeks to explain how and why states collaborate. This literature provides a fruitful framework for an answer to the broader question raised by this study, namely, given the often professed sovereignty of states, under what condition is international cooperation in remote sensing possible? Put another way, why and when are states most likely to give up some of their sovereign rights in exchange of international cooperation?

Imber (1989), analyzes the selective withdrawal decisions of the United States from specialized international agencies such as the International Labor Organization (ILO), the United Nations Educational, Scientific, and Cultural Organization (UNESCO), and the International Atomic Energy Agency (IAEA). Using arguments advanced by proponents who hold contradictory views about the
withdrawal decisions, he analyzes the justifications advanced for making the choice to withdraw from these agencies then makes abstract propositions that go beyond the specific issue analyzed. The relevance of withdrawal from international agencies will be explained shortly since it appears to be a key component to understanding regime theory.

Although Imber does not provide a theory of regimes, his propositions suggest that it may be possible to come up with a set of criteria that can be used to determine the likelihood that a proposed regime will be successful. The four propositions Imber (1989) advances are as follows:

Proposition 1:

It is possible to identify responsibilities of governments in the fields of welfare and technical services that can be more effectively organized through intergovernmental cooperation than by purely national means (p. 18).

Proposition 2:

International organizations can be created which are mandated to provide or to coordinate services across national frontiers (p. 18).

Proposition 3:

The authority of the functional organization can be extended when the members consent to be bound by new rules and procedures agreed in conference by themselves, conferring new tasks on the agency (p. 19).

Proposition 4:

If the benefits of functional cooperation can be enhanced whilst the costs of war are becoming greater, then the choice between these alternatives will encourage governments to favor increasingly the peaceful settlements of disputes (p. 20).
Still in search of a framework for determining the likelihood of achieving collaboration among states, Zacher (1990) offers another approach. First, he discusses two assumptions and then posits probable outcomes if certain conditions exist.

The first assumption is that the objective of states is to achieve a high degree of autonomy, thus a regime that enhances the autonomy of states is more likely to be accepted.

The second assumption is that states are interested in enhancing economic welfare, thus, a regime is more likely to be accepted if it can correct market imperfections, hence, increase efficiency or output.

The significance of regime theory, with regard to communication policy issues, is that the preceding propositions and assumptions touch on some of the issues that appear to be central to the debates going on at the UN and other international agencies. Imber's first proposition, for example, suggests that it is possible to come up with a set of criteria to determine whether the issues raised by remote sensing can be addressed effectively by individual nations, by bilateral agreements, by multilateral agreements, or only by truly global agreements. Chapter One of this study suggests that remote sensing issues can be effectively addressed only by global agreements. The same may not be true of DBS, for example, where the issues raised typically involve a relatively small number of nations.

Propositions two and three suggest the necessity to ask whether the UN is the most appropriate forum for discussing remote sensing issues and the need to examine whether COPUOS, as a functional
organization, has facilitated or impeded the implementation of a regime. These two questions are addressed in Chapter Four.

Proposition four calls for a comparison of the costs that individual states incur for membership to COPUOS, (or any international agency) versus the benefits that accrue to each state as a result of that membership. The implication is that a state may withdraw its membership from an agency, if its input into the agency is greater than its benefits. Thus, the decision of the US to withdraw from UNESECO in 1984, for example, can be understood by comparing US input into UNESCO versus how much the US benefited by belonging to the organization.

While there is no doubt that the propositions of Imber and Zacher touch on pertinent communication policy issues, international regime theory has its potential weaknesses.

First, the issues that Imber and Zacher propose as important for developing a set of criteria for determining when a regime is likely to be achieved are not entirely new. Second, international regime theory still regards states as the primary unit of analysis in communication policy issues, yet it is increasingly clear that states are not the only group of players with stakes in these debates.

There is nothing particularly new in the assumption that the objective of states is to achieve a high degree of autonomy. Indeed, that is what the debates about sovereignty are about. The right of states to make internal decisions without external influence has not been questioned. The real problems arise when changes in technology render traditional concepts of the autonomy of states and the rights of
states in conflict. There is no doubt that remote sensing from space challenges the ability of states to control information about their territories. However, sovereign rights conflict with information rights. It could be argued that the debates are not whether sovereign rights or information rights are important to states but rather how flexible states are willing to be with the exercise of those rights.

International organizations such as the ILO, IAEA, UNESCO, etc. were created partly in recognition of the fact that certain responsibilities of governments could be more effectively organized through international cooperation. Thus, as Imber (1989) correctly notes, the Universal Postal Union (UPU) and the International Telecommunications Union (ITU), for example, were created to regulate the exchange of information across state frontiers. In other words, the primary functions of these organizations was the coordination of existing national systems, often with different technical standards. However, changes in telephone technology, for example, have resulted in the need for an organization to make sure that users on one national telephone system are able to make phone calls to users on another system. Today's telephone technology and what kind of information is exchanged across telephone lines makes it difficult for some states to determine what is permissible on their telephone systems. This is where the major controversies arise, not whether there is a need for the ITU.

The economic, social, political and other advantages to be gained from the exploitation of technical innovations are central to the disagreements between states over communication policy issues.
Some states argue that it is necessary to extend the mandates of international organizations, to confer new tasks on the agencies, to enable them to deal with new issues. Other states see these agencies as purely functional organizations and refuse to link decisions taken within the functional organization to disputes existing outside them.

It is plausible that some states may view proposals to extend the mandate of an agency to be so unacceptable (or so crucial) that they decide to withdraw their membership. The challenge for international regime theory is to come up with more precise, less abstract criteria that will determine the extent to which states are willing to adopt new rules and procedures and confer new tasks on an agency. Obviously the issues arising from the exploration of space in 1991 are not the same as in 1954. The question is, are the member states in COPUOS willing to adopt and be bound by new rules?, and if so, to what extent?

Finally, it is true that membership in most international agencies, especially UN agencies, is open only to states. Consequently, international regime theory treats states as the primary unit of analysis in international communication policy issues. However, it is clear that the ever increasing number of transborder communication networks are being established by transnational corporations and other private companies. Since these corporations are generally excluded from the policy-making process, disagreements between states on policy issues either restrict their access to new markets or make it easy for these corporations to by-pass state guidelines and still reach their desired markets. A good example is the fact that US remote sensing
guidelines apply to EOSAT but not to SPOT Image even though the two operate in the same market. If SPOT appears to abide by US guidelines, that behavior is voluntary.

In summary, Imber (1989) and Zacher (1990) do not provide a theory of regimes. Their propositions are broad and abstract enough to be useful in building a framework for determining when it is likely that a regime will be achieved. Ironically the potential weaknesses of their propositions are also located in the broadness of the propositions. The policy issues raised by the UN debate on an international remote sensing regime, like most communication policy issues, would require criteria that are narrowly defined so that they are able to deal with specific issues, without appearing to be contradictory or ambiguous. However, the same criteria must be broad enough to be able to deal with issues that arise in new and unanticipated ways. That indeed is a challenging task; one that is beyond the scope of this study.
CHAPTER IV
THE UNITED NATIONS SETTING FOR REMOTE SENSING ISSUES

COPUOS: Structure and Decision-Making Process

In studying communication policy issues, scholars frequently examine not only the specific issues being studied but also the agency or organization responsible for drafting and implementing the policies in question. For example, the US Congress established the Federal Communications Commission (FCC) -- originally called the Federal Radio Commission (FRC) in 1927, then renamed the FCC in 1934 to accommodate the emergence of television -- as an independent Federal regulatory agency. Head and Sterling (1990) write, "... the FCC acts a gatekeeper, using its power to open the way for station ownership and close it for others" (p. 440). Consequently, when disputes arise between broadcasters, cable television system operators, telephone companies, or any combination thereof, often it is not only the specific FCC policy in question that is examined but also the structure and procedures of the agency itself.

Chapter One identified COPUOS as the UN forum where the remote sensing debate unfolded. This chapter examines the structure and procedures of the agency from its creation to the present. Additionally, three primary approaches, advanced by various nations at
the UN, toward establishing international guidelines on remote sensing are examined in detail.

The United Nations interest in outer space apparently became evident shortly after the Soviets launched the first Earth orbiting satellite, Sputnik, in 1957. In 1958, the UN General Assembly established an ad hoc committee on outer space with a resolution whose wording reflected a theme of universality that has continued to this day:

Recognizing the common interest of mankind in outer space and recognizing that it is the common aim that outer space should be used for peaceful purposes only,

Bearing in mind the provision of Article 2, paragraph 1, of the Charter of the United nations, which states that the organization is based on the principle of sovereign equality of all its members,

Wishing to avoid the extension of present national rivalries into this new field,

Conscious that recent developments in respect to outer space have added a new dimension to man's existence and opened new possibilities for the increase of his knowledge and the improvement of this life . . . (UNGA, 1958).

This ad hoc Committee, On the Peaceful Uses of Outer Space, was charged with reporting the following year to the fourteenth UN session on the activities and resources of the UN and other international bodies relating to the peaceful uses of outer space and what could appropriately be undertaken to the benefit of states, irrespective of their economic or scientific development. The following year, 1959, CUPUOS was established formally by the UN General Assembly under resolution 1472 (XIV) and was made the only
standing committee of the General Assembly whose purpose was to promote international cooperation in the exploitation of space. It is interesting to note that, like the FCC whose mandate is to regulate broadcasting "in the public interest, convenience, and necessity", the mission of COPUOS appeared to be clear and simple. However, the analysis of the UN Principles on remote sensing in Chapter Six suggests that the translation of this mandate into concrete rules to guide human behavior is quite another task.

In 1961, the General Assembly passed another resolution which made COPUOS the "focal point" for international efforts to obtain cooperation in the exploration of outer space. The Resolution further requested COPUOS, among other things, to:

1) maintain close contact with governmental and non-governmental organizations concerned with outer space matters,

2) provide for the exchange of such information relating to outer space activities as governments may supply on a voluntary basis, supplementing, but not duplicating, existing technical and scientific exchanges, and

3) assist in the study of measures for the promotion of international cooperation in outer space activities (UNGA, 1961).

Two COPUOS committees were organized with specific assignments. The Legal Sub-Committee was established to examine legal issues arising from the exploration and use of outer space. The Scientific and Technical Sub-Committee was given responsibility for examining the physical phenomena of space. COPUOS and its two sub-committees meet annually to consider questions put before them by
the General Assembly, reports submitted to them and issues raised by member states. Working on the basis of consensus, COPUOS makes recommendations on outer space issues to the General Assembly.

With regard to legal questions, the most significant developments have been the conclusion of a number of international legal instruments, among which are the following:

1) Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (referred to as the Outer Space Treaty). First considered in 1966 and entered into force in 1967.

2) Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space (referred to as the Agreement on Assistance). It was first considered in 1962 and entered into force in 1968.

3) Convention on International Liability for Damage Caused by Space Objects (referred to as the Liability Convention). It was considered in 1963 and entered into force in 1972.

4) Convention on Registration of Objects Launched into Outer Space (referred to as the Registration Convention). It was first considered in 1969 and entered into force in 1976.

5) Agreement Governing the Activities of States on the Moon and Other Celestial Bodies (referred to as the Moon Treaty). It was first considered in 1972 and entered into force in 1984.

What is worth noting about the preceding list of agreements is the steady increase in the number of years it takes from when an issue is first considered and when the agreement enters into force. For
example, it took only one year for the Outer Space Treaty to be considered and entered into force (1966-1967). The Moon Treaty took 12 years between first consideration and entry into force (1972-1984).

In 1974, the Legal Sub-Committee began consideration on the question of elaborating principles governing the use of artificial earth satellites for direct television broadcasting with a view to concluding an international agreement or agreements. By 1982, while tentative agreement had been reached on a number of principles, the views of member states concerning the free flow of information and sovereignty were irreconcilable. In 1982, the Committee, in accordance with a General Assembly resolution, attempted to complete the elaboration of a draft set of principles but was unsuccessful. That same year the General Assembly adopted, by a majority vote, the principles governing the use by states of artificial Earth satellites for international direct television broadcasting (resolution 37/92) which conditioned the establishment DBS services on the prior consent of receiving states. The United States alone cast the dissenting vote. Apparently, since the principles were not approved by consensus, no further action was taken on the issue and the question has not been on the agenda of COPUOS since 1982. For a more detailed discussion of DBS, see, for example, Luther (1988), Powell (1985), and Taishoff (1987).

It took eight years from the initial consideration of principles governing DBS to the vote. It is impossible to say how many more years the debate would have taken, had members insisted on reaching
agreement by consensus. That it took 15 years to reach agreement on remote sensing principles, by consensus, is clearly understandable. It would appear that the increase in the time it takes to finalize agreements is attributable, at least partially, to the increasingly complex issues that COPUOS must deal with. However, a few observers, even some delegations, still judge the effectiveness of COPUOS on the basis of how many agreements the committee is able to conclude every few years.

The debate on DBS is of significance to the debate on remote sensing for several reasons. First, the key issue that led to the stalemate on the DBS debate is essentially the same as in the debate on remote sensing -- prior consent, in accordance with state sovereignty, versus freedom of information. Second, adoption of the principles on DBS by the General Assembly, not COPUOS, would support the view that, COPUOS, since its creation, has been faced with increasingly complex issues. Finally, according to a senior staff member at the UN Outer Space Affairs Division, the adoption of the principles on DBS by the General Assembly, by vote, was a departure from normal procedures. There has never been a vote in COPUOS, since the committee agreed to work by consensus (Chipman, 1990).

COPUOS generally reaches consensus by first negotiating voluntary (verbal) agreements among its members. Agreement is said to be reached by consensus when no delegation overtly expresses opposition to an issue. Note that a failure to voice opposition does not necessarily mean that everyone agrees. Stated another way, an agreement reached by "consensus" is not the same as a "unanimous"
agreement where everyone agrees. Consensus means that no one disagrees while unanimity means that everyone agrees. Thus, agreements reached in COPUOS do not necessarily reflect unanimity. According to Chipman (1990) the process of reaching agreement by consensus is "somewhat dubious" since it often involves the exertion of subtle "moral pressure" on dissenting members of the committee.

When consensus is achieved in the committee, recommendations are made to the General Assembly which are normally adopted by consensus too. However, if COPUOS has exhausted all efforts to achieve consensus on an issue to no avail, as on the the principles on DBS, the committee refers the matter to the General Assembly where a decision is reached by majority vote. It is worth noting that current membership in COPUOS is 53. The General Assembly is composed of all UN member states, about 160 members each with one vote. Voting on important questions such as recommendations on peace and security, election of UN members to organs, admission, suspension and expulsion of members, etc. is by two-thirds majority. On other questions, voting is by a simple majority.

It is not really significant whether a specific issue on outer space is considered an important issue, thus, requiring a two-thirds vote in the General Assembly, or the vote is by simple majority. Generally, international law is meaningful only to the extent that states agree to abide by it. Furthermore, since international agreements must be enforced by individual states, putting a proposed international agreement up for vote may be of little significance. States who vote
against the proposal are presumably not bound by the agreement. Thus, for example, the US may simply ignore UN principles on DBS, despite the fact that it was the only nation to vote against the principles.

Note that some scholars assess the status and/or validity of international agreements on the basis of the bewildering diversity of titles attached to each agreement: treaties, conventions, declarations, resolutions, covenants, acts, principles, etc. For example, some would see a 'treaty' as having more weight than a 'resolution'. Jasentuliyana (1988), for example, states that "... the (remote sensing) principles were given the status of a General Assembly resolution rather than a more formal 'declaration of principles' or a legally binding international treaty" (p. 2). This view may be true to the extent that it can be supported by evidence that states are more willing to abide by treaties than resolutions. On the other hand it is a UN 'resolution', not a 'treaty' that provided the legal basis for the Persian Gulf War in January 1991.

It could be argued that the title by which an instrument is known is of little relevance, i.e., that wider acceptance of an international legal instrument is of greater importance than its title. Thus, the set of principles on remote sensing, adopted by consensus, is more convincing, as evidence of the formation of international customary law, than a "remote sensing treaty", signed by a few members of the committee. It appears that the desire of COPUOS to make its decisions by consensus is an expression of a desire to reach
agreements without opposition, thus avoiding the apparent difficulties with seeking absolute unanimity and/or the pitfalls of majority votes.

However, agreements in COPUOS were not always achieved by consensus. According to Chipman (1990), shortly after COPUOS was established, there were debates with regard to how the committee was going to function, what its membership was going to be, and how it would make decisions. The United States, backed by a number of western countries, held the view that the committee should consist primarily of space powers -- of countries with a direct interest in space. Furthermore, they wanted the committee to reach decisions by vote.

It is worth noting that the United Nations had 51 members upon its creation in 1945. When COPUOS was established in 1958, UN membership consisted of about 80 nations. Beginning in 1960, UN membership began to increase, significantly, as European colonies in Africa became independent, thus, eligible for UN membership. Western countries constituted the majority of UN members in 1958. Consequently, COPUOS, at the time of its creation, was dominated by industrialized countries of the West. Socialist and developing countries clearly constituted a minority group on the committee. Keeping in mind that the mechanisms for the Cold War were already in motion and often pitched the Soviet Union and other socialist countries against the US and other western countries, the implications for making decisions in COPUOS by vote are unmistakable.
According to Chipman (1990), socialist countries and the few developing countries that were COPUOS members saw the committee as "essentially a tool of western space powers". Consequently, they boycotted the first few meetings of the committee and insisted that COPUOS was a "political body". They wanted a committee that was representative of the political make-up of the UN. Western countries countered that COPUOS was essentially a "technical coordinating committee".

Today, most developing countries apparently echo the Soviet view of the committee as a partially a global-political body. According to this view, discussions at COPUOS represent not only scientific and technical negotiations between countries but also political negotiations. This is apparently the sentiment expressed by the delegate from Chile when he stated:

To criticize us (developing countries) as politicizing COPUOS is a very subjective judgement because we are dealing in a political forum. The alternative is to try to get into bilateral negotiations with the US which is rather unfortunate. We do not have the people, means, resources, and knowledge (Gonzalez, 1990).

The US view of the committee as primarily a forum for technical and scientific discussions has not changed either. Assessing the effectiveness of COPUOS as a forum for achieving international cooperation, the US delegate regretted that:

Our (US) concern in the 1980s has ... been that some delegations have chosen to use this committee to meet their own narrow political ends. (COPUOS) was never organized with that intention in mind. One of the things that we have been pressing for years is a higher degree of scientific and technical discussion in this committee. Trying to bring experts here. Minimize the political
approach that some delegations seem to want to take. What we think will help this committee is a higher degree of scientific discussion (Hodgkins, 1990).

The US delegate was making direct reference to a decision of the Legal Sub-Committee to include discussions on the use of nuclear power sources, in outer space on its agenda. In 1983, the Legal Sub-Committee's Working Group on nuclear power sources agreed that in the event that a nuclear-powered space object is malfunctioning, with the risk of re-entry of radioactive materials to the Earth, the launching state should be obligated to inform states that may be affected as well as the Secretary-General of the UN. The US together with some western nations continues to insist that such concerns are to be addressed by the UN Disarmament Committee, not COPUOS.

It could be argued that both views are partially true. With regard to the desire to avoid or minimize "political discussions" in the committee, it can be said that the Legal Sub-Committee was created in anticipation of such debates. Indeed, most of the debate in the committee seems to arise from the Legal Sub-Committee. On the other hand, there seems to be little controversy arising from the Scientific and Technical Sub-Committee. No one rejects the need for scientific and technical coordination of space activities. However, space activities also have economic and political consequences and the mandate of COPUOS clearly includes the making of space policy. Seen from one extreme, the US view would amount to, for example, claiming that the FCC is only limited to technical tasks such as the assignment of broadcast frequencies.
On the other hand, it could be argued that for COPUOS to function smoothly and efficiently, delegations must share some basic characteristics (such as knowledge of and experience in space issues) beyond the fact that they all represent the interests of their respective states. For example, Chipman (1990) observed that for so many years some delegations simply came to annual committee meetings "to insist that they were not willing to compromise". Socialist bloc nations came to denounce "western imperialism", developing countries denounced the "stinginess" of industrialized countries, etc. Thus, like the UN in general, COPUOS looked more like a forum for political rhetoric. Efforts towards real negotiation and compromise became secondary. However, it would be a mistake to view "political rhetoric" as nothing more than a means to stall negotiations. Faced with new issues, presenting themselves in new and unexpected forms, it is reasonable to expect that some delegations wanted to gain a better understanding of remote sensing technology before committing their respective countries to specific agreements. Today, despite the fact that COPUOS has existed for more than thirty years, new issues arising from the exploration and exploitation of outer space are increasingly complex to resolve, hence, many delegations are understandably hesitant to make quick decisions on such issues.

As observed during the 1990 annual proceedings of COPUOS, there seemed to be a remarkable lack of participation in discussions by delegates from a substantial number of developing countries. According to the Space Applications Expert at the UN Outer Space Affairs Division, it appears that a few delegates, mostly from
developing countries, hold little or no opinions on space issues when they come to the annual meetings. In some cases, they are simply instructed by their home governments to go along with the opinion of a specific country, usually a country with substantial influence on the committee (Abiodun, 1990).

It could be said that it is the presence, not the opinions, of a substantial number of developing countries on the committee that some spacefaring nations find "threatening". The idea of a forum, based on the idea that all states are equal, is understandably disturbing to developed countries who today constitute a minority on the committee. On the other hand, if discussions are restricted to technical and scientific matters -- as opposed to the idea of international equality -- this, in a sense, will reflect the real power relationships among members who see the committee as a technical coordinating body where discussions on the economic and political impacts of space exploration must be minimized or not discussed at all. The power in such relationships will be defined by the space exploration capabilities of individual states.

The Scientific and Technical Sub-Committee is made up of technical experts, primarily from countries with significant space exploration capabilities. This may partially explain the lack of controversy on issues discussed in this sub-committee. However, the issues raised by the question of how the benefits and burdens of space exploration are to be shared cannot be answered by "scientists" or "politicians" or economists alone. Getting a broader understanding of
policy issues raised by space exploration certainly requires the knowledge and expertise of individuals with different backgrounds.

In the early 1960s, following the boycotts of some committee meetings by a number of socialist and developing countries, a compromise was worked out for broader membership in the committee. However, it was also agreed that decisions would henceforth be made by consensus, not by vote, as had been the case earlier. Apparently, this guaranteed that socialist and developing countries, which were fast becoming a majority in the committee, would not use their majority to take actions against western countries.

Today, an interesting observation that can be made, regarding decision-making procedures in the committee is as follows: Given, for example, the gradual dissolution of the Soviet bloc that began in 1989 and increasing calls for socio-economic and political changes in these countries, it is plausible that "non-socialist" countries will soon constitute the majority on the committee. What will happen if this new majority decides that it is better to reach agreement by vote as opposed to consensus? The answer appears to lie in the procedures by which new members are admitted to the committee.

Membership in COPUOS is determined by the UN General Assembly. Any country interested in joining the committee indicates its interest to COPUOS which then makes recommendations to the General Assembly. Admission of a new member ultimately depends on the decision of the General Assembly.

According to Chipman (1990), two major factors are taken into account. First, the member-to-be must be interested in COPUOS.
This generally means that the country should have an "active interest" in space. The second factor is the question of "geographical balance". Thus, if membership in the committee is to be expanded by a certain number of states, they could not all be socialist or western states, for example.

The problems with these two criteria are apparent. According to the first criterium, despite the fact that the activities of other states may affect a state which has no "active interest" in space, the General Assembly must somehow be convinced that the concerned state, seeking membership in COPUOS has an interest in space. The 1958 debates on the membership of COPUOS, discussed earlier, appeared to suggest that "active interest" was intended to mean states that possessed or were able to launch objects into space. But the passage of time, coupled with advances in space technology, apparently proved that "active interest" is not necessarily dependent on the ability to launch objects into space. Hence, the committee today has members with little or no space exploration capabilities (See Appendix L).

The problem with "geographical balance" is that it is apparently based on the political orientation (socialist, democratic, etc.) of states. While it could be argued that such a balance is indeed desirable, the question arises with regard to what happens when political orientations change, as in the case of the countries of eastern Europe, mentioned earlier. What if someone thought that the size of a country, not its political orientation, should be the determining factor? What about population? Why not gross national product? Should any state or group of states chose to introduce any one of these factors as a
criterium for membership in the committee, the threat to the present delicate balance is obvious.

The present balance in the structure and procedures of COPUOS appears to have been achieved partially as a result of other factors that have little to do with "interest (presence) in space" or "geographical balance". According to Chipman (1990), most countries in the General Assembly have not been particularly interested in joining COPUOS. For example, most developing countries have small missions, with limited staff at the UN. They are overloaded with commitments to other committees, sub-committees, and panels, to a degree that even some of them that are already members of COPUOS do not appear for meetings on crucial space issues.

On the other hand, there are some countries that have sought membership for a long time; some of them to no avail. Membership in COPUOS, when it was established, consisted of less than 10 countries. In 1970, about 12 years after the committee was created, there was a total of 28 members (UN GA, 1970b). The latest expansion of the committee occurred in 1980, increasing its membership by 10 new members to the current 53.

China, which had sought membership for so many years, did not become a member of the committee until 1980. Spain, Portugal, and Turkey were granted one position that they currently share on a rotating basis. Other nations like Cuba and Libya, were granted observer status and are occasionally granted permission to address the committee.
It is plausible that as the impact of space activities like remote sensing become increasingly apparent many more states will demand to be heard in the committee. One alternative is to keep on admitting new members until COPUOS begins to look as large as the General Assembly. Another alternative is for the current committee to explore new ways to achieve consensus in a manner that is perceived, by most or all UN member states with a stake in space activities, to be fair and satisfactory. Obviously, it will be a difficult, challenging, and frustrating task.

The Outer Space Affairs Division: The Outer Space Affairs Division at UN Headquarters has been mentioned elsewhere in this study without specific mention of how it came into being and what it does.

In 1970, the UN General Assembly asked the ad hoc Committee On the Peaceful Uses of Outer Space to review the activities and resources of the United Nations, of specialized agencies of the UN, and of other international bodies, relating to the peaceful use of outer space. In its report to the General Assembly, the committee pointed out that "there was a need for a suitable center related to the United Nations that can act as a focal point for international cooperation in the peaceful uses of outer space" and therefore, "the General Assembly may wish to request the Secretary General to organize a small unit within the Secretariat for this purpose (UN COPUOS, 1970b, p. 22).

The Outer Space Affairs Division was established in the Political and Security Council Affairs Department of the United Nations. As the
Secretariat of COPUOS, the division provides administrative services for the committee, its two sub-committees, and other panels established by COPUOS.

Headed by a director, a few space experts, and other staff members, the division prepares reports and other documents for COPUOS. It also carries out consultative work with specialized agencies of the UN and other international organizations interested in the field of outer space such as the United Nations Development Program (UNDP), the Committee On Space Research (COSPAR), and the International Astronautical Federation (IAF), to name but a few.

Given the preceding understanding of the evolution of the structure and procedures of COPUOS, the remainder of the chapter will examine key remote sensing proposals that were submitted during the early years of the debate. Particular attention is paid to the proposals that crystallized the basic issues in the debates. The final principles that were approved and adopted in 1986 are discussed in Chapter Six.

Early Proposals for a Remote Sensing Regime

When COPUOS began discussions on remote sensing in the early 1970s, several delegations submitted proposals for international policy guidelines. The basic issues that stalled agreement on a universal set of principles were contained in these early proposals. Collectively, the various proposals each fall into one of three categories:

1) Proposals that would require the sensing state to seek and obtain the consent of sensed states before sensing occurs.
2) Proposals where the sensing state would not be required to seek approval of sensed states but guaranteed the sensed state access to data about its territory, on a priority basis, as well as the final decision with regard to dissemination to third parties.

3) Proposals whereby prior consent would not be required and data would be made available on a nondiscriminatory basis.

**Prior Consent**: The idea of seeking the approval of sensed states before sensing occurs is often associated with the proposals of COPUOS member-countries of Latin America.

Argentina was one of the very first nations to submit a draft agreement on remote sensing (UN COPUOS, 1970c). The proposal acknowledges the "... urgent need for overall surveys of earth resources by means of remote sensors ... and that the expected benefits will only be obtained through a general international convention" (p. 1). Furthermore, the proposal views remote sensing "... as an effective stimulus to economic and social development (that will) contribute to the welfare of all mankind by enabling the inventory, planning, development, exploitation and conservation of natural resources to be undertaken on the basis of international cooperation" (p. 1).

A section of the preamble asserts the need to recognize "the rights of the states to which the resources belong", as guaranteed by a 1962 UN resolution on permanent sovereignty over natural resources. Prior consent is not mentioned but Article 7 states that "the principle of equality and the self-determination of peoples embraces not only
the right to internal sovereignty and independence, but also the economic aspect of the freedom [of people] to exercise their legitimate and exclusive rights over their natural resources" (p. 3).

Thus, while prior consent is not mentioned, the concept of sovereignty is defined to include not just sovereign rights over natural resources, but also exclusive rights over information about those resources. International agreements, established long before remote sensing, are used to support this approach. There were more similar proposals to come.

In February 1974, Brazil submitted its proposal (UN COPUOS, 1974a). National sovereignty is again emphasized. However, the requirement for sensing states to seek prior consent is explicitly stated for the first time.

Article 3 states that "State parties shall refrain from undertaking activities of remote sensing of natural resources belonging to another State party, including resources located in maritime areas under national jurisdiction, without the consent of the latter" (UN COPUOS, 1974a, p. 2).

In addition, Article 4 entitles "States . . . to take measures, in accordance with international law, to protect their territory and maritime areas under national jurisdiction from remote sensing activities for which they had denied their consent" (p. 2).

Even if states are not able to ensure that their approval has been sought and obtained before sensing occurs, Article 7 prohibits the sensing state from disseminating data to third parties without the
authorization of the sensed state. Article 5 guarantees sensed states an unconditional right of access to data about their territories.

In October 1974, Brazil and Argentina submitted a joint and more elaborate proposal (UN COPUOS, 1974f). The complete text of the proposal is reproduced in Appendix H. It is mostly a restatement of the two proposals submitted earlier by both countries. Furthermore, it is generally considered comprehensive and representative of other proposals that call for prior consent.

Like earlier submissions, the proposal includes exclusive rights of information about natural resources as inclusive in the concept of sovereignty. Again, a 1962 UN Resolution on sovereign rights over natural resources is used to support this claim.

Article V prohibits sensing without the consent of the sensed state(s). Article VI permits states to take action, according to international law, to prohibit sensing where consent has been denied. Article VIII guarantees "full and unrestricted access" to data. Article IX prohibits dissemination to third parties without the consent of the sensed states. Furthermore, Article X prohibits third parties from "soliciting, accepting, or in any manner, receiving" data from sensing states, without the authorization of the sensed state.

From a purely technological point of view, it is difficult to imagine how some of the above rules would be enforced. The delegate from Chile admitted that, "... our [Latin America] position was very naive because we were claiming prior consent... which is technologically unavailable" (Gonzalez, 1990). Stated another way, the sensing state could agree to prior consent but simply ignore such
agreements since most states do not have the technical capability to know when sensing is being conducted.

In addition, it is apparent that prior consent would place severe restrictions on commercial remote sensing activities since commercial success depends to a large extent on the ability to buy and sell freely.

Despite these criticisms, existing international agreements support some of the provisions in this proposal. For example, the UN Agreement on the sovereign rights of states over their natural resources was established in 1962, long before the advent of civilian remote sensing. Although the counter argument is that, in the final analysis, states still have physical custody of their resources, this argument is undercut by the fact that access to information can confer significant advantages to one party during negotiations such as agreements on petroleum exploration rights. As Lazarus (1983) states, "behind the legal disputations over sovereignty lies a fear among developing countries that remote sensing technology might confer advantage less to themselves than to other parties . . . especially the oil- and mineral-extraction companies and agricultural commodity traders" (p. 103).

**Controlled Dissemination:** The second approach generated by the multiple proposals submitted calls for guidelines which, while not providing the sensed state the right of prior consent, allows it to control the dissemination of data to third parties. France and the Soviet Union are generally considered the primary proponents of this
approach. It should be noted that the position of France has changed considerably.

In 1973, the Soviet Union submitted its first proposal (UN 1973b). It contained five articles. Articles 1 through 3 call for remote sensing to "be conducted in accordance with the principles of international law", for the respect of state sovereignty and their "inalienable right to dispose of their natural resources and of information concerning those resources", and for remote sensing "to be undertaken on the basis of respect by States for each other's interests" (p. 1).

While the first three principles are vague, the next two are more specific. Article 4 requires the sensing state to disclose information about natural resources to the sensed state. Article 5 prohibits the sensing state from disseminating data to third parties or using it "in any other manner to the detriment of" the sensed state without the "clearly expressed consent" of the latter (p. 1).

France also submitted its first proposal in 1973 (UN COPUOS, 1973c). Like the proposals of Argentina, Brazil, and the Soviet Union, it acknowledges the sovereign rights of nations over their natural resources. Article 4 requires the consent of the sensed state(s) before sensing occurs. Article 5(2) prohibits dissemination of data to third parties without the consent of the sensed state.

In May 1974, France and the Soviet Union submitted a joint proposal (UN 1974b). However, prior consent requirements, contained in the earlier French draft were dropped. The complete
text of this proposal is reproduced in Appendix I. It is essentially a restatement of the earlier Soviet proposal.

In 1978, the Soviet Union signed a remote sensing agreement with Cuba, Czechoslovakia, the German Democratic Republic, Hungary, Mongolia, Poland, and Romania (UN COPUOS, 1978c). The complete text of the proposal is reproduced in Appendix J. A copy of the agreement was forwarded to the Secretary-General of the UN for distribution to other UN member-countries. It is basically a more detailed restatement of the Franco-Soviet Proposal with a few new interesting provisions.

Earlier submissions emphasized remote sensing of "natural resources". Apparently as a result of debates in COPUOS with regard to what the term "remote sensing" means, the Soviet bloc agreement includes definitions of "remote sensing", "data", "information" and "natural resources". In keeping with the provisions in earlier drafts, Articles IV and V requires sensing states to seek the approval of sensed states before data is distributed to third parties.

Article X(2) says the agreement is valid for five years, but renewable in successive five-year periods. Article XII allows for the withdrawal of any party to the agreement upon written notice but withdrawals only take effect 12 months from the date they are received.

Although the agreement was signed by eight countries, Article X says the agreement shall enter into force upon approval of five nations.

The Franco-Soviet proposal and Soviet bloc agreement recognize the futility of prior consent. Note that during this period, the Soviet
Union was already spending considerable sums of money and manpower to jam Voice of America radio broadcasts aimed at Soviet citizens. It is plausible that the Soviets lacked the technical capabilities or were not willing to incur the same expenses for remote sensing.

Interestingly, research on the SPOT program began in 1976, although the first French satellite was not launched until 1986. Obviously restrictions on the dissemination of data would have hampered commercial success of the SPOT program. In the early 1980s, the French, like the Soviets, changed their minds about controlled dissemination of data. The notion of "open skies", and "nondiscriminatory access" became more attractive.

According to a member of the French delegation at COPUOS, the policy position of France changed as a result of the realization that early perceptions of the impact of remote sensing might have been exaggerated (Pisani, 1990).

According to Kolossov (1990), "we [the USSR] were supporting the position of developing countries". The Soviet Union also believed that it should be up to the sensed country to decide what information about them should be made available to third parties. The Soviet position began to change when "remote sensing technology in the USSR started developing and the interests of western countries and the USSR became much closer". Further, a group of Soviet scientists convinced the Soviet government that the "idea of commercializing remote sensing and the possibilities of earning some currency" from the activity was worth exploring.
The agreement signed between the Soviet Union and other Soviet bloc countries is still in force but according to Kolossov (1990), "it does not work anymore". What if, for example, Cuba did not want the Soviet agency, Soyuzkarta, to make its data available to a third party? "Obviously, although Cuba may protest because the [Soviet bloc] agreement is still in force, but we [the USSR] will refer to the UN principles" (Kolossov, 1990).

"Open Skies", "Open Access": The third approach is based on the assumption that policy guidelines that allow for the gathering and dissemination of data, without any restrictions, is in the best interest of everyone concerned. The United States, with the support of a number of western countries (Canada, the United Kingdom, etc.) has been the primary advocate of this approach.

The US submitted its proposal in 1976 (UN COPUOS, 1975b). The complete text of the proposal is reproduced in Appendix K. The US held the view that the UN Outer Space Treaty (1967) was adequate to cover remote sensing, thus, the US did not see the need for a separate set of guidelines on remote sensing.

The preamble of the proposal refers to remote sensing of the "natural environment" (not natural resources) as a means of providing "unique opportunities of all peoples to gain useful understanding of the earth and its environment". With regard to the UN debate, the most significant provisions are to be found in Articles V, VI, and VII.

Article V requires sensing states to make data available "to interested States, international organizations, individuals, scientific
communities and others on an equitable, timely and nondiscriminatory basis".

Article VI addresses the issue of providing data to sensed states about their territories. Such data shall be made available to the sensed state "as soon as practicable, and in any event as soon as they [data] are available to any State other than the sensing State".

Article VII addresses the question of sensed states expressing the desire to participate in remote sensing programs, in other words, the transfer of technology. Sensing states "shall within their capabilities endeavor to assist on an equitable basis other interested states . . . to develop an understanding of the technique, potential benefits and costs of remote sensing".

The US has been consistent in opposing any provisions for prior consent or controlled dissemination of data. However, some observers believe that certain provisions in US domestic rules on remote sensing appear to suggest that the right to gather data and disseminate them, without any restrictions whatsoever, is not an absolute right. For example, provisions in the Landsat Act of 1984 permit the Secretaries of Defense and Commerce to restrict and/or prohibit the dissemination of Landsat data that could harm US national security.

The Act does not say what is to be done about the national security interests of other countries or what constitutes threats to national security. Nonetheless, dissemination of Landsat data that the government considers to be harmful to US national security is an offense punishable by heavy fines and/or prison sentences. It is worth noting that these provisions apply to information about US territories.
gathered by US satellites. Theoretically, any interested party may obtain the same data (gathered over US territories) from other countries whose satellites fly over the US, without the fear of being prosecuted under the national security provisions in the Landsat Act.

The Road to Consensus

The three approaches just described constituted the basis for the debates that unfolded between the early 1970s and 1986, when a set of principles was finally adopted. These principles are discussed in detail in chapter four. It is worth noting that the proposals submitted by individual countries were relatively more specific, in prescribing what principles ought to be adopted, than the principles adopted in 1986.

While the early proposals were specific with regard to prior consent, controlled dissemination, and open skies/open dissemination, some provisions in the 1986 principles can be interpreted as requiring or prohibiting the basic provisions in any one of the three approaches. This is apparently the reason why some scholars such as DeSaussure (1989), criticize the UN Principles of 1986 for failing to provide definitive answers to some of the basic issues raised by remote sensing.

According to a staff member of the Outer Space Affairs Division, once these three approaches had been established, "for many years, through the early 1980s, there was just a total deadlock". The agreement reached in 1986 was primarily due to "a substantial change in the general attitude toward economic cooperation, essentially the
integration of various countries into an international market" (Chipman, 1990). A review of the verbatim records of the committee from 1969 to 1990 supports this claim (UN COPUOS, 1969 through 1990m). In essence, the records reveal that having stated their positions in the early 1970s, delegates came to the meetings year after year and simply reasserted their views. According to Chipman (1990) "... nobody was prepared to compromise. They apparently enjoyed the rhetoric of the inflexibility [of delegations holding opposing views]". The breakthrough appears to have occurred in 1984 when France submitted another set of proposed rules. This latest proposal was the basis for the principles that were adopted two years later.

Note that the French launched their first remote sensing satellite, SPOT-1, in 1986 -- the same year the UN principles were adopted. France does not have a formal set of domestic rules such as the Landsat Act that was adopted in the United States. According to a member of the French delegation at COPUOS, France regards the UN principles as satisfactory, thus, did not see the need to draft and implement a separate set of domestic rules (Pisani, 1990). However, according to Chipman (1990), the breakthrough in negotiations did not occur because the French proposal (1984) offered any significantly new ideas that had not been discussed in the past. Rather, the agreement was reached because "in about 1985, [delegates] began to lose interest in confrontation and many countries decided that they were interested in working together in reaching an agreement". Chipman (1990) attributes the willingness to cooperate as a result of improved relations, between the US and the Soviet Union, that began
in the mid-1980s. Indeed, verbatim records of the debates in the COPUOS in the 1970s appear to mirror the political tensions that existed at that time. However, failure to conclude a remote sensing agreement in the 1970s cannot be attributed purely to the existence of political tensions between the superpowers. France sided with the Soviet Union in the 1970s, against the US, perhaps as a result of considerations of the economic (not political) impact of remote sensing. Thus, adoption of the remote sensing principles in 1986 cannot be explained solely in terms of the easing of political tensions between nations.

In 1976, the US delegate at COPUOS stated that:

an essential tenet of both the Argentine-Brazilian and the French-Soviet draft texts [on remote sensing] appeared to be the belief that, if each State had a right to prohibit the dissemination to third parties of dat about its territories, then those States would be more secure and better off. 

... reference to remote sensing simply in terms of natural resources was inadequate.

... it would be more meaningful to refer to remote sensing of the natural environment of the earth (UN COPUOS, 1975a).

The US supported its position against proposed restrictions on the acquisition and distribution of data by pointing out that experiments undertaken with Landsat 1 & 2 revealed that the utilization of data for land-use analysis, mapping, water-quality studies, disaster relief, protection of the environment and many other purposes, were as important as potential resource identification. Thus, prior to the adoption of the 1968 principles, the US insisted that it was misleading to address only one of the potential uses for
satellite data since all states, especially developing countries, had broad and sometimes urgent interests in all those uses.

Further, US delegates repeatedly pointed out that to refer only to data about resources was technically unrealistic, since the raw data acquired constitutes a data base which also gives information relating to other uses. Only subsequent analysis and interpretation of the data determines the type of information to be elicited, since the raw data in itself is not peculiar to natural resources.

This observation is critical to understanding the difference between "data", "information", and "knowledge". Given an increasingly interdependent global economy, prohibiting others from knowing that a specific country possesses certain natural resources does not necessarily confer any advantages to that country, if it lacks knowledge regarding the global need for those resources and what alternatives are available to those in need of them. In other words, knowledge of where those resources are needed and what could be got in exchange for them is just as important as physical custody of the resources.

The same assumption is applicable to other scenarios. For example, it could be argued that it is more profitable to own a computer system through which all reservations for seats on airlines or hotel rooms are made than actually owning fleets of airplanes or hotel chains, without control of the reservation system. The analogy to the debate on remote sensing, hence, the difference between data, information, and knowledge is as follows: The access to raw satellite data about natural resources is analogous to physical custody of hotels, airplanes. The ability to process the data and interpret it accurately is
analogous to having information about where there are vacant seats on airplanes or vacant rooms in hotels. The ability to combine this information with information from other sources about the market for those resources, and use it to exploit one's resources effectively is analogous to possessing knowledge, i.e. being in a position of choosing to which specific airline or hotel customers are eventually sent. Thus, it can be argued that prior consent requirements in the remote sensing debate were shortsighted for countries that do not have the "knowledge" to exploit and dispose of their natural resources efficiently.

The final negotiations that led to approval of the 1986 principles on remote sensing were informal, i.e., they occurred outside of the formal setting of COPUOS. Austria played the role intermediary between parties with opposing views.

When the French proposal was introduced in 1984 Austria was chosen to play the role of negotiator. All the delegates interviewed for this study stated that Austria was acceptable to most delegations. In past debates, Austria was generally perceived to be fair since appeared to have no significant national interest in remote sensing. The negotiations were eventually moved outside the formal settings of the committee.

According to a member of the delegation of Austria, the decision to hold further negotiations outside COPUOS was based on a desire:

"to underline the informality of the context. We [Austria] first set out to gather ideas on how much was posturing and how much was real interest behind the [different] positions. Once we got a clear
picture, we tried to find a lowest common denominator" (Freudenschuss, 1990).

First, Austria consulted with small groups of delegates from countries that held similar views.

We talked on first name basis. We would not say, for example, "I give the floor to the distinguished delegate of . .. We also would underline that we were talking among friends, that their input was their personal thoughts and they were not bound by it. They would not necessarily state their strict national positions but provide us, as coordinator, with an input of thoughts upon which we could, under our own responsibility, try to formulate a text (Freudenschuss, 1990).

The Austrian coordinators were mindful of the manner in which the principles on DBS had been adopted in 1983. When consensus could not be reached in COPUOS, over prior consent requirements, the matter was referred to the General Assembly where the current UN principles on DBS were decided by vote, to the dissatisfaction of some countries.

That was exactly the kind of example we did not want to follow . . . We wanted to get something, even if it was less than what many delegations wanted. We thought it will be useful if we had something which everybody agreed, particularly the case of the US This is very important because the US underlines the non-binding character of the principles. However, they also agreed that once they agreed to a non-binding instrument, they will follow it, (Freudenschuss, 1990).

Regarding the vagueness with which the key issues in the debate are addressed in the principles:

It would not have been possible to come to an agreement if we had insisted on being more specific. That was the price that had to be paid. Developing countries also came to the realization that this was the best deal they could get. If they held out for more, they would not have gotten anything because the countries who have the technology were very clear that they needed to set the principles.
They were ready to agree to the principles, but on their own terms. ... Certainly, one could argue, if you take the original positions of developing countries, that they made a lot of concessions. But that was the price they had to pay to get any kind of agreement. However, since the principles were adopted, there have been some voices, not too many, not terribly strong, which have suggested that countries look again at these principles, in the light of current practices (Freudenschuss, 1990).

Given the preceding, it appears that the principles were adopted primarily as a result of a desire for better economic relations among members with opposing views. This observation is supported by the following: The delegates interviewed for this study represented the conflicting views expressed throughout the debate. However, although the principles do not adequately address the key issues raised in the debate, all delegates interviewed expressed varying degrees of general satisfaction with the principles.

The delegates from France and the United States, for example, believe there is no need to review the principles. On the other hand, the delegate from Chile believes there may be a need to review the principles soon, but even so, such a review would only be intended to address current practice (Pisani, 1990; Hodgkins, 1990; Gonzalez, 1990). In the final analysis, the principles do not tell us whether the concept of sovereignty includes information about resources. Furthermore, how the conflict between sovereignty and free flow of information is resolved remains uncertain.

Certainly, some of the issues raised in this debate are not unique to conflicting interests between nations. In the United States, for example, similar conflicts exist among broadcasters, telephone companies, cable television system operators, the FCC, and the public
in the overall process of the provision and consumption of various communication services.
CHAPTER V
EVENTS OUTSIDE THE UNITED NATIONS

Development of the Remote Sensing Industry

This chapter describes events that occurred outside the United Nations since the question of international guidelines for remote sensing was raised. These events were: the cessation of the view of remote sensing as simply a tool for scientific studies of the Earth and a trend toward commercialization and privatization, hence the emergence of a global market for satellite data.

During the 1970s, the US government funded the Landsat program mainly as a tool for scientists to investigate phenomena about the Earth. Satellite data were used primarily by scientists and by government agencies such as the Department of Interior. In the late 1970s, as potential uses for satellite imagery became more apparent, there arose suggestions that the technology be transferred to the private sector as means of educating the general public about the significance of satellite data. At the same time, plans were to reduce, gradually, government funding of the program until the emerging industry could become self-supporting from the sale of data. The US government transferred control of the Landsat system to a private company in 1984.
In France, plans for a remote sensing program were initiated in 1976. The program was to be financed primarily through government subsidies, but operated by a private company until it became self-supporting through data sales. Thus began the road toward commercialization.

Other remote sensing programs were being developed in other countries but without the emphasis on commercialization. This chapter discusses the trend toward commercialization, the development of new markets and products, advances in remote sensing technology, and the adoption of various domestic (policy) approaches to guide the emerging industry.

The process of gathering, processing, and distribution of satellite data involves a number of players all participating at various stages in the process. Some analysts describe remote sensing in terms of a "space segment" and a "ground segment". Space segment refers to the building, launching, and maintaining of the satellite in orbit. All the satellites currently in orbit are funded primarily through government subsidies. In other words, without financial support from governments there might be no civilian remote sensing satellites in space today.

The ground segment includes data reception capabilities, data processing (the production of computer compatible tapes or photographic frames) and data interpretation. Despite the fact that only five countries operate civilian remote sensing satellites today, the long list of ground receiving stations, both operational and planned, suggests that a growing number of countries are establishing ground
stations to take advantage of instantaneous data transmission and the growing volume of data that will be generated by future satellites (see Appendix C & D).

Satellite data are obtained either as final photographic images (frames) or as computer compatible tapes (CCT). CCTs must be further interpreted with the assistance of computers to highlight specific desired characteristics of the territory over which the data was acquired. The ability to process and manipulate CCTs requires greater technical capabilities, software, and training than does manual interpretation of photographic frames. In the case of agricultural data, for example, the software may include sophisticated growth models yielding a wider range of detailed analyses and interpretation of a particular resource area. Thus, despite the growing number of ground receiving stations, many countries do not have the self-supporting in-country computer capabilities for such purposes.

Besides providers of primary (raw) data such as EOSAT and SPOT, there are hundreds of "value-added" companies, located primarily in the US and Europe, who, for a fee, will extract the desired information contained in CCTs for various groups of end-users.

The impact of the value-added segment of the remote sensing industry in difficult to quantify, primarily because there are literally hundreds of value-added vendors in the US alone, and perhaps thousands world-wide. The "remote sensing industry" used in this study does not include the value-added segment of the industry because the available literature does not reveal a direct influence or
participation of this segment of the industry in the policy making process.

On the other hand, the raw data supply segment of the industry is intrinsically linked to the policy making process and, as shall be seen in the last part of this chapter, has actively participated in the formulation of domestic remote sensing policies. Further, raw data suppliers such as SPOT and EOSAT have been largely responsible for the development of new products and markets for the industry.

**Commercialization and Privatization:** With reference to the process of establishing international policy guidelines for remote sensing, if the term "commercialization" is used simply to indicate that a fee is charged for satellite data, then commercialization was introduced in 1972 when the US launched Landsat-1 (ERTS-1). According to this definition all remote sensing programs in operation today are commercial. Japan's MOS and India's IRS programs, for example, are said to be non-commercial but both charge fees for access to data. However, there is a qualitative between various remote sensing programs with regard to how fees for data are assessed.

During the period that the US government operated the Landsat program, there was no direct relation between the fees that were charged for data and the cost of operating the system, i.e. the intent was not to recoup the cost of operating the system through data sales. Indeed, some officials in the US government saw remote sensing as a "diplomatic tool", i.e. the US could win more friends abroad by providing data to various countries at nominal cost. EOSAT, the private
company that took over the Landsat system is under enormous pressure to generate enough revenues from the sale of data, within a specified number of years, to be able to cover the total cost of operating the system as well as pay for the construction and launch of future satellites. SPOT, the French program is also commercial but the French government has not given the private operator a specific time frame within which it must become financially self-supporting to be able to bear the total cost of providing data to the public, i.e. the cost of both space and ground segments.

While the US and French approach is to treat satellite data as a commodity that must be sold, developing countries see the same information as a means for enhancing national development, hence satellite data is viewed as a public good, not a commodity. Thus, the government of India, for example, runs its remote sensing system with little regard to the relationship between the cost of operating the system and the revenue generated from data sales. Given these two different views of information, it is apparent that users who regard information as a public good will be reluctant to pay for it, especially information about their own territories. But how else can commercial success be measured, besides making comparisons between investment and revenue and making further efforts to increase the latter?

Commercialization did not become an issue during negotiations at COPUOS until the mid-1980s, when the US government announced that it was initiating the process of transferring its remote sensing program from the public to the private sector.
The Landsat system was developed by NASA as an experimental program. When the program proved to be a technical success, the US government began considering alternatives that could be used to recoup the costs of operating the system. When transfer of the system to a private company was mentioned as an alternative, a number of officials resisted the idea. They were concerned that a commercial operator may find economic incentives to restrict or even cut off the supply of data to some users, thus, complicating existing arrangements made between the US government and countries who had invested substantial amounts in ground receiving equipment. However, others argued that because of the potential for substantial financial gain, the private sector would exploit the capabilities of the technology better than the government had done so far. Further, transfer of the system to the private sector would relieve the government of the cost of operating the system. And to make sure that Landsat would be operated as the government desired, it was proposed that guidelines that specified conditions for transferring the system to a private operator be drafted. The first clear policy statement of Landsat commercialization was made by the Administration of President Jimmy Carter in 1979. President Carter cited commercialization as a goal of his administration and committed the United States to provide continuity of data flow from the Landsat system, at least through the 1980s.

Early in its tenure, the Reagan Administration decided to accelerate the process of transferring Landsat to the private sector. In 1981 President Reagan asked for an evaluation of the prospects for
private remote sensing. Concurrently, the administration abandoned plans to construct Landsats 6 and 7 to follow Landsat 5. In addition to Landsat, the Reagan Administration announced its intent to transfer the government's meteorological satellite system to the private sector as well.

Following several rounds of legislative debates in the US Senate, committee members agreed that US national security concerns and international obligations relating to weather information could not be satisfied by transfer of meteorological satellites to the private sector. However, it was agreed that these concerns were not as critical with Landsat and that Landsat commercialization should be given further consideration. In making these decisions, the larger opinion in the US Senate was that private remote sensing ventures cannot profit until markets for data expand. Further, it was thought that markets will not expand until the private sector aggressively markets data products. The proposal to commercialize meteorological satellites was withdrawn and a request for proposals and comments, pertaining to Landsat was issued.

The request for proposals required respondents to bid for development of a follow-on system to Landsat and permitted bids for the operation or acquisition of the existing system. The Department of Commerce was to determine what bid(s), if any, should be selected, then seek to contract for the development of a follow-up system and for the operation of Landsat 5 and marketing of Landsat data.

Of the seven bids that were received, EOSAT was awarded the contract to market Landsat data and develop the follow-up system

The literature on discussions in the French legislature about Spot is comparatively scarce. The available literature suggests that, unlike Landsat, SPOT was conceived and initiated from the beginning with the intention of making it into a profit-making venture. According to Bescond (1989), former president of SPOT Image (USA), SPOT was conceived to represent "the world's first commercial remote sensing venture ... unique in its technological capabilities. It also represents the transition of remote sensing from a government-sponsored research and development program to a commercially viable operation" (p. 289).

Thus, from the very beginning, all aspects of the SPOT program, from the space segment to the data distribution system, were geared towards meeting user needs. For example, SPOT Image Corporation was formed as far back as 1983, three years before SPOT-1 was launched, to market SPOT data exclusively to the US user community which was recognized "... to be the largest and most advanced in the world" (Bescond, 1989, p. 290).

In response to the challenges that lay before it, given the unchallenged presence of EOSAT in the US market, SPOT Image Corporation immediately set out to establish a number of "... unique
program geared specifically toward advancing remote sensing in the USA, by supporting the development of new applications and increase market" (Bescond, 1989, p. 290). For example, shortly after the launch of Spot-1 in 1986, SPOT Image Corporation signed agreements with NOAA to supply image data to the US, National Satellite Land Remote Sensing Data Archive. A similar agreement was signed with the Canadian Center for Remote Sensing.

Perhaps it is the combination of certain unique features in SPOT's technology, discussed in the last part of this chapter, and SPOT's marketing approach, that lead Bescond (1988) to conclude that "... SPOT will lead the way in establishing commercial remote sensing as an accessible technology of the future" (p. 293). But there are some significant differences in some of the services and products offered by SPOT and EOSAT that do not lend themselves to competitive comparisons. These will be discussed shortly.

Nonetheless, it appears that each of the two companies has sought to strengthen its presence in the world market where it sees a possible weakness of the other. For example, although the ground receiving station in Prince Albert, Canada (see Appendix C) is listed as a EOSAT receiving station, it was originally built to receive SPOT data, then later modified to receive EOSAT data as well. The only EOSAT ground receiving station in the North American continent was that located at the Goddard Space Flight Center in Maryland, USA.

Each SPOT receiving station is designed to receive data from any area within a radius of 2,500 kilometers, thus, as the circles, representing the receiving footprints for various ground stations in
Appendix C show, the SPOT station in Canada receives data about almost the entire land mass of the US while the EOSAT station in Maryland covers only a fraction of the same area. As noted earlier, the US user community currently represents the largest segment of the world market for satellite data. If building a receiving station in Canada that is able to receive SPOT data was a strategic decision, it appears to have been a wise decision. As if to counter, EOSAT recently announced plans to construct a ground receiving station in Norman, Oklahoma, designed such that its receiving footprint will cover the entire continental USA and much of southern Canada (EOSAT, 1990, p. 2).

Given the preceding, it is apparent that commercialization entails more than charging a fee for data. Although all existing remote sensing programs currently depend to varying degrees on subsidies from their national governments, commercialization became an issue at COPUOS shortly after the Landsat program was turned over to EOSAT and the company started increasing prices for data, in an apparent attempt to develop the program into a self-supporting venture as per the agreement with the US government. In other words, the intent is to generate enough revenue to cover all costs of operation, including the building and launching of future satellites, while government subsidies are gradually phased out.

In the case of non-profit programs such as those of India and Japan, the fees charged for data are not set with any intent to recover the cost of operation and there appears to be no pressure from their governments for the programs to turn a profit. Asked what will
happen to the IRS program if, despite subsidies from the Indian government, companies such as EOSAT and SPOT offer data to the users in India at prices lower than IRS charges, an official of the Indian Space Organization said IRS prices are low enough that there is currently little or no incentive for users in India to buy data elsewhere (Chandrasekhar, 1990). Despite commercialization and privatization, despite the fact that EOSAT and SPOT have maintained a steady increase in the price of their data, their prices do not reflect the true cost of producing the data.

Table 1

**WORLDWIDE REVENUES OF EOSAT and SPOT (1986-1989)**

*(Revenues in Millions $US)*

<table>
<thead>
<tr>
<th>Year</th>
<th>EOSAT</th>
<th>SPOT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1986</td>
<td>19.0</td>
<td>5.0</td>
</tr>
<tr>
<td>1987</td>
<td>21.0</td>
<td>10.0</td>
</tr>
<tr>
<td>1988</td>
<td>23.0</td>
<td>16.0</td>
</tr>
<tr>
<td>1989</td>
<td>25.0</td>
<td>22.0</td>
</tr>
</tbody>
</table>

Judging from the revenues of the two companies in the past four years, the rapid annual increase in SPOT revenues is apparent. In fact, if current trends continue, SPOT annual revenues may surpass EOSAT within the next few years. But determining the success of a commercial remote sensing program goes beyond a mere comparison of annual revenues.

According to Harr and Kohli (1990), determining the cost of data for a truly commercial i.e., self-supporting remote sensing system is based on the cost of construction, launch, and operation of the satellite system. Determining these costs accurately is a difficult process. Harr and Kohli (1990) suggest the following components in determining the cost of a satellite system:

- Cost for design and manufacture of the satellite,
- launch costs,
- ground station costs;
- cost of data processing equipment and distribution.

The costs for design and manufacture of a complete remote sensing satellite system range from $60 million to $300 million. This wide range depends on the desired technical capabilities. For example, a satellite designed with sensors that cover only a few spectral bands and a low ground resolution will cost much less than one that generates data in multiple spectral bands with very high resolution.

According to Harr and Kohli (1990), the cost for launching a satellite on the US space shuttle in 1985 was $38 million. The following year, NASA set the cost at $53 million. Furthermore, the US

Following the explosion of the US space shuttle, Challenger, in 1986, the US space program was brought to a standstill. Small commercial Expendable Launch Vehicles (ELV), such as Ariane and Delta, were seen as an alternative to the space shuttle. However, the cost of launching a satellite with an ELV vary with the weight of the satellite. According to Harr and Kohli (1990), the price for shared launch on Ariane was initially fixed between $30 million and $35 million per customer, for a shared launch. In 1988, the price jumped to $42 million. The price for a dedicated launch (a single payload) on Delta was set at $50 million. Prices for commercial launches on ELVs eventually stabilized at $5,000-6,000 per kilogram. At these rates, the cost for launching SPOT-2, for example, which weighed 1870kg, would have been between $9 million and $11 million.

It is difficult to determine the costs of a ground receiving station, as well as equipment for processing, analyzing, storing, retrieving, and distributing the data. In the first place, most of the existing ground receiving stations today are government-owned and were built before the trend towards commercialization and privatization. Current arrangements are that the host government is fully responsible for installing a ground receiving station as well as for equipment for processing data. EOSAT charges an annual fee of $600,000 as royalties from each ground station that receives Landsat data. After that the receiving station is, according to EOSAT's Director
of International Sales for Africa and the Middle East, "... free to sell the data or do anything they want with it. It is theirs" (Ferguson, 1990).

On the other hand, perhaps because it maintains copyrights to all data gathered by its satellites, SPOT assesses variable royalty payments for transfer of raw data to third parties. Given the absence of international regulations with respect to the copyright of remote sensing data, the unauthorized use of copyrighted remote sensing data may develop and proliferate in the future, thus, introducing a new issue for policy makers. A ground station that receives data from both Landsat and SPOT must satisfy the separate financial arrangements with both companies.

Given the preceding, it is clear that from a purely operation-for-profit point of view, current revenues of EOSAT and SPOT do not reflect the true cost of acquiring and processing. Consequently, officials at both companies agree that future price increases are inevitable (Ferguson, 1990; Clark, 1990). According to Ferguson (1990), there are two communities of users that complain most about data prices: developing countries and academic institutions who buy satellite data for academic research. According to SPOT's Director for Corporate Communication, future increases in the prices for SPOT data will be determined largely by the trend towards "... packaging data (according to the needs of individual users) into ready-to-use form, as opposed to the sale of CCT's" (Nelson, 1990). In any event, the consensus in both companies is that the prices for data can only go up, at least for now.
About the prospects for EOSAT to become self-supporting in the near future, Ferguson (1990) states:

When we [EOSAT] inherited this system from the government, they had one satellite operating, Landsat 5. Landsat 4 which had malfunctioned had been turned off. It cost the government $36 million per year to operate that one satellite. We repaired and reactivated Landsat 4 and now operate both satellites at $18 million a year. That is hard, cold evidence of the efficiency of private operation. We have an agreement with the government to provide us with operating funds, $18 million a year till 1994 or 1995. At that time we expect to be operating the satellites on our own, with all funds coming from the sale of data. We are optimistic about it and that's all of our planning (Ferguson, 1990).

In assessing the potential for success of a third commercial remote sensing system, Harr and Kohli (1990) state that:

The existence of two competing systems reasonably guarantees encouragement and support for the user from the satellite operators. ... Establishing a third satellite remote sensing service offers no clear advantage at present. ... A new system would have to develop new markets by offering either new technological developments or exclusivity (p. 22-23).

However, the authors go on to note that the US Department of Commerce is exploring options for a commercial advanced Earth remote sensing satellite system beyond Landsat-6. Furthermore, the experience gained with Japan's interest in ocean observation could provide the basis for developing new markets that are currently not served by either SPOT or EOSAT.
New Markets and Products: Broad (1989b) reported that the CIA and other federal agencies in the US, as well as the UN Division of Narcotic Drugs, were using satellite data from Landsat and SPOT to map out fields where crops used in the manufacture of illegal drugs are cultivated in South America and in Thailand. Presumably, the goal of these agencies is to define these fields clearly along with the maze of clandestine air strips, roads and factories, run by the illicit drug industry, and target them for destruction. The use of satellite data for international law enforcement should come as no surprise to the observer who is familiar with the history of military reconnaissance described in Chapter Two.

According to George May, director of the NASA sponsored Space Remote Sensing Center and the Stennis Space Center in Mississippi (USA), a couple of hours after an unexpected severe drop in temperature, bank officials can use satellite data to determine the extent of crop damage resulting from the freeze and estimate, with some accuracy, reassess the ability of farmers to repay loans obtained from banks. Similarly, satellite data about the nature of the soil in a specified area can be used to determine whether a farmer gets a loan from the bank or not (May, 1990).

In the 1970s, the market for satellite data was comprised primarily of a few government agencies, industry, and academic institutions. In the United States, for example, some of the government agencies that used satellite data most were the Departments of Interior and Agriculture, and the US Geological Survey. Other government agencies such as the US Agency for
International Aid, started to use data for various overseas projects. Thus, it was predominantly a government market.

After the privatization of the Landsat system and the entry of SPOT into the image market, the private sector began to represent an increasingly significant segment, compared to government agencies, of the market for remote sensing products and services. According to Ferguson (1990), private firms such as fast-food chains, real estate firms, banks, agricultural businesses, and others, are finding satellite data an essential part of their businesses. Thus, Bescond (1989) notes, "...satellite-based remote sensing has evolved from a series of government-sponsored development projects, beginning in the 1950s, to a rapidly growing commercial industry" (p. 289). Today, EOSAT and SPOT list the applications for their data to include the following:

- Agriculture/Crop Analysis
- Forestry
- Coastal Studies
- Hydrography
- Engineering
- Cartography
- Media, etc.

Their customer base includes engineering firms, urban planners, environmental consultants, fast food franchisers, market analysts, timber/pulp and paper firms, oil and gas companies, aerial photography firms, mapping agencies, and the list continues to grow longer.
While it makes sense that most of the groups of private users listed here may need satellite data, the casual observer might wonder what fast food chains do with remote sensing data. It certainly is not needed to improve the taste of their burgers! Fast food chains, each competing for a greater market share, have found satellite data useful in tracking changes in the network of interstate highways, enabling them to establish new outlets at strategic road interchanges. But the use of satellite imagery for this purpose was not the idea of fast food moguls.

In the early years of civilian remote sensing, those in charge of the Landsat system apparently waited for those who thought the technology could be of use to him/her to approach them. Upon transfer of the system to EOSAT, or perhaps in response to the government's challenges that the company become self-reliant within a few years and/or the entry of SPOT into the image market, or any combination thereof, EOSAT, like SPOT, is increasingly becoming a marketing company, not just a service provider. EOSAT's Ferguson described this change as follows:

One of the biggest problems with remote sensing from the beginning has been that is has been considered to be some sort of esoteric, mysterious technology. It has been treated that way for at least a decade. Anyone who used remote sensing was a research scientist or academician or someone from the government agencies who had a PhD in Geology or Physics. They were the remote sensing specialists. They created a language which protected their profession, making the user reliant on the specialist because he/she (the user) cannot understand the language or thought processes that are used to yield results from the data. What we have done at EOSAT is to demystify the technology. We've converted it into a language that any businessman or housewife who's interested in our
products can understand what we're talking about. Rather than trouble the customer with how the technology works we simply say, 'this is the answer to your problem' (Ferguson, 1990).

Besides the switch from a service organization to one that actively seeks out new applications for its products and aggressively markets them, EOSAT, like SPOT, is paying more attention to the private sector. Discussing the effects of commercialization and the focus on the private sector, SPOT Image's former president listed the following at three important concepts emphasized by SPOT:

(i) getting data into the hands of the users quickly and reliably,
(ii) adapting to meet the changing needs of the users and the industry, and
(iii) establishing cooperative working relationships with the value-added industry segment (Bescond, 1989, p. 291).

Apparently in keeping with this shift from service providers to marketing organizations, both SPOT and EOSAT are establishing an impressive list of sales teams both in their respective national headquarters and abroad. SPOT, for example, just signed a contract for a minimum $4.7 million with the US government to supply the Air Force with thousands of scenes that will go into the Air Force's flight simulation systems. According to SPOT's Nelson, it represents "... the biggest (single) contract ever to be signed in the remote sensing industry" and the only reason he could talk about it freely was that it had already been reported in the newspapers (Nelson, 1990).

To conclude, tables 2, 3, and 4, that follow, summarize the preceding analysis. Table 2 is extracted from a study conducted by the UN Center on Transnational Corporation in 1984 that presents a
profile of Landsat data sales in the US, from 1977-1982, by the two types of data that were then available (photographic frames and CCTs) and by the principal customers (government, industry, academia, and individuals). While the percentages of data purchased by academic institutions and individuals remained relatively stagnant during those years, in both categories (photographic frames and CCTs), government purchases declined steadily. Industry purchases increased in both categories.

Table 3 is a worldwide summary of SPOT application markets. A similar summary was not available from EOSAT. What is significant here is that while application markets such as agriculture, mapping, and geology still remain dominant, an increasing number of smaller markets, such as the media, are gradually being added to the list. To serve some of these emerging markets adequately, technical changes will have to be made in future remote sensing satellites. Some of these new applications are also raising increasingly difficult policy issues. Changes in remote sensing technology and domestic policy issues are discussed in the next two sections of this chapter.

Table 4 is a worldwide summary of SPOT Geographic markets in 1989. Europe represents SPOT's largest market, followed by Asia-Pacific then North America. Although a comparative summary was not available from EOSAT, a US Department of Commerce study, released in June 1990, stated that, international sales was the fastest growing market for Landsat data, increasing 46% in 1989. The report for Landsat data indicates that sales of Landsat data to US government agencies were stagnant in 1989, resulting in a declining government

Table 2

**USER PROFILE OF LANDSAT DATA SALES IN THE US, 1977-82**  
(Percentage of Total Value)

<table>
<thead>
<tr>
<th>Type of data &amp; yr.</th>
<th>Government</th>
<th>Industry</th>
<th>Academia</th>
<th>Individuals</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Photographic frames</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1977/78</td>
<td>48</td>
<td>32</td>
<td>12</td>
<td>8</td>
<td>100%</td>
</tr>
<tr>
<td>1978/79</td>
<td>39</td>
<td>36</td>
<td>16</td>
<td>9</td>
<td>100%</td>
</tr>
<tr>
<td>1979/80</td>
<td>35</td>
<td>39</td>
<td>16</td>
<td>10</td>
<td>100%</td>
</tr>
<tr>
<td>1980/81</td>
<td>33</td>
<td>35</td>
<td>12</td>
<td>11</td>
<td>100%</td>
</tr>
<tr>
<td>1981/82</td>
<td>33</td>
<td>45</td>
<td>12</td>
<td>11</td>
<td>100%</td>
</tr>
<tr>
<td>Average</td>
<td>35</td>
<td>41</td>
<td>14</td>
<td>10</td>
<td>100%</td>
</tr>
</tbody>
</table>

| CCTs                |            |          |          |             |       |
| 1977/78             | 46         | 41       | 13       | 1           | 100%  |
| 1978/79             | 35         | 41       | 22       | 3           | 100%  |
| 1979/80             | 30         | 57       | 12       | 1           | 100%  |
| 1980/81             | 35         | 55       | 9        | 1           | 100%  |
| 1981/82             | 40         | 50       | 8        | 2           | 100%  |
| Average             | 36         | 53       | 10       | 1           | 100%  |

Source: UN Center on Transnational Corporation. (1984, p. 27)
Table 3

**SPOT: WORLDWIDE APPLICATIONS MARKETS, 1989**
(By Percentage)

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mapping</td>
<td>30%</td>
</tr>
<tr>
<td>Vegetation Studies, Forestry, Agriculture</td>
<td>20%</td>
</tr>
<tr>
<td>Geology, Non-renewable Resources</td>
<td>18%</td>
</tr>
<tr>
<td>Engineering/Construction</td>
<td>8%</td>
</tr>
<tr>
<td>Urban Planning</td>
<td>4%</td>
</tr>
<tr>
<td>Coastal Studies</td>
<td>3%</td>
</tr>
<tr>
<td>Media</td>
<td>2%</td>
</tr>
<tr>
<td>General Public</td>
<td>2%</td>
</tr>
<tr>
<td>Other</td>
<td>13%</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

Source: SPOT Image Corporation, Reston, Virginia

Table 4

**SPOT WORLDWIDE GEOGRAPHIC MARKETS 1989**
(By Percentage)

<table>
<thead>
<tr>
<th>Region</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Europe</td>
<td>39%</td>
</tr>
<tr>
<td>Asia-Pacific</td>
<td>24%</td>
</tr>
<tr>
<td>North America</td>
<td>21%</td>
</tr>
<tr>
<td>Africa</td>
<td>9%</td>
</tr>
<tr>
<td>Latin America</td>
<td>4%</td>
</tr>
<tr>
<td>Middle East</td>
<td>3%</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

Source: SPOT Image Corporation, Reston, Virginia
**Advances in Remote Sensing Technology.**

An intricate (technical) description of the advances that have been made in remote sensing technology is unnecessary and beyond the scope of this study. Nevertheless, the emergence of some markets and products can be attributed partially to advances in remote sensing technology. Furthermore, some remote sensing policy issues did not emerge until the present generation of satellites were put into orbit. Consequently, a minimum overview of advances in the technology will bolster understanding and analysis of the policy making process.

Early military reconnaissance satellites of the Cold War era were equipped with bulky cameras that took pictures of the land surfaces they flew over. They were designed to eject their film which was recovered in mid-air or in the ocean by low flying aircraft. The pictures they yielded were often coarse. A significant breakthrough in the technology came when the satellites were equipped with onboard digital processing devices. Thus, instead of film that had to be ejected and recovered for processing, data were collected and stored onboard the satellite, then transmitted by radio waves to receiving stations on Earth.

The above process entails the collection of solar radiation from land surfaces or radiation emitted by the satellites and reflected from land surfaces. To achieve this, the satellite is equipped with "sensors" capable of picking up such forms of radiation and using this radiated energy to reconstruct images of objects located in the areas reflecting this energy. But not all materials reflect energy in the same way. For
example, a desert will reflect radiation of a certain wavelength while a forest will send back a different wavelength. Consequently, it became necessary to use sensors that were capable of responding in diverse bands of the electromagnetic spectrum in order to formulate different maps according to an array of conditions.

There are two basic types of sensors used for remote sensing: optical sensors and microwave sensors. Optical sensors are known by a variety of names, such as the Multispectral Scanner Subsystem (MSS), the Return Beam Vidicon (RBV), the Thematic Mapper (TM), and the High Resolution Visible (HRV). All these sensors measure the solar radiation reflected from land surfaces. Optical sensors are often described as "passive" sensors because they collect solar radiation that is reflected by objects on Earth. The second group of sensors used for remote sensing are microwave sensors. They include the Synthetic Aperture Radar (SAR), the Radar Altimeter (RA), and the Microwave Scanning Radiometer (MSR). This group differs from the first group in that the instrument itself (not the sun) sends down a belt of radiation to the ground which is subsequently collected after being reflected back.

In practice, every surface element detected by the sensors is transformed into a digital electric signal which is then transmitted to Earth. Here too, the details of a the reconstructed image depend partially on the number of bits per second that the instruments on-board the satellite is capable of transmitting. The higher the number of bits received, the more detailed the reconstructed image. Landsat-1 was capable of transmitting 15 million bits per second. The last of the
Landsat series, Landsat-5, currently transmits 85 million bits per second. But the work done by the satellites must be complemented by what is done on the ground.

Ground receiving stations collect the data transmitted by the satellite then computers are used to transform the mass of information into specific images. The general purpose machines used in the early 1970s, fairly restricted in scope, are now being replaced by more modern parallel processors whereby individual computers can concentrate on portions of images. The results are then integrated to produce the final, definitive image. According to an engineer from Hughes Santa Barbara Research Center in California, the company that is building the next generation of Landsat satellites, EOSAT is asking for a very sophisticated system that will generate an enormous amount of data for which there currently exists no processing equipment.

The technical concept that is often heard in discussions about remote sensing is "resolution". A multilingual dictionary of remote sensing and photogrammetry defines the term as "the ability of an entire remote sensor system, including lens, antennae, display, exposure, processing, and other factors, to render a sharply defined image. It may be expressed as line pairs per milliliter or meters, or in many other manners" (Rabchevsky, 1984, p. 178). There are two types of resolution. The first, "spatial resolution", refers to the system's ability to distinguish objects on the ground of varying size. Thus, for example, a system with a spatial resolution of 100 meters can distinguish (identify) objects with a diameter of 100 meters or
larger can distinguish (identify) an object with a diameter of 100 meters or larger.

The second type of resolution, "spectral resolution", refers to the system's ability to distinguish increasingly smaller (textual) differences among the material features of areas overflown. Spectral resolution is determined by the number of spectral bands and signal levels of its sensors. Thus, a system with low spectral resolution may be able to distinguish between a desert and a cornfield but it may not be able to tell the difference between a stack of hay and a missile silo. For example, Landsat-5 has a spatial resolution of 30 meters while SPOT-2's is 10 meters. But SPOT has fewer spectral bands than Landsat. Consequently, if one is making topographic maps or trying to find nuclear missiles in Iraq, for example, applications where spatial resolution is important, SPOT would be a better choice. On the other hand, if one is seeking to isolate different species of trees in a forest, an application where spectral resolution is more important, Landsat images would be the better choice.

Because of these technical differences, officials at EOSAT and at SPOT often say that their products are complimentary, not necessarily competitive. In other words, depending on the application, a user may need both SPOT and Landsat data of the same area, if the task at hand requires data where both the spectral and spatial resolution is high. This may be part of the reason why an increasing number of ground receiving stations are making the necessary adjustments to receive both SPOT and Landsat data. Thus, the US Airforce contract that SPOT was awarded might have had less to do with the
salesmanship of SPOT officials than with the nature of their data and the task to be accomplished. The Airforce needed the data to make topographic maps, hence, SPOT's higher spatial resolution, together with their stereoviewing capability, was obviously more desirable than Landsat's greater spectral resolution.

To summarize, remote sensing technology has advanced considerably since the early 1970s. These technical advances and the sales orientation of the industry, are creating new products and new markets. But changes in technology and the emerging markets have been made possible, in part, by changes in policy. The next section will discuss changes in domestic policy.

**Domestic Policies and Practices.**

Perhaps the most pertinent remote sensing issues that domestic policy makers have and continue to grapple is resolution; particularly spatial resolution. Just what resolution is permissible for civilian remote sensing satellites?

Landsat-1, launched in 1972, had a resolution of 80 meters. Today, Landsat-6 has a resolution of 30 meters. SPOT-2 has a resolution of 10 meters in the panchromatic (black and white) band and 20 meters in the multispectral band. Soyuzkarta's images are said to have a resolution of 5 meters. Landsat-6 will have a resolution equivalent to SPOT's. Was the policy decision to allow for a higher resolution made to fulfill the needs of specific market segments that need data with higher resolution, or was it made to make Landsat more competitive with the other remote sensing programs?
Policy concerns about the capabilities of civilian remote sensing may have arisen in part from the countless stories that are told about the capabilities of military reconnaissance satellites, especially since there is generally no official indication of what military satellites can or cannot see.

For instance, there is the tale of the role of military reconnaissance satellites in plotting the abortive attempt to rescue 52 Americans held against their will by Iranian students at the American embassy in Iran, for more than one year, towards the end of the Carter Administration. The story is that a picture taken by military reconnaissance satellites was used to plot the route into the occupied embassy. In some pictures, the story goes on, the resolution was so good that a photo interpreter could tell one Iranian mullah from the other. Other stories say satellites can tell whether a cat crossing the road is a male or female, that satellites can read automobile license plates. One story that seems to be popular with the media reports that there is a satellite photo of a man on a street in Siberia holding a newspaper and that one can make out the name "Pravda" on it.

What these claims have in common, whether the claims are true or not, is that they say little about the satellites' resolving power. Nevertheless, in many instances, they say more about advances in remote sensing technology. What may surprise a critic is how some of these myths are passed on by even well-informed observers. For instance, a respected author, who writes frequently on the subject, states that "... the most powerful of these (spy) satellites is said to be able to spot license plates on cars and trucks" (Broad, 1990, p. A5).
Besides the fact that license plates are mounted vertically, which would make them hard to read from space, even if one were laid out flat, the resolution of a spy satellite would not be good enough to read it. A ground resolution of two inches does not mean that one can read letters that are two inches tall, rather, it means that an object two inches wide can be distinguished from its background. A spatial resolution of 15 feet would not be enough to indicate whether a car is a Toyota or a Ford, but just that there was an object the size of a car.

Given the preceding, a legitimate question is why no one in the military moves to correct these rumors. According to a former photo interpreter at the CIA, no one moves to correct these rumors because to do so might reveal the true capabilities of military satellites. He also suggests that the intelligence community has a tendency to try to make itself look better than it really is. Consequently, if the public is led to believe that the CIA can read license plates from outer space, then that is just fine with the agency (NOVA, 1987).

The available literature suggests that the US may be the only nation that has formal (written) domestic guidelines on civilian remote sensing that are currently in effect. Still, some of the daily practices of other nations that have remote sensing systems may indicate what their domestic guidelines would be like. On the other hand, the US Landsat Commercialization Act of 1984 may have had more to do with the terms of the contract that transferred the Landsat system to EOSAT than with the policy issues that were being discussed at the UN. The opening paragraph of the official legislative history of the Landsat Act clearly states that "the purpose of the bill is to provide a
framework for a phased, orderly commercialization of land remote sensing technologies". However, the Act is generally considered US policy because it also "... includes provisions for appropriate Government regulation of private land remote sensing" (US Code, 1984b, p. 658).

Perhaps aware of the role that military reconnaissance satellites played during the Cold War era, particularly in the 1960s, shortly before Landsat-1 was launched, the US government announced to the UN General Assembly that it was launching a scientific satellite for the study of Earth resources. The skepticism and concern that was expressed by most nations at the UN is understandable. It was, after all, the first Earth resources satellite.

Apparently anticipating such skepticism, the US government announced that Landsat-1 would be operated under the policy of "open skies", meaning it would be free to drift over any territory and the data obtained would be available to all countries on a "nondiscriminatory" basis. This, the "open skies", "open access" policy under which SPOT claims to be operating today, was originally proposed by the US "Nondiscriminatory" is defined in the Landsat Act as meaning "without preference, bias, or any arrangement that favors any purchaser or class of purchasers over the other" (US Code, 1984b, p. 667). However, consultants paid by the US Department of Commerce, in 1988, to conduct a series of studies on future remote sensing systems, recommended in part that the "nondiscriminatory" policy be reviewed, as it may be profitable for a commercial operator to provide

In essence, the policy of "open skies" and "nondiscriminatory access" blunted international criticism of fact that US satellites are collecting data about nations, without their consent, while the debate at the UN was underway. But according to the above recommendation, nondiscriminatory access to data may not be in the best interest of a private, commercial operator.

The Landsat Act also acknowledges that commercial remote sensing practices may conflict with US "national security" interests, and "international obligations". However, no attempt is made to define or explain the concepts of "national security" or "international obligations". Nevertheless, the Secretary of Commerce, who is authorized to issue remote sensing licenses to US operators, is also authorized to deny a licence if there is reason to believe that it will not be in the national interest to issue one. Additionally, the Secretary of Defense is authorized to censor data, if it is believed that release of the data to the public will not be in the national interest.

In the 1970s, a presidential decree limited the acceptable spatial resolution of US civilian remote sensing satellites to a maximum of 30 meters. Apparently, the concern was that images obtained by civilian satellites, with sharper resolutions, could reveal national secrets. However, when SPOT-1 was launched, with a resolution of 10 meters, US policy makers were urged to consider relaxing restrictions on resolution. Future systems, with higher resolutions, have since been approved.
It may be worth noting that the US government simply "relaxed" (not removed) its rules. For instance, the penalties and prison terms for violating national security remain unchanged in the Landsat Act. The government has chosen not to emphasize those provisions for now but they can be invoked at any time.

The interaction between policy, technology, and market forces is most apparent in the case of the use of satellite imagery by the news media. According to SPOT's worldwide market by application, use of remote sensing satellite imagery by the media represented only 2% of the total market for 1989 (See Table 3). Still, the prospects of such a small market, made possible by high resolution imagery, generated a storm of debate in the US. On one side, the Department of Defense is concerned about the possibility that unrestricted use of satellite imagery by the media could jeopardize US national security. On the other hand, representatives of the media point out that to subject the media to censorship, on the basis of ill-defined guidelines on national security, would be a violation of their First Amendment rights (Aamoth, 1986; Borg, 1988; Brender, 1989; Covault, 1984; De Santis, 1989; Eberhart, 1987; Friedman, 1988; Glaser & Brender, 1986; Reimer, 1988; Scharff, 1989; Zimmerman, 1989).

Besides the conflict between national security and First Amendment rights, another issue that may emerge, when the new generation of satellites begin providing high resolution imagery, will be complaints about possible violations of privacy (Lipschultz, 1988).

There is no evidence to suggest that the French have had the type of extensive discussion on domestic policy that have been going
on in the US. According to officials at SPOT Image Corporation, the company operates in accordance with UN guidelines. The French government is satisfied with current international guidelines and sees no need for separate domestic rules. SPOT emphasizes its adherence to the policy of "open skies" and "open access". Open access is essentially the same as "nondiscriminatory access" in the Landsat Act.

To make sure that "open skies, open access" literally means what SPOT says it means, an official of the company was asked during an interview if they would release data about France, knowing well that the data requested was about a specific military installation in France where public access is restricted. Apparently to make the point clear one more time, he said, attempts have been made by the Carnegie Endowment for International Peace to investigate what SPOT means by "open access". The Endowment supposedly put in "blind" orders for SPOT imagery on various regions of France, including classified areas such as the Plateau d'Avignon. According to the official, the imagery was provided as requested. He went on to point out that orders for satellite data from SPOT are fed into computers as numbers, thus, the significance of the area about which the data is being requested may not only be known to the customer requesting the data, not SPOT's computer operators (Nelson, 1990).

However, a few months after the interview, William Broad, (writing in the New York Times about the potential for war between the US and Iraq) mentioned that Iraq could use SPOT imagery to reveal the location of American forces. Broad quotes SPOT official who was interviewed earlier as saying that SPOT will not sell Middle
Eastern imagery to the media, given the possibility of a military confrontation (between the US and Iraq) in the region. Said the official, "We [SPOT] have decided not to get involved in the current situation" (Broad, 1990).

What is significant in the preceding paragraph is not the wisdom of SPOT's decision to withhold imagery that has military implications in a situation of potential conflict between nations. What is doubtful is the extent to which SPOT is consistent in maintaining its policy of open skies, open access. There are very obvious inconsistencies between SPOT's stated policies and actual adherence to those guidelines.

Appendix E is a chronology of news media use of SPOT imagery, released by the company, as part of a package designed to promote its products. The implications of the contents of the list, vis-a-vis SPOT's apparent volte face from its stated data distribution policies, are apparent. SPOT did not hesitate to release satellite imagery of the Middle East to the media when there was a war actually going on between Iran and Iraq. There was no hesitation in releasing imagery of an alleged chemical weapons plant in Libya that the US government was threatening to bomb. Images of Soviet locations that have been sold to the media are numerous and the list speaks for itself. See Appendix E.

Given the preceding, the following may be asked of SPOT's data release policies: Is it just a matter of coincidence that images of military installations in France or the US are not included in the above mentioned list or is the media simply not interested in US or French
missile sites? Is SPOT guided by some unwritten (informal) domestic guidelines or does "open skies, open access" literally mean what SPOT says it means? Perhaps the answers to these questions will emerge in the near future when other nations launch competing remote sensing systems, i.e. when the sources for imagery become numerous and cut across different political philosophies.

The Soviet Union, together with a group of Soviet bloc nations, signed a remote sensing agreement in 1978. According to this agreement, the Soviets will not to release data about these nations to third parties without their consent. In essence, the Soviet bloc agreement appears to have been designed to make sure that data about sensed nations is not made available to third parties without the approval of the sensed nation -- a position the Soviets had advanced at the UN since the early-1970s. For a more detailed discussion of the Soviet position at the UN, see the section entitled "Controlled Dissemination" in Chapter Four.

According to a Soviet official who participated in the policy negotiations at the UN, the Soviet bloc agreement is still valid but is generally disregarded (Kolossov, 1990). The Soviets are increasingly interested in providing satellite data to the public on a commercial basis. The data distribution policy of the Soviet remote sensing agency, Soyuzkarta, is not clear. It is said that Soyuzkarta's policy is that the agency will provide data about a specific country only if the request originates from an address in that country. In other words, Soyuzkarta will sell data about the US, for example, only if the request originates from the US.
If current Soviet domestic remote sensing guidelines are designed to be in accordance with the provisions of the 1978 Soviet bloc remote sensing agreement, then the shortcomings of these guidelines are evident. For example, what is there to guarantee that a request for Soviet data about a specific country meets the approval of the sensed country, even if that request is sent from an address in that country. What, for example, is the guarantee that a request for Soviet data, submitted by a US-based media organization, about specific US military installations, is not against US domestic guidelines? In conclusion, the intertwined relationship between policy, technology, and market forces is evident, especially in the case of the US where there is a clear distinction between the three factors. However, the domestic policies and/or practices of the few countries discussed here are obviously inadequate to deal with their own national concerns, not to mention the concerns of the global community of nations. Some of the domestic guidelines discussed here conflict with competing interests within the same country such as the apparent conflict between national security and freedom of the press in the US.

Given the apparent difficulties in resolving the conflicts in communication rights among different social groups, within the same national boundaries, balancing conflicting rights among nations is understandably more difficult. But the fact that remote sensing is a global technology and that sensing is an activity that does not recognize national political boundaries, nations involved in the UN debate continue to cling to the hope of a more adequate international
regime, despite profoundly different views about remote sensing among them.

The next chapter analyzes the UN remote sensing principles of 1986, with particular attention to how the principles address the key issues/questions that were raised in COPUOS.
CHAPTER VI

ANALYSIS OF THE UN REMOTE SENSING PRINCIPLES OF 1986

The current international principles relating to remote sensing of the Earth from space were negotiated and agreed, by consensus, in the Working Group of the Legal Sub-Committee of the United Nations Committee on the Peaceful Uses of Outer Space (COPUOS). The Working Group reached agreement in April 1986, and the principles were endorsed by COPUOS and adopted by the UN General Assembly in the same year (UN COPUOS, 1986d).

This chapter is an analysis of the principles with regard to how they address profound disagreements on basic issues raised during the debates over many years of negotiations. Appendix F is a complete text of the principles, thus, sections of the text will be quoted throughout this chapter without the need to cite the specific source of the principles, repeatedly. The process of negotiation that led to adoption of the principles is discussed in Chapter Four.

Major obstacles to reaching an agreement arose out of the conflict between the demands of developing and socialist countries that the acquisition and dissemination of data be subject to the approval of the sensed countries and the opposition of the United States and other western countries to any restrictions on data collection and distribution. The current principles apparently permit
worldwide collection and distribution of data. There are also provisions in the principles to ensure that sensed states have access to data of their countries.

Note although the principles were adopted by consensus, many countries express varying degrees of satisfaction with the principles. The Committee's report to the General Assembly notes that some delegations expressed the view that, while the agreed principles were an acceptable compromise, they would continue to work on the principles so that the concerns of developing countries would be more adequately met (UN COPUOS, 1986d, 1986h).

According to the Director of the Outer Space Affairs Division at the UN, because of the reservations of some countries, the principles were given the status of a General Assembly resolution rather than a more formal "declaration of principles" or a legally binding international treaty. Furthermore, although there have not been any efforts to upgrade the principles to any stronger status, a number of countries have reiterated their continuing concerns (Jasentuliyana, 1988).

The road to consensus within COPUOS was a result of many years of frustrating negotiations. The plethora of issues raised by remote sensing activity were initially examined at the First UN Conference on the Peaceful Uses of Outer Space in Vienna in 1968. Argentina was the first nation, in June 1970, to submit a formal draft to govern remote sensing. A working group was then established within the Legal Sub-Committee of COPUOS to work out rules which would be acceptable to COPUOS members (Chipman, 1990). From the
outset there was disagreement on fundamental policy guidelines which should apply to remote sensing activity.

Various draft proposals that were submitted can be classified under three categories:

1. A number of proposals called for the operator of any remote sensing system to obtain the consent of the sensed state(s) before sensing would occur. The thinking here was that since other UN resolutions provided that states have permanent sovereignty over their own natural wealth and resources, information about these physical assets was included in the concept of sovereignty. Accordingly, prior consent of the sensed state was necessary so as not to violate its sovereign rights.

2. A second group of proposals, while not requiring prior consent, called for provisions that would guarantee the sensed state priority access to data about its territory. Furthermore, the sensed state would have the final decision as to distribution of data, obtained over its territories, to third parties.

3. A third batch of proposals rejected most of the provisions in the above two groups of proposals for being inconsistent with the provisions of the Outer Space Treaty which provide that space be free for exploration and use by all states without discrimination. Appendix G is a complete text of the UN Outer Space Treaty of 1967. Parts of the treaty will be referred to without repeated citations.

The remote sensing debate emerged primarily as a result of failure to reach agreement on two crucial issues: state sovereignty
and freedom of information. Specifically, any set of principles would have to address the following questions:

1. Is information about natural resources located in any state inherently part of those resources?

2) What proprietary rights, if any, does a sensed state have to information retrieved about its territories?

3) How much freedom should a remote sensing operator, or his nation, have in distributing information about other nations to third parties?

It is worth noting that these issues arose in the early 1970s, at the beginning of the remote sensing debate. As membership in COPUOS expanded and the value of the derived data and its interpretation increased with more sophisticated sensors, reaching agreement on these issues apparently became increasingly difficult. According to DeSaussure (1989), the only real significance of the principles adopted in 1986 may be that they express the desire of the UN to achieve international harmony since "... each member of the UN is left virtually unfettered discretion to establish its own remote sensing regime. Uniform regulation is not mandated. As long as nations prescribe laws for their own territories or citizens" (pp. 367-358). However, as has been established in previous chapters, remote sensing from space is a global activity. The adoption of the principles, despite the continuing concerns of some states, clearly indicates the need for international compatibility in rules when domestic rulemaking extends to activities beyond territorial borders.
Principle I of the UN principles defines "remote sensing" as the sensing of the Earth's surface from space for the purpose of "improving natural resources management, land use and the protection of the environment". In the past, some countries, particularly the Soviets, objected to including the word "environment" in the definition because that could be taken to encompass human activity as well. The United States and other western nations have interpreted "natural resources" to include the entire physical environment, including human activity. Some earlier drafts excluded any reference to the environment from the definition, while others did not include the phrase "the protection of the environment" (see, for example, UN COPUOS 1975a through 1979f). As finally approved, the scope of activity included in the definition remains an issue for unilateral definition.

According to the Director of the Outer Space Affairs Division at the UN, "the most dramatic development in satellite remote sensing since the Principles were adopted has been the growing interest in and use of high-resolution satellite imagery by the news media" (Jasentuliyan, 1988, p. 2). Most US television news viewers have probably seen some published images of burning nuclear reactors, strategic submarine bases, rocket launching sites, and middle-Eastern military constructions, to name but a few. Indeed, Appendix E is a chronology of news media use of SPOT imagery.

It is not clear whether the remote sensing principles legitimize the acquisition, distribution and publication of such images or not. According to Jasentuliyan (1988), part of the purpose of a restrictive
definition of remote sensing was presumably to ensure that the principles would not give countries a right of access to data from other countries' surveillance satellites. Since surveillance satellites have always been closely held, they have aroused little protest. It is possible that the situation could change as civilian remote sensing operators increasingly make available surveillance-type data to anyone who can pay.

It is important to point out that the preceding is not necessarily an indication of the wish to argue that the publication of sensitive political pictures is necessarily bad. Indeed, a strong case could be made for the benefits of broad public access to such information and for the view that complaints generally derive from a desire for secrecy that is not in the broader public interest.

Principle I also defines the terms "primary data," "processed data" and "analyzed information". Primary data are the raw data acquired by remote sensing sensors. Processed data are the products resulting from the enhancement of the primary data. Analyzed information is the processed data transformed by its interpretation and combination with other information. Simply stated, remote sensing data is potentially most beneficial to users who possess the sophisticated technical capabilities and manpower, together with other information sources, that are required to transform primary data into analyzed information. Most developing countries lack these capabilities. While these three classifications of data are useful, they are not particularly significant since the provisions for distribution, in Principle XII, seem to be the same for each class of data.
Principle XII is generally considered to be the heart of the UN principles. It provides that the sensed state shall have access to the primary data and processed data concerning its own territories "on a non-discriminatory basis and on reasonable cost terms" as soon as such data is produced. In addition, the sensed state shall also have access to available analyzed information concerning the territories on the same terms, with due regard to the needs of developing countries.

The fact that sensed states are entitled to data and information about their territories on an equal basis with other states would seem to negate any inference that permanent sovereignty over one's own wealth and resources includes data derived from remote sensing activity. If such data were included within the concept of sovereignty, the sensed state would be entitled to exclusive, first use of it. Given the increasing significance of satellite data, coupled with the trend toward privatization and commercialization, Principle XII leaves several questions unanswered. For example, if the sensing state or a private entity under its national jurisdiction, elects to retain exclusive possession of data obtained by its satellite(s), can it for economic, military, or other reasons deny access to the data by sensed states? Who has proprietary rights over data, the sensing or the sensed state?

Those who favor sensing and dissemination of data without any restrictions argue that in the absence of access to the resources on the ground, the tentative information that could be obtained from interpretation of satellite data is of little use. In other words, since the sensed country ultimately controls ground access to its resources,
the fears that developing countries expressed of aggressive exploitation of their resources, by developed countries, to their detriment, were exaggerated (Hodgkins, 1990; Pisani, 1990; Freudenschuss, 1990). However, as the delegate from Chile put it:

countries like mine have a lot of resources and would like equal standing in negotiations with transnational entities that normally know where our natural resources are located. Given the significance of our natural resources to us, it is very important that we have equal and adequate information during negotiations. ... If you judge these principles on a wider context, it is a question of moral as well as legal obligations" (Gonzalez, 1990).

Principle II calls for remote sensing activities to be carried out "for the benefit and in the interest of all countries, irrespective of their degree of economic, social or scientific and technical development, and taking into particular consideration the needs of developing countries". The language of Principle II is essentially the same as contained in Article I, paragraph 1 of the Outer Space Treaty.

Principle III is also repetitive of existing space law. It provides that remote sensing activities shall be conducted in accordance with existing international law, the UN Charter and other relevant treaties. The language is virtually identical to Article III of the Outer Space Treaty.

Principle IV provides that remote sensing be conducted in accordance with the principles contained in Article I of the Outer Space Treaty, a requirement already stated in Principle II. However, Principle IV adds a provision which is not repetitious and could open up more debate on the sovereign rights of sensed states. It provides that remote sensing be conducted with respect for the principles of
full and permanent sovereignty of all states and people over their own wealth and natural resources.

According to Gonzalez (1990), UN General Assembly Resolution 1803, adopted in 1962, gives states permanent sovereignty over their natural resources. This resolution is the basis for the insistence by some countries that remote sensing not be conducted in a manner detrimental to their legitimate rights and interests. It is plausible that refusal to share data with sensed states could rekindle the debate on sovereign rights. What is common in principles II through IV is not only the fact that they are merely restatements of previous agreements on the use of outer space, more significantly, there is no conversion of these general expressions into specific rules.

Principles V through VIII are mainly exhortations for participating states to cooperate. Principle V, for example, calls for joint ventures, by two or more states, to be pursuant to "equitable and mutually acceptable terms". Principle VII adds that such arrangement must be made through "mutually agreed terms" or by "international cooperation", as stated in Principle VIII. It is not clear whether the UN Principles view the issues raised by remote sensing activity as issues that can be addressed only by global agreements since the provision in Principles V through VII appear to leave ground for bilateral and multilateral agreements.

According to Jasentuliyana (1988) "while these appeals for international cooperation are too general to have any legal authority, they emphasize the importance of such cooperation" (p. 7). Indeed, most remote sensing operators, particularly commercial operators,
express the need to increase global use of remote sensing data in order to make the operation of satellite systems as financially self-sufficient as possible. Hence, it could be argued that the development of capacities to use the data for economic development in all countries will be to the benefit of all concerned. The US, for example, apparently used its policy of "nondiscriminatory access" not only as an indication of its willingness to cooperate but also to prevent or diffuse controversies that arose from its satellites observing other countries. But that was before 1984 when the decision to transfer control of its satellites to private, commercial operators introduced a new set of issues. Consequently, any emphasis on international cooperation must take into account the fact that the private sector does not view remote sensing as a charitable enterprise. The challenge is to make international cooperation beneficial to all participants.

Principle IX requires, among other things, that satellite operators "make available any other relevant information to the greatest extend feasible and practicable to any other State, particularly any developing country that is affected by the program, at its request". Standing alone, this principle could be viewed as one that entitles the sensed state(s) to nothing more than that which the sensing state wishes to make available. If there is any obligation for the sensing state to release more than raw data, it must be found, for example, in Principle IV, which calls for respect of the principle of full and permanent sovereignty of states over their own wealth and resources.

There appears to be little disagreement over Principles X and XI, both of which require sensing states to disclose any information
which could help another state avert or mitigate a natural disaster or avoid harm to the Earth's natural environment. Presumably this would include more than raw or primary data. It would include the processed and analyzed product as well.

Principle XIII calls for sensing states to consult with sensed states to make available opportunities for participation. Despite the increasing trend toward commercialization the role of the private operator is not mentioned. Does EOSAT or SPOT, for example, have a public duty to consult with sensed states? If so, what are they obligated to disclose? In which categories of data -- raw, processed, analyzed -- may the private operator place, withhold, or restrict dissemination? In the past few years, commercial operators have had to make arbitrary decisions regarding the above questions. Apparently, their decisions are based on what they believe is in the interest of state with jurisdiction over their remote sensing licenses. However, it is reasonable to expect that a private operator will not be enthusiastic about divulging all of its objectives, its know how, or the results of its investigation with officials of a foreign government.

Principle XIV recognizes state responsibility for national remote sensing activities in space whether conducted by government, non-governmental, or private entities. This provision complies with Article VI of the Outer Space Treaty. According to this provision, as far as the international community is concerned, the United States, for example, is responsible for EOSAT's remote sensing activities. Despite the fact that the SPOT program is a joint venture between France, Sweden, and Belgium, the French are generally presumed to
be responsible for the program, perhaps because they own the
greatest number of shares in the program.

It could be argued that that increasing trend toward corporate
takeovers, joint ventures, and other forms of shared ownership in
global telecommunications may make it difficult to determine the
party/parties that are liable for such joint ventures. For example,
suppose the government of Burkina Faso was interested in setting up a
remote sensing program. However, due to the high start up costs, a
private businessman in Japan is approached for partnership in the
program. The two parties pay a Canadian firm to build their satellite
which is subsequently put into orbit by China. The contract to operate
the satellite and market the data is awarded to a German firm --
because of its marketing savvy -- which, in turn, decides to set up shop
in the United States because of the large North American market for
satellite data.

The above scenario is complicated, but not totally unimaginable.
Now, superimpose all the issues raised by the policy debates at the UN
over this kind of operation and try to provide answers to the questions
raised in COPUOS. For example, who has jurisdiction over this
program? The government of Burkina Faso, since it partially financed
the program? What about the private businessman in Japan who co-
financed the program? Canada, since they built the satellite or China
that put it into orbit? Maybe the German government, since it is a
program run by a German company. And while we are at it, does the
company has to abide by US remote sensing guidelines, since they are
operating in the US? What if Germany's domestic guidelines are
different from those of the US; should a German company be subject
to US policy? On the other hand, maybe the company should be
subject to the rules of Burkina Faso?

Remote sensing, like other telecommunications ventures, is
becoming an expanding industry in which hundreds of millions of
dollars are invested every year. It could be argued that if we consider
the future of international cooperation in remote sensing, it should be
recognized that such a future does not have to be limited to
cooperation between national programs. More fully international
programs do not preclude an important role for private business.
However, international guidelines for remote sensing do not clearly
define the responsibilities and obligations of private enterprise to the
global community of nations.

In the past, when the international community was faced with
the need for an internationally cooperative satellite system and a
desire to operate the system on a commercial basis, the International
Telecommunications Satellite Organization (INTELSAT) and the
International Maritime Satellite Organization (INMARSAT) were
created through intergovernmental agreements in partnership with
the private industry. Today, some observers believe that this
successful model could be followed in remote sensing, with the private
sector playing a leading role, with companies such as EOSAT and
SPOT playing roles similar to those played by the Communications
Satellite Corporation (COMSAT) in space telecommunications (for
example, see Day, 1991).
The last UN principle on remote sensing, Principle XI, provides for dispute resolution through "established procedures". It adds little to the notion that settlements should be in accordance with international law. While the procedures for dispute resolution, in the context of state practice and international decisions, are well established and are available in a variety of possible alternatives, from negotiation to international adjudication, these procedures may not be relevant in the context of private operators. It can be assumed that a private operator would prefer to settle his disputes within his own national legal system, rather than have his case argued before a foreign court and under an unfamiliar legal system. Furthermore, the effectiveness of international agreements depends partially on the acceptance of individual states to be bound by such agreements and to enforce them within their territories. It can be assumed that most countries will be reluctant to subject private entities within their jurisdiction to international rules that they (states) do not agree with in the first place.

It could be argued that the UN Principles on remote sensing have been left deliberately general and nonspecific in order to provide operators with a large degree of flexibility in constructing their own national regimes. However, a thorough review of early proposals submitted by various countries to the legal subcommittee of COPUOS suggests that the members did not intend such a broad and apparently vague set of rules. These early proposals contained very specific provisions. They are discussed in detail in Chapter Four.
In the absence of a set of international guidelines that are not only widely accepted but also adequate, it appears that the domestic practices of states will be the basis for an emerging customary law in remote sensing. However, as DeSaussure (1989) notes, space exploration is moving fast but "... the luxury of time to develop a customary remote sensing regime is not the same as in the development of maritime law through many centuries" (p. 375). Interestingly, two years after the adoption of the UN principles, the Director of the Outer Space Affairs Division at the UN noted, "it is not clear whether the remote sensing Principles legitimize the acquisitions, distribution and publication of... images or not". Further, while the UN principles on remote sensing were the product of long legal and political negotiations, they are first and foremost "an agreement on economic relations. . ." (Jasentuliyan, 1988, pp. 3 & 9).

In summary, while the preceding analysis is of the UN Principles on remote sensing, the issues discussed are applicable to other developing international telecommunication networks. For example, there is a growing number of computer data banks in which public, corporate, military, financial, scientific and personal information is stored. These data banks can be accessed by a growing number of users from almost anywhere in the world, legally or illegally. Given the fact that different countries have different guidelines on how these data should be treated, i.e., who should have access to which data, it is apparent that some of the issues raised in the remote sensing debate will resurface as modems and personal computers become more
readily available. These issues will include questions regarding the terms of access to information, conditions for restricting access, as well as questions regarding dissemination to other parties.
CHAPTER VII
SUMMARY, DISCUSSION AND CONCLUSIONS

Summary

Communication scholars generally acknowledge that the past 20 or 30 years have witnessed the emergence and gradual worldwide diffusion of a diversity of communication technologies. Today, technologies such as computers, satellites, cable, and a variety of interconnected data networks have enhanced the ability of some segments of the global community to move vast amounts of information from one location to another, regardless of time and space. However, there is uncertainty with regard to the social, economic, cultural, and political impacts of these technologies on human relationships.

The increasing flow of information across national/political boundaries has given rise to a broad range of issues, including questions pertaining to privacy protection, the growth of trade in data services, access to the international data market, to name but a few. Given the various forms of interdependence between and among states, the introduction of remote sensing, a technology that plays a significant role in the exploration, development and management of resources, profound disagreements among nations, over how remote sensing activities should be conducted, emerged when the subject was brought up for discussion at the United Nations.
Orbiting 400 to 600 miles above the Earth, remote sensing satellites are able to make detailed observations of various phenomena on earth, beyond what is visible to human eyes. The information they provide is useful for a wide variety of applications, including: mapping, vegetation studies, forestry, agriculture, geology, non-renewable resources, urban planning, news pictures (media), and coastal studies, to name a few.

Some of the concerns who find remote sensing data useful in their daily activities include: military strategists, urban planners, agricultural market analysis, oil and gas companies, environmental consultants, etc. The significance of remote sensing satellites in human communication lies in the utility of the information they provide in a variety of negotiations such as between transnational petroleum exploration companies and developing countries.

Chapter Two provides a detailed description of remote sensing, beginning with historic models such as "remote sensing" (observations) from tree tops and high hills, from balloons, then airplanes, and finally, the advent of civilian remote sensing from outer space. Note that surveillance from tree tops, high hills, balloons, or airplanes, requires the consent of the sensed state(s) otherwise international law permits the sensed state to intervene and stop the process or even destroy the platform from which the sensing is being conducted—provided that the platform is within the sensed state's territory. In other words, consent of the sensed state is required if sensing is to be conducted from platforms such as balloons or airplanes. While sensing from lower platforms such as balloons and
airplanes can only cover relatively smaller surfaces of the Earth, the whole Earth can be sensed from outer space and in a relatively short time. Yet sensed states have very little or no control over what information is gathered about them. What has changed? At least three changes have occurred.

The first change that has occurred is that remote sensing is not predominantly a tool for gathering military intelligence. Civilian remote sensing is used to gather commercial intelligence. As a tool for gathering military intelligence, remote sensing provides information about military facilities and other targets that can be attacked in case of a war. The development of remote sensing as a tool for gathering military intelligence and the transfer of the technology to the civilian sector are discussed in Chapter Two. As a tool for gathering commercial intelligence, remote sensing is the source of a plethora of information types each with its own unique applications. For example, while scientists can use satellite data to measure the effects of human activity on the global environment and warn us about phenomena such as global warming or depletion of the ozone layer, the same raw data can be used to detect natural resources. And access or lack of access to data is crucial in negotiating contracts for exploiting these resources. Consequently, developing countries who do not have adequate access to satellite data are not willing to let others (industrialized countries) know more about them than they know about themselves. The views of both developed and industrialized countries, with regard to how civilian remote sensing ought to be conducted, are discussed in Chapter Four.
The second change that has taken place is the shift from sensing from lower platforms (balloons, airplanes, etc.) to sensing from outer space, hence the capability of sensing the whole Earth from a single platform. Most states, including developing countries, are capable of detecting a balloon or airplane flying over their territories without their consent. At these lower altitudes, it is possible for most states to intervene and find out what is being sensed and who is conducting the sensing. However, at altitudes of 400 miles or more in space, it is not possible for most states even to know when they are being sensed. The few nations that are in a position to detect sensing instruments at such altitudes are themselves involved in sensing.

The third and perhaps the most significant change that has occurred is the increasing shift from the production and distribution of things to the production and distribution of ideas in post-industrial societies, in other words, the view that an information-based service economy is the natural successor to an industrial-based economy. See, for example, Dizard (1989), Hamelink (1988), O'Brien (1983). Three scholarly approaches that are useful for analyzing remote sensing and provide a framework for illuminating broader issues of communication policy formation are discussed in Chapter Three.

According to Hamelink (1988), during the past two decades, "developments in computer technology have laid the basis for a large, expanding, and profitable industry"--the information industry (p. 4). Dizard (1989) has charted a four sector aggregation of the US work force from 1860-1990. It shows a decline in the percent of workers in "agriculture" and "industry" from about 40% and 38% to about 3% and
20% respectively. During the same period, the number of workers involved in "service" and "information" have increased from about 17% and 5% to about 30% and 50% respectively (p. 103).

Stated simply, information, including remote sensing data, in post-industrial countries is increasingly becoming a "commodity" like energy, automobiles, chemicals, etc. The exploitation of information as a commodity requires that it be captured, processed, stored, retrieved, transported. Most importantly, it requires that information be made scarce, i.e., access depends on the users' ability to pay a fee. However, information is still viewed by many developing countries as a "public good", not a commodity. Thus, while information about the weather, for example, is sold in the many developed countries, most individuals, even in industrialized countries, would resist the idea of paying for this information. However, companies and government agencies in developed countries will pay for information. But governments and companies in developing countries cannot afford to pay. Remote sensing data is no exception. Various remote sensing programs are discussed in Chapter Two. Note that commercialization is a trend favored by developed countries such as the US and France while developing countries such as India see satellite data as a public good that they willingly share with neighboring countries.

Contemporary techniques for remote sensing can be traced to the emergence of the Cold War between the US and the Soviet Union, following the conclusion of World War II. At the end of World War II, the US and Soviet governments began conducting overflights over each other's territories, first using balloons, then airplanes, and then
satellites orbiting in space, all equipped with photographic film and cameras, to provide them with military intelligence. In the early 1970s, scientists at NASA, after studying data provided by astronauts in earlier space missions, convinced the US government to launch a satellite, dedicated to the study of Earth resources. Landsat-1, originally bearing the initials ERTS-1 (Earth Resources Technology Satellite), was launched in 1972. The latest of the Landsat series, Landsat-5, was launched in 1984. Before Landsat-1 was launched, the US announced its intention to the international community at the United Nations General Assembly in 1969 and invited interested nations to join in further research and development of the technology. The US promised to abide by a policy of nondiscriminatory access to data, an approach that stifled dissent by some countries while guaranteeing US satellites to collect data from all over the Earth.

But the process of extracting specific types of information from satellite data requires expensive computers and highly skilled manpower. Most developing countries have neither of the two. Further, being able to use satellite data in the most efficient manner possible often requires access to other information resources such as information about the global commodities market. Again, developing countries lack adequate access to these information networks. Thus, access to raw "unprocessed" satellite data is not very useful to countries that do not have access to the analytic products generated from the data as well as access to other critical information networks.

The UN General Assembly referred the subject of remote sensing to the Committee On the Peaceful Uses of Outer Space
(COPUOS), a committee that had been established in 1959 to review international cooperation in the peaceful uses of outer space and to study legal problems that might arise from the exploration and use of outer space. The debate in COPUOS, on appropriate policy guidelines to regulate remote sensing activity, generated three main approaches.

The first approach holds that any agreement must guarantee sensed nations the right to consent to be sensed before the activity occurs. Additionally, the sensed nation should be given access to data about its territories on a priority basis and will make the final decision regarding the dissemination of such data to third parties. This approach was based on proposals submitted by Brazil and Argentina, and supported by a number of developing countries.

A second approach, based on proposals submitted by France and the Soviet Union, proposed a set of guidelines, which, while not providing the sensed nation the right of prior consent, allows it to control the dissemination of information acquired about its territories to third parties.

The third approach, proposed by the US, rejects prior consent requirements as well as any restrictions on access to data. It holds that the ability to sense freely and openly disseminate acquired data are in the best interest of everyone concerned. The origin and evolution of these three approaches is discussed in Chapter Four.

These three conflicting approaches were debated during the annual meetings of COPUOS, every year, from the early 1970s until 1986 when a set of principles was adopted by consensus. In essence, the three proposals put the sovereign rights of states in conflict with
their freedom of information rights. Stated as communication policy issues, the conflicting interests raised by remote sensing activity are treated in this study in terms of the following questions:

1) Does the concept of sovereignty include a right for states to control information about themselves?

2) Does the concept of freedom of information include a right for states to gather information wherever they desire and have the means to do so?

3) Do third parties have a right to information about other parties that such parties may choose to withhold?

The conflict between sovereignty and information rights is discussed in Chapter Three, where international regime theory is also discussed in terms of establishing a framework (criteria) that can be used to determine the conditions under which states will give up some of their rights in exchange for international cooperation. The concept of sovereignty includes more than freedom from military aggression. However, it is a concept that has been held static, despite rapid technological changes, thus, making it difficult to resolve new issues that are presenting themselves in new and unexpected forms.

The concept of sovereignty emerged, at least, in the Middle Ages when European societies recognized the need for boards that had the authority to make final decisions such that appeals to a higher authority was not possible. By the late 1800s, the idea of sovereignty representing an all powerful state was being challenged when it was recognized that absolute political power and absolute independence do not exist anywhere, since the power of the state itself is limited
externally by the rights of other states. Although sovereignty implies the recognition that a sovereign state is not subordinate to other states, irrespective of its power, communication technologies such as remote sensing challenge the capacity of states to exercise these rights.

Contemporary views on sovereignty are apparently based in part on World War II experiences and the fear of military attacks from the air and the sea. Consequently, some find it necessary to define specific limits between "air space" that is under national control, and "outer space" that is under international control. During the UN debates on remote sensing the Soviet Union, for example, proposed establishing the boundary between air space and outer space at an altitude of 110 kilometers above sea level (UN COPUOS, 1986e, p. 3). According to this proposal, any system operating in outer space would have the right to fly over sovereign territories. The shortcomings with this proposal is apparent. First, most remote sensing satellites currently operate in higher orbits (400-600 miles). No nation currently conducting remote sensing activity would agree to establishing a boundary that placed its satellites in "air space". Second, it is technically possible to put future satellites into even higher orbits, thus, a boundary established today may be obsolete in a few years.

A more reasonable approach would be to consider the content that goes through a specific communication device and the social impacts of that process instead of the device (hardware) itself. For example, the wisdom placing content restrictions on television programming that is delivered through direct broadcast satellites is
worth rethinking in light of the fact that the same programs can be delivered via other technologies such as video cassettes.

There are two types of information rights that conflict with sovereignty: freedom of information and free flow of information. Freedom of information implies the right to seek and transmit information from country to country. The idea has been debated at the UN since 1962 but only certain preambular provisions have been adopted. The provisions for freedom of information include the obligation to seek information without prejudice and to spread it without malicious intent. It is difficult to check against these practices in the context of information as a commodity. For example, is malicious intent involved if EOSAT or SPOT denies a specific nation access to its own data, because the nation cannot afford the data, but sells the data to a transnational company that is about to negotiate natural resource exploitation contracts with that nation?

International guidelines on free flow of information exist but do not seem to be applicable to information as a commodity. The agreements are designed to further specific exchanges such as artistic exhibitions and official documents while at the same time prohibiting the circulation of certain material from country to country, such as obscene publications. Thus, just as there is no simple answer to the question whether sovereignty over natural resources includes rights to information about those resources; the applicability of free flow and freedom of information to remote sensing activities is doubtful.

Despite the adoption of the UN remote sensing principles in 1986, five years later, some scholars as well as some delegations at
COPUOS continue to express varying degrees of dissatisfaction with the principles. Scholars such as DeSaussure (1989) criticize the UN principles for being so broad that they fail to address the basic issues raised by remote sensing adequately. Individual states are said to be left to establish their own domestic remote sensing guidelines, despite the fact that remote sensing is an activity that extends beyond territorial boundaries.

The delegations at COPUOS that express some dissatisfaction with the principles do not completely reject them. However, they believe that some of the principles may have to be reviewed, given the proliferation of the many benefits derived from this space activity, both in the public and private domain, in the last 5-6 years. The three conflicting approaches that stalled agreement at COPUOS for about 15 years are discussed in Chapter Four is the process by which consensus was finally achieved. Chapter Five discusses events outside the control of the UN: development of the remote sensing industry, changes in technology, and various domestic policy guidelines. Chapter Six is a detailed analysis of the UN remote sensing principles, with emphasis on how the basic issues that delayed agreement are addressed by the principles.

During the many years of frustrating negotiations and profound disagreements, in the UN, three important developments were taking place outside the setting of the UN. These developments were:

1) The emergence of an international market for satellite data, nurtured partially by the entry of many more state and non-state actors in remote sensing, an increasing trend toward
commercialization and privatization, hence, competition and the introduction of new products and services;
2) the drafting and implementation of various -- and not necessarily compatible -- national remote sensing policies to guide daily operations of the industry in the absence of international guidelines; and
3) changes in remote sensing technology itself as a result of market forces domestic policy guidelines.

In 1984, the US government transferred control of its remote sensing program to a private company, the Earth Observation Satellite Company (EOSAT). EOSAT is authorized to operate the Landsat system on a commercial basis, with considerable subsidies from the US government. In 1986, France entered the image market with the launch of its first remote sensing satellite, SPOT-1. SPOT-2 was launched in 1990. Like Landsat, the SPOT program is operated by a private company, on a commercial basis, with considerable subsidies from the French government. Both companies hope to develop the technology and market for satellite data to a point where they are completely independent of government subsidies.

In addition to the SPOT and EOSAT systems, a number of other countries have built and launched their own remote sensing satellites and/or acquired various remote sensing capabilities, since the mid-1980s. They include the USSR, India, Japan, Germany, Sweden, etc. Other nations, such as Brazil, are planning to launch their own satellites in the near future. Unlike EOSAT and SPOT, most of these new programs were conceived to provide data primarily for the
national development of the countries concerned, not as commercial ventures. The major remote sensing programs are discussed in Chapter Two.

The second major event that took place outside the United Nations is the drafting and implementation of various domestic remote sensing guidelines, apparently in the absence of international guidelines. The US, for example, drafted and implemented the Landsat Act of 1984, upon the transfer of the Landsat program to EOSAT. Between 1972 and 1984, the US government operated the system on a policy of "open skies" and "nondiscriminatory access". This means that US satellites were free to fly and gather data wherever they could (open skies) and the government pledged to make that data available to anyone on a nondiscriminatory basis (nondiscriminatory access). However, the government's goals are not necessarily compatible with those of a private, commercial operator. For example, EOSAT would like to have the provisions for nondiscriminatory access dropped since it may be more profitable to provide some data to some users on an exclusive basis for a higher price.

France does not have formal domestic guidelines like the US. The French simply state that UN guidelines are satisfactory for their day-to-day operations. In theory, SPOT Image (USA) is free to behave in the US according to their interpretation of UN guidelines. Their day-to-day operations in the US are not affected by US domestic guidelines. Various domestic remote sensing guidelines are discussed in Chapter Five.
The third development outside the United Nations is in remote sensing technology. Besides the fact that remote sensing moved from tree tops, to balloons, to airplanes, and finally to outer space; the two most significant developments have been the shift from photographic film to electronic "sensors" and refinements in "resolution". Early remote sensing platforms carried photographic equipment for taking still pictures as they flew over various territories. The film was then ejected at pre-arranged destination and recovered in mid-air by helicopters or other air-recovery techniques. Occasionally, film capsules were lost or provided only meager data. The platforms today are equipped with electronic sensors that transmit their data to ground receiving stations located on Earth. The need for photographic film has been eliminated and the data transmitted electronically yields more detailed images.

Resolution refers to the ability of sensors to distinguish (identify) increasingly smaller objects with greater precision. Landsat-5 has a resolution of 30 meters meaning that it can distinguish objects with diameters of 30 meters or higher from their background. SPOT-2 has resolutions of 10 and 20 meters. Soviet satellites have the highest resolution, 5 meters, but their products are fixed photographic plates as opposed to EOSAT or SPOT's computer-manipulable data.

While increased resolution has created new markets, such as the news media, for the remote sensing industry; some policymakers are concerned about more detailed satellite imagery. In the US, for example, the Department of Defense has expressed concern that sharper images, such as required by the media, may harm US national
security interests. Thus, the Landsat Act of 1984 permits the Secretary of Defense to prohibit the dissemination of such images. However, in theory, the same images can be obtained from France's SPOT or the Soviet agency Soyuzkarta, both of who sell imagery in the US but are not bound by US domestic policy. Advances in remote sensing technology together with market and policy implications of these changes are discussed in Chapter Five.

Given the preceding summary, it is clear that although the international debate on remote sensing took place at the United Nations, UN actions and/or inactions on remote sensing can be better understood by relating UN activities to development outside the UN.

Discussion

Remote sensing is a particularly interesting case study to use to illuminate the broader issues of international communication policy formation for several reasons:

First, remote sensing is similar to other telecommunication technologies that require international guidelines, yet it is distinctive in other ways. All countries are affected by remote sensing activity either as sensors, sensed states, or consumers of satellite data. Stated another way, not all countries are conducting remote sensing activities but all countries are affected by the activities of the few countries that gather and disseminate satellite data. Thus, remote sensing issues can be addressed, most effectively, only by truly global agreements. This is one aspect that makes remote sensing unique from other communication/information technologies that stretch beyond national
boundaries such as direct broadcasting by satellite (DBS) or terrestrial broadcasting (such as short wave radio). Problems with DBS or short wave radio usually involve the inadvertent spillage or deliberate broadcast of signals into countries that do not wish to receive the signals. The signal often covers a relatively small number of countries. These problems can be resolved through bilateral or multilateral agreements between the countries involved. When agreements fail the receiving country can jam the offending broadcast signals. The Soviet Union, for example, for so many years was forced to jam Voice of America broadcasts aimed at Soviet audiences. In this case, the US claimed that international agreements on free flow of information permits such broadcasts while the Soviet Union asserted its sovereign right not to receive information that it does not desire. This is not the case with remote sensing.

Unlike DBS or short wave radio, remote sensing issues cannot be addressed adequately through individual national (domestic) guidelines or by bilateral or even multilateral agreements. Since all countries are affected by the activity, the issues can only be addressed by global agreements. The Landsat Act of 1984 is a good example of the futility of attempts by individual nations to address remote sensing issues through national guidelines. The provisions of the Act apply only to the activities of EOSAT, not SPOT Image or Soyuzkarta, despite the fact that all three companies sell data in the same US market. The failure of the international community to adopt a multilateral remote sensing treaty signed by the Soviet Union and seven other Soviet bloc nations in 1978 clearly suggests that even multilateral arrangements
may not adequately address global issues. It could be said that the reason why remote sensing issues have not been addressed by organizations such as the OECD is precisely because they recognize that the issues are global.

Unlike the case with terrestrial broadcasting where it is relatively easy for the nation that does not wish to receive the broadcast signals to interfere such signals, there is nothing that sensed nations can do to stop sensing from taking place. Remote sensing satellites register energy that is reflected by objects on Earth. Thus, unlike in terrestrial broadcasting where available technology makes it possible for both the sending and receiving nations to assert (even enforce) their rights, that is not the case with remote sensing. With remote sensing the conflict between sovereign rights and freedom of information rights clearly favors the later, since there is little or nothing that sensed states can do to assert their sovereign rights.

Note that the same sensors on board satellites in outer space can be mounted on airplanes and balloons. Balloons and airplanes, are subject to prior consent in order to fly over the territories of other nations. Thus, remote sensing, without prior consent, appears to be legal only to the extent that it is conducted in outer space, beyond the reach of most countries.

While the argument for free flow and/or freedom of information is valid, from a legal point of view, it appears to be based on an assumption that is flawed. To argue that states have a right to gather information from wherever they can and disseminate it to whomever
they wish, implicitly assumes equity in the patterns of transborder data flows. Such equality does not exist.

Scholars who have charted the infrastructure of transborder data flow, i.e. the networks through which machine-readable data moves across national boundaries for processing, storage or retrieval, have concluded that the international data market and the application of transborder data flows for corporate purposes are largely limited to the developed market economies. Developing countries participate primarily as data suppliers and purchasers of processed data and capital goods needed for their own rudimentary telematics sector. Further, while public data communication networks are linked up internationally, there are only very few extensions into the developing and socialist countries.

The closest approximation to an arrangement that will support the idea of free flow exists only in the networks established between the United States and other developed western countries. But, even in the case of developed western countries, O'Brien (1983) notes that "... given the near US monopoly of databases and equipment, transborder flow, even in a raw variety has become a major concern to European countries" (p. 11). Consequently, some developing countries are becoming aware of the importance of data flows and introducing domestic guidelines that restrict the transmission of computer-held data to other countries.

Transnational corporations are quite concerned about these developments for obvious reasons. Because of the geographical distribution of markets and corporate assets, the diversity of services
offered, etc., free flow and freedom of information enhances the ability of transnational corporations, (especially the parent corporations in which decision-making powers are typically invested), to coordinate their global operations efficiently.

Given the importance of information, these developments raise a basic question regarding the capacity of developing countries to pursue a self-reliant development strategy. Thus, communication scholars generally agree that differential access to information and the ability to use information efficiently is a major element in the determination of the distribution of the world's income.

Consequently, at least two factors appear to be particularly significant in determining the nature of the impact of remote sensing and all other forms of transborder data flows on any one country. The first is the ability of each country to utilize relevant technology, equipment and data in the interest of national development in order to remain competitive in international markets. The second is the ability to obtain access to the international data market.

With respect to the first factor, most developing countries do not have the relevant technology. While the concept of nondiscriminatory access appears to be designed to guarantee access to the international data market, the reality of commercialization and privatization of remote sensing activity suggests that nondiscriminatory access may not be a feasible proposition since it may be more profitable to provide some information to a few users on an exclusive basis. The trend toward commercialization and
privatization in the remote sensing industry is discussed in Chapter Five.

The lack of adequate access to international data networks by developing countries evidently means that these countries lack the ability to dispose of natural resources, over which they have physical custody, in the most efficient manner possible. Put another way, proposals for prior consent and controlled dissemination of satellite data to third parties could be seen as an expression of the lack of the ability to convert power over resources into power over events. The debate on remote sensing clearly points to the fact that control over access to information on resources is more beneficial than physical custody of those resources without the knowledge on how to exploit those resources most efficiently.

**Conclusions**

The issues raised by remote sensing center around the conflict in communication rights. The rights of people (as individuals) to control access to personal information is generally recognized by the global community of nations. Thus, for example, there are various national guidelines regarding the disclosure of various types of information such as financial records, medical records, credit records, etc. Of course, it will be impossible for any nation to assess the impact of devastating plague, for example, if there was no provision for the release of relevant medical records. However, guidelines on rights over personal information prescribe specific guidelines under which the release of personal information is viewed as socially desirable.
Generally, such guidelines are drafted to ensure that society benefits from the release of personal information while the individual is not disadvantaged as a result of the release of that information. A crucial question in the debate on remote sensing is whether nations have the same types of rights over information as individuals.

The UN principles on remote sensing clearly suggest that nations have rights to control information about their resources. At the same time the right of nations to seek and disseminate information is also acknowledged. However, the greatest weakness of the principles is that they do not provide clear answers with regard to how the two conflicting communication rights are to be balanced. In this regard, there are at least two issues that COPUOS, and most agencies that are involved in the formation of international telecommunication guidelines, will have to deal with. The first is that of non-state actors who are playing increasingly dominant roles in the establishment of a variety of international telecommunication networks but whose roles are unclear in the policymaking process, despite the tremendous impact of their activities. The second challenge is to guarantee access to information to a variety of users at the same time that information is increasingly becoming a commodity that must be made scarce in order to increase its economic value.

When international agencies such as the ITU were established, their primary functions revolved around coordinating and setting technical standards for different national communication systems so that users in one country could communicate with users in other countries. The telephone, for example, was a device used primarily for
voice communication. As long as someone could make a call across the oceans and be heard audibly, an agency such as the ITU was doing its job. However, telephones today are used for other purposes such as data transmission, facsimile, etc. that have tremendous economic, social, and political impacts on large segments of society. The fact that remote sensing data is the source of a variety of information types with different applications is indicative of current trends in international telecommunications. Consequently, the issues that arise are increasingly complex to deal with.

International agencies have typically had to deal with single issues such as compatibility in technical standards, and often the primary actors have been states or their agents. The role of non-state actors such as EOSAT, SPOT, etc. in the remote sensing debate is only in the making of their respective domestic policies. The inability of international agencies to deal with the activities of non-state actors is very evident. Principle 14 of the UN remote sensing principles is apparently an attempt to do just that. It provides that countries operating remote sensing systems shall bear international responsibility for their activities, irrespective of whether such activities are carried out by government agencies or private companies. However, there is no agreed interpretation of what it means to bear international responsibility. For example, does this mean that a developing country can sue the US or France for economic injury if data about its territories, collected and disseminated by EOSAT or SPOT, is used to its economic detriment? Does bearing international responsibility mean giving data away, free, to countries
that cannot afford it? Stated simply, international guidelines need to
be precise enough to be interpreted into concrete (unambiguous)
guidelines for day-to-day operations of non state actors. The alternative
is for state actors to agree on precise interpretations of the broad
guidelines to be able and willing to enforce compliance by their
subjects.

The question of access to information is the second crucial issue
that international policymakers will have to deal with. The economic
significance of information, accompanied by efforts to make it scarce,
has been noted. However, the view of information as a commodity by
post-industrial societies conflicts with the view of information as a
public good by less developed countries. The cost of access can only
reduce as the number of users increases. Unlike other commodities,
such as petroleum, that are gradually depleted with increased use, that
is not the case with information. However, in the case of remote
sensing, the cost of gathering, processing, and distributing satellite
data today far exceeds the revenues of the industry. The market for
satellite imagery is still being developed. There will be continued
increases in the cost of access in the near future. As these costs
increase so will the number of complaints from users who cannot
afford the costs. Indeed, if all government subsidies were withdrawn
from the industry today, there would be no remote sensing industry.
Commercial operators are clearly eager to build the industry to a point
where it is independent from government subsidies. The alternative
for states who view information as a public good is to compare their
current costs of access to the cost of operating a remote sensing system by a group of states with similar views about information.

Chapter one raised ten specific research questions for this study:

1). How can UN actions and/or inactions on remote sensing be understood by relating UN activities to developments outside the control of the UN?
2). How has the nature of remote sensing technology, the development of an international market for remote sensing products, and various domestic approaches to remote sensing shaped UN attempts to implement international guidelines?
3). How effective is the UN as a forum for communication policy issues?
4). Is remote sensing a technology that requires global agreements (as opposed to bilateral or multilateral agreements) to implement a meaningful policy?
5). How is remote sensing similar or different from other communication technologies?
6). To what extent is remote sensing just another communication technology or to what extent does it raise some unique issues?
7). How important are remote sensing issues in broadening our understanding of other communication issues?
8). How do fundamental concepts such as free flow of information and sovereignty interact in remote sensing?
9). What is the balance of rights between sensing and sensed nations?
10). Are global agreements on remote sensing issues possible?

These questions can be summarized and organized into the following four clusters:

A. Questions 1, 2 & 3 comprise the first cluster. These questions ask to what extent UN actions and/or inaction or remote sensing can be understood by relating UN activities to activities outside the control of the UN. Furthermore, the effectiveness of the UN as a forum for achieving international cooperation is questioned.
There is no doubt that the implementation of various domestic policies, the emergence of an international market for remote sensing data, and changes in remote sensing technology are all important events that contribute significantly to our understanding of the making of international policy at the UN. These events provide guideposts to the changing policy positions of some delegations at the UN. For example, France's decision to back away from its earlier position on controlled dissemination of data to third parties partially explains the development of the SPOT program.

The question regarding the effectiveness of the UN as a forum for communication policy issues has been answered by the participants in the debates. Despite the many years of apparently frustrating debates, despite the fact the delegation expressed varying degrees of satisfaction with the UN principles; they all agree that COPUOS is the appropriate forum for issues regarding the exploration of space. This does not preclude possible structural changes within COPUOS or a review of COPUOS's mandate. However, it is clear that the committee can be only as effective to the extent members are willing to abide by new rules that they chose to adopt.

B) The second cluster is made up of questions 4, 5, 6 & 7. These questions ask whether remote sensing issues require global agreements and whether remote sensing broadens our understanding of other communication issues.

Although remote sensing satellites are currently operated by relatively few countries, virtually every country is affected by remote sensing activity. To the extent that all countries realize the
significance of satellite imagery, remote sensing issues can be addressed effectively only by global agreements. The inadequacy of actions by individual nations (through the various domestic policies and practices) as well as multilateral agreements, have been discussed at the beginning of this chapter and in more detail in chapter five.

The similarities and differences between remote sensing and other communication technologies such as transnational data communication networks, DBS, telephone, etc, have been discussed in Chapter One and at the beginning of this chapter. Remote sensing is similar to these technologies in that it raises some of the same issues that have been raised before, such as DBS and the issues of sovereignty and free flow of information. However it is remote sensing is different from these technologies that it raises familiar issues in new and unexpected ways.

C) The third cluster of questions is made up of questions 8 & 9 which ask how technology is making us rethink fundamental concepts such as sovereignty and information rights, and how these conflicting rights may be balanced through international agreements.

Sovereignty is a key concept in this study and is discussed in detail in Chapter Three. International regime theory, a body of literature that promises to provide a framework for determining the conditions under which international agreement is possible, is discussed in Chapter Three too. Remote sensing and some other communication technologies do not recognize national political boundaries that separate nations. Consequently, they defy traditional
concepts of sovereignty. One approach to understanding sovereignty, with regard to communication technologies, is to determine the extent to which these technologies, regardless of where they are located, affect the ability of nations to shape their respective economic, political, and cultural destinies. In this regard, a common error is to attempt to determine the rights and responsibilities of states by looking at telecommunication hardware, instead of the content that flows through that hardware. Consequently, the rights of states conducting remote sensing from outer space appear to be more important than the rights of sensed states. However, if the same activity is conducted from lower platforms, such as airplanes, the rights of sensed states become more important. Similarly, if part of the reason for regulating DBS has to do with perceived impacts of broadcast programming, the irony is that the same programming still flows across national boundaries through alternative technologies such as video cassettes. Obviously, content, not the hardware through which this content flows, should be a more important consideration in the regulation of international telecommunication technologies.

D) The last cluster is but one question, question 10, that simply asks whether remote sensing agreements are possible.

The answer is not as easy as the question suggests. The UN agreements on remote sensing appears to be more of an indication by states that they are willing to seek cooperation in the activity. The existence of critical factors in the debate outside the control of the UN make any answer to this question a conditional one. For example, how are the actions of non-state actors to be accounted for, especially when
all states do not agree with international guidelines and it is only the states that can ensure that their subjects comply with international guidelines? Nonetheless, it could be said that, given the current lack of equity in remote sensing capabilities between states, unequal access to satellite data, the lack of access to other crucial information networks; a true remote sensing agreement is still elusive.

This study might have raised many more questions and provided fewer answers. However, the process of formulating international telecommunication guidelines and the factors influencing that process should be clear. The challenges that policymakers must face in developing socially desirable policies in an era of commercial competitiveness is clear. The key to successful policymaking lies in the ability to seek delicate balances between conflicting communication rights, to the satisfaction of a host of different stakeholders.
LIST OF REFERENCES


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<table>
<thead>
<tr>
<th>Name</th>
<th>Title/Affiliation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Dr. Adigun A. Abiodun</td>
<td>Expert on Space Applications</td>
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<td></td>
<td>Outer Space Affairs Division</td>
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<tr>
<td>2. Dr. Marietta Benko</td>
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<tr>
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<td></td>
<td>Cologne, Germany.</td>
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<td>Indian Space Research Org.</td>
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<tr>
<td></td>
<td>Bangalore, India.</td>
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<tr>
<td>4. Ralph Chipman</td>
<td>Senior Staff</td>
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<td>Outer Space Affairs Division</td>
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<td>Director, International Sales for Africa &amp; the Middle East.</td>
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<td></td>
<td>EOSAT Company,</td>
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<td>Lanham, Maryland.</td>
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<td>6. Dr. Helmut Freudenschuss</td>
<td>Mission of Austria to the UN</td>
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<tr>
<td></td>
<td>United Nations</td>
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<tr>
<td></td>
<td>New York.</td>
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<tr>
<td>7. Sr. Raimundo Gonzalez</td>
<td>Consejero, Ministerio de Relaciones Exteriores</td>
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<tr>
<td></td>
<td>Santiago, Chile.</td>
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<tr>
<td>8. Kenneth A. Hodgkins</td>
<td>Office of Advanced Technology,</td>
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<td></td>
<td>U.S. Department of State</td>
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<td></td>
<td>Washington, DC.</td>
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<td>Name</td>
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<tr>
<td>9</td>
<td>Prof. Y.M. Kolossov, L.L.D.</td>
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<tr>
<td>10</td>
<td>Zheng Lizhong</td>
</tr>
<tr>
<td>11</td>
<td>Clark A. Nelson</td>
</tr>
<tr>
<td>13</td>
<td>Silja Stromberg</td>
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</table>
APPENDIX B
INTERVIEW QUESTIONS

UN Delegates

1. UN records indicate that when the subject of remote sensing was introduced in COPUOS, in the 1970s, your delegation proposed the following ... Is this accurate? If not, correct me. If accurate, what factors were considered before drafting your proposal?

2. What was/is the legal basis for your proposals and what mechanism guaranteed compliance to your proposals, in the case that they were adopted?

3. How important was/is remote sensing to your country?

4. UN records indicate that the principles adopted in 1986 were adopted in a spirit of compromise, how was compromise achieved?

5. Is your delegation satisfied with the principles?

6. Is there anything on the subject of remote sensing that you'd like to discuss?

7. How effective is COPUOS as a forum for international cooperation on space exploration issues?

Remote Sensing Industry Officials

1. What potential did your organization/company see in remote sensing as a viable public service or commercial venture?

2. Describe the need to satellite data at that time, i.e. who were the primary users of data at that time?
3. Have those needs changed? If so, how? If not, why not?

4. What factors are influencing these changes? i.e. public demands for specific types of data? new products that your company is introducing? other forces -- which ones?

5. What are the conditions, if any, of your dependence on government subsidies?

6. How do you see the future of the industry? Anything you'd like to discuss that is critical to your daily operations and/or future plans?
APPENDIX C
LANDSAT 4/5 COVERAGE


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APPENDIX D

REMOTE SENSING GROUND RECEIVING STATIONS (as of May 1990)
(Stations with Landsat and/or SPOT Reception Capability)

Stations Currently Operational

<table>
<thead>
<tr>
<th>No.</th>
<th>Station</th>
<th>Country</th>
<th>Landsat</th>
<th>SPOT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Alice Springs,</td>
<td>AUSTRALIA</td>
<td>Landsat</td>
<td>SPOT</td>
</tr>
<tr>
<td>2.</td>
<td>Bangkok,</td>
<td>THAILAND</td>
<td>Landsat</td>
<td>SPOT</td>
</tr>
<tr>
<td>3.</td>
<td>Beijing,</td>
<td>CHINA</td>
<td>Landsat</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Cuiaba,</td>
<td>BRAZIL</td>
<td>Landsat</td>
<td>SPOT</td>
</tr>
<tr>
<td>5.</td>
<td>Fucino,</td>
<td>ITALY</td>
<td>Landsat</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Gatineau,</td>
<td>CANADA</td>
<td>-</td>
<td>SPOT</td>
</tr>
<tr>
<td>7.</td>
<td>Greenbelt,</td>
<td>MD, U.S.A.</td>
<td>Landsat</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Hatoyama,</td>
<td>JAPAN</td>
<td>Landsat</td>
<td>SPOT</td>
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<td>9.</td>
<td>Hyderabad,</td>
<td>INDIA</td>
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<td>10.</td>
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<td>11.</td>
<td>Jakarta,</td>
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<td>Landsat</td>
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<tr>
<td>12.</td>
<td>Johannesburg,</td>
<td>SOUTH AFRICA</td>
<td>Landsat</td>
<td>SPOT</td>
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<tr>
<td>13.</td>
<td>Kiruna, (ESA),</td>
<td>SWEDEN</td>
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<td>SPOT</td>
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<td>14.</td>
<td>Mar Chiquita,</td>
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<td>15.</td>
<td>Maspalomas,</td>
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<td>18.</td>
<td>Riyadh,</td>
<td>SAUDI ARABIA</td>
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<tr>
<td>19.</td>
<td>Toulouse,</td>
<td>FRANCE</td>
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<td>SPOT</td>
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**Stations Under Construction or Negotiation**

<p>| | | |</p>
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<tr>
<th></th>
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<tr>
<td>1</td>
<td>Ecuador</td>
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<td>2</td>
<td>China (second for Landsat)</td>
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<tr>
<td>3</td>
<td>Indonesia</td>
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<td>7</td>
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<td>Turkey</td>
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Source: EOSAT, Lanham, MD and SPOT Image, Reston, VA. (May 1990).
APPENDIX E

CHRONOLOGY OF NEWS MEDIA USE OF SPOT IMAGERY (MAY 1990)

April and May 1986  SPOT imagery of Chernobyl was used by all major networks and newspapers.


August 4, 1986  ABC, CBS, and CNN aired SPOT imagery of the Soviet nuclear testing facility at Semipalatinsk.

August 25, 1986  SPOT imagery of the Soviet Space launch complex at Tyuratam was aired on ABC and The New York Times published a story using the imagery.

October, 1986  The October issue of National Geographic Magazine featured SPOT imagery of the Soviet cosmodromes at Plesetsk and Baikonur.

October 16, 1986  SPOT imagery was used by Swedish television in a story on Soviet submarine bases on the Kola Peninsula.

January 8, 1987  ABC News aired SPOT imagery of the Iran/Iraq war.

March 2, 1987  SPOT imagery of Soviet naval and air bases was used by Aviation Week and Space Technology Magazine.
April 2, 1987  ABC News used SPOT imagery of the Soviet Krasnoyarsk radar facility to verify that the facility violates the ABM treaty.

July 7, 1987  ABC aired SPOT imagery of the Persian Gulf. This was the media's first major use of three-dimensional perspective imagery.

July 8, 1987  ABC News aired SPOT imagery of suspected Iranian Silkworm missile sites on Qeshm Island in the Straits of Hormuz.

July 9, 1987  SPOT imagery of the Iranian naval port at Bandar Abbas in the Straits of Hormuz was broadcast on ABC News.

October 23, 1987  SPOT imagery of a suspected Soviet ground based laser facility in central USSR was broadcast on ABC News. The same imagery was used in a story publicized by *The New York Times*. (Pravda made reference to the ABC News piece, October 23, 1987, and published a lengthy article on the facility.)


May 11, 1988  ABC News broadcast SPOT imagery of the Soviet space complex at Baikanour.

May 20, 1988  SPOT imagery of Abu Musa Island in the Persian Gulf was used by ABC to point out new suspected Silkworm missile sites. (10 days later the Pentagon confirmed the story.)

October 1, 1988  SPOT imagery of ballistic missile sites on central Saudi Arabia was published by *Jane's Defense Weekly*. The same images appeared on Swiss television.
December 1, 1988

A story was published by *The Chicago Tribune* based on recent SPOT data of a Soviet nuclear accident that reportedly occurred in 1957. The computer-enhanced images showed that a 100-square mile area around a military nuclear complex east of the Ural Mountains was still abandoned 31 years after the reported disaster.

January 5, 1988

ABC, NBC, CBS, *Time* and *Newsweek* published SPOT 10-meter resolution imagery of the chemical weapons plant 40 miles SW of Tripoli in the Libyan desert.

APPENDIX F
UNITED NATIONS PRINCIPLES ON REMOTE SENSING (1986)

REPORT OF THE CHAIRMAN OF THE WORKING GROUP ON AGENDA ITEM 3

(Legal Implications of remote sensing of the Earth from space, with the aim of finalizing the draft set of principles)

1. On 24 March 1986, the Sub-Committee re-established its Working Group on agenda item 3.


3. The Working Group recalled that at the twenty-fourth session of the Legal Sub-Committee, a number of very constructive efforts had been made to resolve difficulties and to arrive at a consensus on the text of the draft principles but that consultations had not been finalized. The consultations, however, had led to the submission of a working document by the Chairman of the Working Group (see A/AC.105/352, annex I, appendix, sect. B). It had been felt that the working document could provide a basis for an agreement by consensus. The recommendation had been made by the Sub-Committee that the Committee on the Peaceful Uses of Outer Space should, at its twenty-eighth session, provide opportunities for continuing informal consultations on the basis of the working document.

4. The Working Group noted that there had been consultations at the twenty-eighth session of the Committees on the Peaceful Uses of Outer Space. These consultations had led to the submission by the delegation of Austria of a further working document (A/AC.105/L/158) incorporating a few additional changes. It had been felt that this document, which was annexed to the report of the Committee (A/40/20 and Corr.1, annex V), could provide a basis for an agreement by consensus in the near future.

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5. The Working Group also noted that the General Assembly, at its fortieth session, by resolution 40/162, has decided that the Sub-Committee, taking into account the concerns of all countries, particularly those of developing countries, should continue its consideration of the present agenda item with the aim of finalizing the draft set of principles.

6. Following discussions and a number of informal consultations, the Working Group, on 1 April 1986, in a spirit of compromise, recorded consensus on the text of a draft set of principles, relating to remote sensing of the Earth from space, set out below.

Draft Principles on Remote Sensing

Principle I

For the purposes of these principles with respect to remote sensing activities:

(a) The term "remote sensing" means the sensing of the Earth's surface from space by making use of the properties of electromagnetic waves emitted, reflected or diffracted by the sensed objects, for the purpose of improving natural resources management, land use and the protection of the environment;

(b) The term "primary data" means those raw data that are acquired by remote sensors borne by a space object and that are transmitted or delivered to the ground from space by telemetry in the form of electromagnetic signals, by photographic film, magnetic tape or any other means;

(c) The term "processed data" means the products resulting from the processing of the primary data, needed in order to make such data usable;

(d) The term "analyzed information" means the information resulting from the interpretation of processed data, inputs of data and knowledge from other sources;

(e) The term "remote sensing activities" means the operation of remote sensing space systems, primary data collection and storage stations, and activities in processing, interpreting and disseminating the processed data.
**Principle II**

Remote sensing activities shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic, social or scientific and technological development, and taking into particular consideration the needs of the developing countries.

**Principle III**

Remote sensing activities shall be conducted in accordance with international law, including the Charter of the United Nations, the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, and the relevant instruments of the International Telecommunication Union.

**Principle IV**

Remote sensing activities shall be conducted in accordance with the principles contained in article I of the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, which, in particular provides that the exploration and use of outer space shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development, and stipulates the principle of freedom of exploration and use of outer space on a basis of equality. These activities shall be conducted on the basis of respect for the principle of full and permanent sovereignty of all States and people over their own wealth and natural resources, with due regard to the rights and interests, in accordance with international law, of other States and entities under their jurisdiction. Such activities shall not be conducted in a manner detrimental to the legitimate rights and interests of the sensed State.

**Principle V**

States carrying out remote sensing activities shall promote international co-operation in these activities. To this end, they shall make available to other States opportunities for participation therein. Such participation shall be based in each case on equitable and mutually acceptable terms.
Principle VI

In order to maximize the availability of benefits from remote sensing activities, States are encouraged through agreements or other arrangement to provide for the establishment and operation of data collecting and storage stations and processing and interpretation facilities, in particular within the framework of regional agreements or arrangements wherever feasible.

Principle VII

States participating in remote sensing activities shall make available technical assistance to other interested States on mutually agreed terms.

Principle VIII

The United Nations and the relevant agencies within the United Nations system shall promote international co-operation, including technical assistance and co-ordination in the area of remote sensing.

Principle IX

In accordance with article IV of the Convention on Registration of Objects Launched into Outer Space and article XI of the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, a State carrying out a programme of remote sensing shall inform the Secretary-General of the United Nations. It shall, moreover, make available any other relevant information to the greatest extent feasible and practicable to any other State, particularly any developing country that is affected by the programme, as its request.

Principle X

Remote sensing shall promote the protection of the Earth's natural environment.

To this end, States participating in remote sensing activities that have identified information in their possession that is capable of averting any phenomenon harmful to the Earth's natural environment shall disclose such information to States concerned.
Principle XI

Remote sensing shall promote the protection of mankind from natural disasters.

To this end, States participating in remote sensing activities that have identified processed data and analyzed information in their possession that may be useful to States affected by natural disasters, or likely to be affected by impending natural disasters, shall transmit such data and information to States concerned as promptly as possible.

Principle XII

As soon as the primary data and the processed data concerning the territory under its jurisdiction are produced, the sensed State shall have access to them on a nondiscriminatory basis and on reasonable costs terms. The sensed State shall also have access to the available analyzed information concerning the territory under its jurisdiction in the possession of any State participating in remote sensing activities on the same basis and terms, taking particularly into account the needs and interests of the developing countries.

Principle XIII

To promote and intensify international co-operation, especially with regard to the needs of developing countries, a State carrying out remote sensing of the Earth from outer space shall, upon request, enter into consultations with a State whose territory is sensed in order to make available opportunities for participation and enhance the mutual benefits to be derived therefrom.

Principle XIV

In compliance with article VI of the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, States operating remote sensing satellites shall bear international responsibility for their activities and assure that such activities are conducted in accordance with these principles and the norms of international law, irrespective of whether such activities are carried out by governmental or non-governmental entities or through international organizations to which such States are parties. This principle is without prejudice to the applicability of the norms of international law on State responsibility for remote sensing activities.
**Principle XV**

Any dispute resulting from the application of these principles shall be resolved through the established procedures for the peaceful settlement of disputes.

7. The Working Group held its final meeting on 11 April 1986, when it considered and approved the present report.

APPENDIX G

UNITED NATIONS OUTER SPACE TREATY (1967)

TREATY ON PRINCIPLES GOVERNING THE ACTIVITIES OF STATES IN THE EXPLORATION AND USE OF OUTER SPACE, INCLUDING THE MOON AND OTHER CELESTIAL BODIES (OUTER SPACE TREATY), 1967

The States Parties to this Treaty

Inspired by the great prospects opening up before mankind as a result of man's entry into outer space,

Recognizing the common interest of all mankind in the progress of the exploration and use of outer space for peaceful purposes,

Believing that the exploration and use of outer space should be carried on for the benefit of all peoples irrespective of the degree of their economic or scientific development,

Desiring to contribute to broad international co-operation in the scientific as well as the legal aspects of the exploration and use of outer space for peaceful purposes,

Believing that such co-operation will contribute to the development of mutual understanding and to the strengthening of friendly relations between States and peoples,

Recalling resolution 1962 (XVIII), entitled "Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space," which was adopted unanimously by the United Nations General Assembly on 13 December 1963,

Recalling resolution 1884 (XVIII), calling upon States to refrain from placing in orbit around the Earth any objects carrying nuclear weapons or any other kinds of weapons of mass destruction or from installing such weapons on celestial bodies, which was adopted unanimously by the United Nations General Assembly on 17 October 1963.

Taking account of United Nations General Assembly resolution 110 (11) of 3 November 1947, which condemned propaganda designed or likely to provoke or encourage any threat to the peace, breach of the peace or act of aggression, and considering that the aforementioned resolution is applicable to outer space.
Convinced that a Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, will further the purposes and principles of the Charter of the United Nations,

Have agreed on the following:

Article I

The exploration and use of outer space, including the Moon and other celestial bodies, shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development, and shall be the province of all mankind.

Outer space, including the Moon and other celestial bodies, shall be free, for exploration and use by all States without discrimination of any kind, on a basis of equality and in accordance with international law, and there shall be free access to all areas of celestial bodies.

There shall be freedom of scientific investigation in outer space, including the Moon and other celestial bodies, and States shall facilitate and encourage international co-operation in such investigation.

Article II

Outer Space, including the Moon and other celestial bodies, is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means.

Article III

States Parties to the Treaty shall carry on activities in the exploration and use of outer space, including the Moon and other celestial bodies, in accordance with international law, including the Charter of the United Nations, in the interest of maintaining peace and security and promoting international co-operation and understanding.

Article IV

States Parties to the Treaty undertake not to place in orbit around the Earth any objects carrying nuclear weapons or any other kinds of weapons of mass destruction, install such weapons on celestial bodies, or station weapons in outer space in any other manner.
The Moon and other celestial bodies shall be used by all States Parties to the Treaty exclusively for peaceful purposes. The establishment of military bases, installations and fortifications, the testing of any type of weapons and the conduct of military manoeuvres on celestial bodies shall be forbidden. The use of military personnel for scientific research or for any other peaceful purposes shall not be prohibited. The use of any equipment of facility necessary for peaceful exploration of the Moon and other celestial bodies shall also not be prohibited.

Article V

States Parties to the Treaty shall regard astronauts as envoys of mankind in outer space and shall render to them all possible assistance in the event of accident, distress, or emergency landing on the territory of another State Party or on the high seas. When astronauts make such a landing, they shall be safely and promptly returned to the State of registry of their space vehicle.

In carrying on activities in outer space and on celestial bodies, the astronauts of one State Party shall render all possible assistance to the astronauts of other States Parties.

States Parties to the Treaty shall immediately inform the other States Parties to the Treaty or the Secretary-General of the United Nations of any phenomena they discover in outer space, including the Moon and other celestial bodies, which could constitute a danger to the life or health of astronauts.

Article VI

States Parties to the Treaty shall bear international responsibility for national activities in outer space, including the Moon and other celestial bodies, whether such activities are carried on by governmental agencies or by non-governmental entities, and for assuring that national activities are carried out in conformity with the provisions set forth in the present Treaty. The activities of non-governmental entities in outer space, including the Moon and other celestial bodies, shall require authorization and continuing supervision by the appropriate State Party to the Treaty. When activities are carried on in outer space, including the Moon and other celestial bodies, by an international organization, responsibility for compliance with this Treaty shall be borne both by the international organization and by the State Parties to the Treaty participating in such organization.
Article VII

Each State Party to the Treaty that launches or procures the launching of an object into outer space, including the Moon and other celestial bodies, and each State Party from whose territory or facility an object is launched, is internationally liable for damage to another State Party to the Treaty or to its natural or juridical persons by such object or its component parts on the Earth, in air space or in outer space, including the Moon and other celestial bodies.

Article VIII

A State Party to the treaty on whose registry an object launched into outer space is carried shall retain jurisdiction and control over such object, and over any personnel thereof, while in outer space or on a celestial body. Ownership of objects launched into outer space, including objects landed or constructed on a celestial body, and of their component parts, is not affected by their presence in outer space or on a celestial body or by their return to Earth. Such objects or component parts found beyond the limits of the State Party to the Treaty on whose registry they are carried shall be returned to that State Party, which shall, upon request, furnish identifying data prior to their return.

Article IX

In the exploration and use of outer space, including the Moon and other celestial bodies, States Parties to the Treaty shall be guided by the principle of co-operation and mutual assistance and shall conduct all their activities in outer space, including the Moon and other celestial bodies, with due regard to the corresponding interests of all other States Parties to the Treaty. States Parties to the Treaty shall pursue studies of outer space, including the Moon and other celestial bodies, and conduct exploration of them so as to avoid their harmful contamination and also adverse changes in the environment of the Earth resulting from the introduction of extraterrestrial matter and, where necessary, shall adopt appropriate measures for this purpose. If a State Party to the Treaty has reason to believe that an activity or experiment planned by it or its nationals in outer space, including the Moon and other celestial bodies, would cause potentially harmful interference with activities of other States Parties in the peaceful exploration and use of outer space, including the Moon and other celestial bodies, it shall undertake appropriate international consultations before proceeding with any such activity or experiment planned by another State Party in outer space, including the Moon and other celestial bodies, would cause potentially harmful interference
with activities in the peaceful exploration and use of outer space, including the Moon and other celestial bodies, may request consultation concerning the activity or experiment.

Article X

In order to promote international co-operation in the exploration and use of outer space, including the Moon and other celestial bodies, in conformity with the purposes of this Treaty, the States Parties to the Treaty shall consider on a basis of equality any requests by other States Parties to the Treaty to be afforded an opportunity to observe the flight of space objects launched by those States. The nature of such an opportunity for observation and the conditions under which it could be afforded shall be determined by agreement between the States concerned.

Article XI

In order to promote international co-operation in the peaceful exploration and use of outer space, States Parties to the Treaty conducting activities in outer space, including the Moon and other celestial bodies, agree to inform the Secretary-General of the United Nations as well as the public and the international scientific community, to the greatest extent feasible and practicable, of the nature, conduct, locations and results of such activities. On receiving the said information, the Secretary-General of the United Nations should be prepared to disseminate it immediately and effectively.

Article XII

All stations, installations, equipment and space vehicles on the Moon and other celestial bodies shall be open to representatives of other States Parties to the Treaty on a basis of reciprocity. Such representatives shall give reasonable advance notice of a projected visit, in order that appropriate consultations may be held and that maximum precautions may be taken to assure safety and to avoid interference with normal operations in the facility to be visited.

Article XIII

The provisions of this Treaty shall apply to the activities of States Parties to the Treaty in the exploration and use of outer space, including the Moon and other celestial bodies, whether such activities are carried on by a single State Party to the Treaty or jointly with
other States, including cases where they are carried on within the framework of international intergovernmental organizations.

Any practical questions arising in connection with activities carried on by international intergovernmental organizations in the exploration and use of outer space, including the Moon and other celestial bodies, shall be resolved by the States Parties to the Treaty either with the appropriate international organizations or with one or more States members of that international organization, which are Parties to this Treaty.

Article XIV

1. This treaty shall be open to all States for signature. Any State which does not sign this Treaty before its entry into force in accordance with paragraph 3 of this article may accede to it at any time.

2. This Treaty shall be subject to ratification by signatory States. Instruments of ratification and instruments of accession shall be deposited with the governments of the Union of Soviet Socialist Republics, the United Kingdom of Great Britain and Northern Ireland and the United States of America, which are hereby designated the Depository Governments.

3. This Treaty shall enter into force upon the deposit of instruments of ratification by five Governments including the Governments designated as Depository Governments under this Treaty.

4. For States whose instruments of ratification or accession are deposited subsequent to the entry into force of this Treaty, it shall enter into force on the date of the deposit of their instruments of ratification or accession.

5. The Depository Governments shall promptly inform all signatory and acceding States of the date of each signature, the date of deposit of each instrument of ratification of and accession to this Treaty, the date of its entry into force and other notices.

6. This Treaty shall be registered by the Depository Governments pursuant to Article 102 of the Charter of the United Nations.

Article XV

Any State Party to the Treaty may propose amendments to this Treaty. Amendments shall enter into force for each State Party to the Treaty accepting the amendments upon their acceptance by a majority of the
States Parties to the Treaty and thereafter for each remaining State Party to the Treaty on the date of acceptance by it.

Article XVI

Any State Party to the Treaty may give notice of its withdrawal from the Treaty one year after its entry into force by written notification to the Depository Governments. Such withdrawal shall take effect one year from the date of receipt of this notification.

Article XVII

This Treaty, of which the Chinese, English, French, Russian and Spanish texts are equally authentic, shall be deposited in the archives of the Depository Governments. Duly certified copies of this Treaty shall be transmitted by the Depository Governments to the Governments of the signatory and acceding States.

In witness whereof the undersigned, duly authorized, have signed this Treaty.

Done in triplicate at the cities of London, Moscow and Washington, this twenty-seventh day of January, one thousand nine hundred sixty-seven.

APPENDIX H

ARGENTINA-BRAZIL DRAFT PRINCIPLES ON REMOTE SENSING
(1974)

TREATY ON REMOTE SENSING OF NATURAL RESOURCES BY
MEANS OF SPACE TECHNOLOGY

Draft basic articles

The States Parties to this Treaty:

Considering that the global research of earth resources by means of
space technology is an effective ways of determining the existence and
the location of these resources, as well as the possibilities of
increasing them, with a view to cope with the growing scarcity of food
and raw materials;

Considering further that the main economic assets of every State
are its human and natural resources;

Convinced that the new techniques of remote sensing of earth
resources, as an effective stimulus for economic and social
development, will admittedly contribute to the well-being of humanity
as a whole, and allow for international co-operation, taking particularly
into account the needs and interests of the developing countries;

Conscious of the multiple and relevant international effects derived
from the use of the technology of remote sensing of earth resources,
which create legal problems that require an immediate and equitable
solution in the framework of a general treaty and agreements on
mutual co-operation;

Reaffirming the principles contained in the United Nations General
Assembly resolutions concerning the permanent sovereignty of
peoples and nations over their own natural resources in particular
resolutions 1803 (XVII) of 14 December 1962 and 2158 (XXI) of 25
November 1966;
Desiring to safeguard the exercise of the sovereign rights of States over their own natural resources;

Taking into account the principles of international law, the Charter of the United Nations and the Treaty of Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies;

Have agreed on the following:

**Article I**

National and international programmes for remote sensing of natural resources by means of space technology shall promote international co-operation and their implementation shall benefit and serve the interest of all mankind, taking especially into consideration benefits to and the interest and needs of the developing countries.

**Article II**

States parties shall carry out activities of remote sensing of natural resources by means of space technology in accordance with the principles of international law, the Charter of the United Nations and the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies.

**Article III**

Programmes for world-wide remote sensing shall take into account the need to prevent the exploitation of natural resources from causing the spoliation or destruction of the environment.

**Article IV**

Activities of remote sensing of natural resources by means of space technology must be based on the principle of sovereign equality of States and of the honourable fulfillment of international commitments, as well as other relevant principles of international law regarding friendly relations and co-operation among States. The principles of sovereign equality of States and self-determination of peoples embrace not only the right to internal sovereignty and independence, but also the economic aspect of the freedom to use and distribute their wealth, whereby peoples may exercise their legitimate and exclusive sovereign rights over their own natural resources.
Article V

States parties shall refrain from undertaking activities of remote sensing of natural resources belonging to another State party, including the resources located in maritime areas under national jurisdiction, without the consent of the latter.

Article VI

States parties will take all measures authorized by international law to protect their territory and maritime areas under their jurisdiction from remote sensing activities for which they had denied their consent.

Article VII

States parties which have given consent for their territory and maritime areas under their jurisdiction to be object of remote sensing of natural resources are entitled to participate in those activities in a manner to be decided upon by specific arrangements between the parties concerned, which will include the guarantee of technical assistance to be provided by the sensing State to the sensed State during the whole process of these activities.

Article VIII

States parties whose territory and maritime areas under their jurisdiction the object of remote sensing of natural resources are entitled to full and unrestricted access to all data obtained through those activities.

Article IX

States parties obtaining information relating to the natural resources of another State party through remote sensing shall neither divulge such information nor transmit or transfer it in any manner to a third State, international organization or private entity, without the express authorization of the party to which the natural resources belong, nor can they utilize the information thus obtained to the detriment of the latter.
Article X

States parties shall refrain from soliciting, accepting or, in any manner, receiving from a third State, international organization or private entity, information regarding the natural resources of another State party obtained through remote sensing without the express authorization of the State party to which the natural resources belong, nor can they utilize such information to the detriment of the latter.

Article XI

States parties possessing the technological capability of remote sensing shall endeavour to assist other States parties lacking this technology in the implementation of natural programmes for surveying natural resources planned by the latter.

Article XII

States parties acknowledge the right of all States to participate fully in activities of remote sensing of natural resources of territorial and maritime areas outside national sovereignty or jurisdiction, as well as the need to guarantee free access to all information obtained through these activities.

Article XIII

States parties shall be held internationally responsible for national activities or remote sensing of natural resources, irrespective of whether such activities are carried out by governmental or non-governmental entities, and shall guarantee that such activities will comply with the provisions of the present treaty.

Article XIV

Disputes resulting from activities of remote sensing of natural resources shall be resolved in accordance with the methods envisaged in Article 33 of the Charter of the United Nations.

Article XV

States parties are entitled to celebrate international agreements confirming, completing and developing the provisions of the present treaty.
Article XVI

Nothing in this treaty shall affect the rights and duties contracted by States parties through bilateral or regional agreements.

APPENDIX I

FRANCO-SOVIE T DRAFT PRINCIPLES ON REMOTE SENSING (1974)

DRAFT PRINCIPLES GOVERNING THE ACTIVITIES
OF STATES IN THE FIELD OF REMOTE SENSING OF EARTH RESOURCES BY MEANS OF SPACE TECHNOLOGY

FRANCE and USSR: Working paper

1. Outer space shall be free for use of all States, without discrimination of any kind on a basis of equality and in accordance with international law, including the United Nations Charter and the 1967 Outer Space Treaty, for carrying out remote sensing of earth resources exclusively for peaceful purposes.

2. Such use shall, in particular, respect the principle of the sovereignty of States and especially the right of peoples and States to exercise permanent sovereignty over their wealth and resources as a basic element of their right of self-determination as well as their inalienable right to dispose of their natural resources and of information concerning those revenues.

3. Activities in the field of remote sensing of earth resources from outer space and international co-operation in that field shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development, and their results should contribute to an improvement in the balance of the natural environment.

4. A State engaged in the exploration of natural resources by means of space technology which, in the course of such activities, obtains information on the natural resources of another State must transmit such information to the latter State on mutually acceptable terms.

5. (1) Any State whose territory is affected by activities connected with the remote sensing of earth resources may, in agreement with the State conducting the remote sensing, participate in those activities on equal and mutually acceptable terms.
(2) A State which obtains information concerning the natural resources of another State as a result of remote sensing activities shall not be entitled to make it public without the clearly expressed consent of the State to which the natural resources belong or to use it in any other manner to the detriment of such State. Documentation resulting from remote sensing activities may not be communicated to third parties, whether Governments, international organizations or private persons, without the consent of the State whose territory is affected.

(3) Exception from the principle contained in sub-paragraph (2) above is made for information on natural disasters and phenomena which can be detrimental to the environment in general.

6. All States shall be entitled on equal and mutually acceptable terms to receive and process data resulting from activities in the remote sensing of areas situated outside the national jurisdiction of any State. They shall also be entitled to access, on the same terms, to the results of such activities within the framework of institutionalized international co-operation.

7. Every State conducting activities in the field of remote sensing of earth resources shall inform the Secretary-General thereof, in accordance with article XI of the Outer Space Treaty.

APPENDIX J

SOVIET BLOC CONVENTION ON REMOTE SENSING (1978)

INTERNATIONAL CO-OPERATION IN THE PEACEFUL USES OF OUTER SPACE

Letter dated 28 June 1978 from the Permanent Representative of the Union of Soviet Socialist Republics to the United Nations addressed to the Secretary-General

I have the honour to transmit to you herewith the text of the Convention on the Transfer and Use of Data of the Remote Sensing of the Earth from Outer Space, which was signed in Moscow on 19 May 1978 by Cuba, Czechoslovakia, the German Democratic Republic, Hungary, Mongolia, Poland, Romania and the Union of Soviet Socialist Republics and which, after its entry into force, will be opened for accession by all other States.

I should be grateful if you would have the text distributed as an official document of the General Assembly under item 51 of the preliminary list.

(Signed) O. TROYANOVSKY
CONVENTION

On the Transfer and Use of Data of the Remote Sensing of the Earth from Outer Space

The States Parties to this Convention, hereinafter referred to as the "Contracting Parties",

Considering that outer space is free for use by all States without discrimination of any kind, on a basis of equality and in accordance with international law, including the Charter of the United Nations and the Treaty on Principles Governing the Activities of States in the Exploitation and Use of Outer Space, including the Moon and Other Celestial Bodies, for the purpose of carrying on activities in the remote sensing of the Earth from outer space;

believing that in carrying on such activities the sovereign rights of States, in particular their inalienable right to dispose of their natural resources and of information concerning those resources, should be respected;

reaffirming that activities in the field of remote sensing of the Earth from outer space and international co-operation to this end should promote peace and understanding among States and be carried out for the benefit and in the interests of all peoples irrespective of their degree of economic or scientific development;

convinced that space technology can provide new valuable information necessary for the exploration of the natural resources of the Earth, geology, agriculture, forestry, hydrology, oceanography, geography and cartography, meteorology, environmental control, and for the solution of other problems connected with the systematic exploration of the Earth and its surrounding space in the interests of science and the economic activities of States;

determined to create favourable conditions and necessary technical and economic prerequisites for expanding co-operation in the effective practical use of data of the remote sensing of the Earth from outer space,

Have agreed as follows:
Article I

For the purpose of this Convention:

(a) The term "remote sensing of the Earth from outer space" means observations and measurements of energy and polarization characteristics of self-radiation and reflected radiation of elements of the land, ocean and atmosphere of the Earth in different ranges of electromagnetic waves which facilitate the location, description of the nature and temporal variations of natural parameters and phenomena, natural resources of the Earth, the environment as well as anthropogenic objects and formations;

(b) The term "data of the remote sensing of the Earth from outer space" means the initial data obtained by remote sensors installed on space objects and transmitted from them by telemetry in the form of electromagnetic signals or physically in the form of photographic film or magnetic tape, as well as preprocessed data derived from the flow of data which may be used for later analysis;

(c) The term "information" means the end-product of the analytical process of handling, deciphering and interpreting remote sensing data from outer space, in combination with the data and evidence obtained from other sources;

(d) The term "natural resources of the Earth" means natural resources forming part of the aggregate of natural conditions of the human habitat and constituting major components of man's natural environment which are used in social production for satisfying the material and cultural requirements of society.

Article II

The Contracting Parties shall co-operate with each other in the transfer and use of data of the remote sensing of the Earth from outer space.

Article III

The specific list, technical parameters, the volume of the said data, the time-table of their receipt and conditions of the transfer as well as the degree of participation of the Contracting Parties concerned in their processing and thematic interpretation shall be determined by agreement between the Contracting Parties concerned on a bilateral or multilateral basis.
Article IV

A Contracting Party in possession of initial data of the remote sensing of the Earth from outer space, with a better than 50 meters resolution on the terrain, relating to the territory of another Contracting Party, shall not disclose or make them available to anyone except with an explicit consent thereto of the Contracting Party to which the sensed territories belong, not shall it use them or any other data in any way to the detriment of that Contracting Party.

Article V

A Contracting Party that has obtained as a result of the deciphering and thematic interpretation of any data of the remote sensing of the Earth from outer space information about the natural resources or the economic potential of another Contracting Party shall not disclose such information or make it available to anyone except with an explicit consent thereto of the Contracting Party to which the sensed territories and natural resources belong, nor shall it use such or any other information in any way to the detriment of that Contracting Party.

Article VII

The Contracting Parties shall co-operate, subject to agreement on a bilateral or multilateral basis, in elaborating and developing technical means and methods necessary for taking measurements, the processing and thematic interpretation of the data obtained from the remote sensing of the Earth from outer space, as well as in training appropriate personnel for making an early and most efficient practical use of modern space technology and data of the remote sensing of the Earth from outer space.

Article VIII

1. The Contracting Parties shall resolve questions arising in the process of the implementation of this Convention in the spirit of mutual respect by negotiation and consultation.

2. In order to resolve questions arising in connection with the implementation of this Convention, meetings of representative of the Contracting Parties concerned may be held, when necessary, by agreement between such Contracting Parties.
Article IX

Any contracting Party may propose amendments to this Convention. Amendments shall enter into force for each Contracting Party accepting the amendments upon their approval by two-thirds of the Contracting Parties. An amendment that has entered into force becomes binding upon the other Contracting Parties upon their acceptance of such amendment.

Article X

1. This Convention shall be subject to approval of signatory States in accordance with their legislation. The Convention shall enter into force on the deposit of instruments of approval by five Governments, including the Depositary Government of the Convention.

For Contracting Parties whose instruments of approval are deposited after the entry into force of this Convention, it shall enter into force on the data of the deposit of their instruments of approval.

2. This Convention shall remain, in force for five years.

For each of the Contracting Parties which does not withdraw from the Convention six months prior to the expiry of the said five-year period and successive five-year periods, it shall remain in force for each successive period of five years.

Article XI

1. Other States sharing the purposes and principles of the Convention may accede to this Convention. Instruments of accession shall be deposited with the depositary of the Convention.

2. Accession of a new State shall be considered to have taken effect 30 days from the data of receipt by the depositary of the instrument of accession, who shall promptly notify so all the Contracting Parties.

Article XII

1. Each of the Contracting Parties may withdraw from this Convention by giving notice to the depositary of the Convention. Such withdrawal shall take effect 12 months from the date of receipt by the depositary of the notification.
2. Withdrawal from the Convention shall not affect obligations of co-operating organizations of the Contracting Parties under the working agreements or contracts concluded by them.

Article XIII

1. This Convention shall be deposited with the Government of the Union of Soviet Socialist Republics, which shall act as the depositary.

2. The depositary shall transmit certified copies of this Convention to all the Contracting Parties and inform them of all notifications received by him.

3. This Convention shall be registered by the depositary pursuant to Article 102 of the Charter of the United Nations.

Article XIV

This Convention is drawn up in four copies in the Russian, English, French and Spanish languages, all of the texts being equally authentic.

APPENDIX K

UNITED STATES DRAFT PRINCIPLES ON REMOTE SENSING (1975)

LEGAL IMPLICATIONS OF REMOTE SENSING OF THE EARTH FROM SPACE

Remote Sensing of the natural environment of the earth from outer space

United States working paper on the development of additional guidelines

Possible preambular provisions

Recalling the provisions of the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies,

Reaffirming that the common interest of mankind is served by the exploration and use of outer space for peaceful purposes,

Considering that international co-operation in the continuing development of technology enabling mankind to undertake remote sensing of the natural environment of the earth from outer space may provide unique opportunities for all peoples to gain useful understanding of the earth and its environment,

Recognizing that the most valuable potential advantages to mankind from these technological developments, including among others preservation of the environment and effective management and control by States of their natural resources, will depend on the sharing of data and its use on a regional and global basis.
Possible operative provisions

I. Remote sensing of the natural environment of the earth from outer space shall be conducted in accordance with the principles of the United Nations Charter, the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, and other generally accepted principles of international law relating to man's activities in outer space.

II. Satellites designed for remote sensing of the natural environment of the earth shall be registered with the Secretary-General of the United Nations in accordance with the Convention on Registration of Objects Launched into Outer Space. States shall as appropriate inform the Secretary-General of the progress of such remote sensing space programmes they have undertaken.

III. Remote sensing of the natural environment of the earth from outer space should promote inter alia (a) international co-operation in the solution of international problems relating to natural resources and the environment, (b) the development of friendly relations among States, (c) co-operation in scientific investigation, and (d) the use of outer space for the benefit and in the interest of all mankind.

IV. States undertaking programmes designed for remote sensing of the natural environment from satellites shall encourage the broadest feasible international participation in appropriate phases of those programmes.

V. States receiving data directly from satellites designed for remote sensing of the natural environment of the earth shall make those data available to interested States, international organizations, individuals, scientific communities and others on an equitable, timely and non-discriminatory basis. To enhance the ability of all States, organizations and individuals to share in the knowledge gained from remote sensing of the natural environment from outer space, States should publish catalogues or other appropriate listings of publicly available data which they have received directly from such remote sensing satellites.

VI. States receiving data directly from such remote sensing satellites shall ensure in particular that data of a sensed area within the territory of any other State are available to the sensed State as soon as practicable, and in any event as soon as they are available to any State other the sensing States. States owning such remote sensing satellites shall facilitate the direct reception of data from those satellites by other interested States when technically possible and on equitable terms.
VII. States engaged in such remote sensing programmes shall within their capabilities endeavour to assist on an equitable basis other interested States, organizations and individuals to develop an understanding of the techniques, potential benefits and costs of remote sensing. Such assistance could include the provision of opportunities to learn what data are available, how to handle and interpret the data, and, where appropriate, how to apply the knowledge gained to meet national, regional and global needs.

VIII. States should co-operate with other States in the same geographical region in the use of data from such remote sensing programmes, whether regional or global in nature, to promote the common development of knowledge about that region.

IX. States which undertake such remote sensing programmes should encourage relevant international organizations to which they belong to assist other member States in acquiring and using data from those programmes so that the maximum number of States can share in potential benefits which may result from the development of this technology.

## APPENDIX L

### UN COPUOS MEMBERS' LIST (June 1990)

### Nations with Regular Membership

| 1.  | Albania          | 28. | Japan          |
| 2.  | Argentina        | 29. | Kenya          |
| 3.  | Australia        | 30. | Lebanon        |
| 4.  | Austria          | 31. | Mexico         |
| 5.  | Belgium          | 32. | Mongolia       |
| 6.  | Benin            | 33. | Morocco        |
| 7.  | Brazil           | 34. | Netherlands, The |
| 10. | Cameroon         | 37. | Pakistan       |
| 11. | Canada           | 38. | Philippines    |
| 12. | Chad             | 39. | Poland         |
| 13. | Chile            | 40. | Portugal       |
| 14. | China            | 41. | Romania        |
| 15. | Columbia         | 42. | Sierra Leone   |
| 16. | Czechoslovakia   | 43. | Sudan          |
| 17. | Ecuador          | 44. | Sweden         |
| 19. | France           | 46. | Turkey         |
| 20. | German Democratic Rep. | 47. | U.S.S.R.       |
| 22. | Hungary          | 49. | United States of America |
| 23. | India            | 50. | Uruguay        |
| 24. | Indonesia        | 51. | Venezuela      |
| 25. | Iran, Islamic Rep. of | 52. | Viet Nam       |
| 26. | Iraq             | 53. | Yugoslavia     |
| 27. | Italy            |      |                |
Observer Nations

1. Cuba  5. Peru
2. Greece  6. Spain
3. Libya  7. Holy See
4. Malaysia  8. Switzerland

Specialized Agencies (UN)

1. Food & Agriculture Organization of the UN (FAO)
2. International Atomic Energy Agency (IAEA)
3. International Telecommunications Union (ITU)
4. UN Educational, Scientific & Cultural Organization (UNESCO)
5. World Meteorological Organization (WMO)

Intergovernmental Organizations

1. European Space Agency (ESA)
2. International Telecommunications Satellite Organization (INTELSAT)
3. International Maritime Satellite Organization (INMARSAT)

Non-Governmental Organizations

1. Committee On Space Research (COSPAR)
2. International Astronautical Federation (IAF)