SHORT TITLE

LAW & ORGANIZATIONS FOR REMOTE SENSING FROM SPACE

ABSTRACT

LEGAL AND ORGANIZATIONAL ASPECTS OF REMOTE SENSING OF EARTH RESOURCES FROM OUTER SPACE

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Remote sensing of the earth from outer space may contribute to more effective development and management of natural resources, particularly important to emerging nations. The first satellite designed exclusively for this purpose was launched July 23, 1972.

Internationalization of the use of earth resources satellites can best be achieved through multilateral institutional arrangements for an eventual operating organization. To capitalize upon the valuable fund of knowledge within the United Nations and the important values in international co-operation, a new UN co-ordinating agency should initiate the creation of an independent international entity outside of the UN framework.

States' sovereignty over their natural resources is not a legal barrier to remote sensing from space. The 1967 Space Treaty supports a nation's claim to share in data obtained. The question of liability requires a distinction between the use of remote sensors and of the data they yield. Effective use of the radio spectrum and of specific orbits requires special consideration. Procedures to settle grievances arising from the use of both sensing devices and resources information should be implemented within the structure of an international operating organization.

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by

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As required by the Faculty of Graduate Studies and Research, it is declared herewith that the preparation of this thesis is entirely the work of the author, and was done without assistance beyond the normal direction provided by members of the Faculty of the Institute. The conclusions which are expressed reflect only the opinions of the author.

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PREFACE

On July 23, 1972, while this thesis was in the final stage of preparation for submission, news was received* that the United States had successfully orbited the first of its Earth Resources Technology Satellites, the ERTS-A. The impact of this announcement will undoubtedly awaken a variety of emotions in all corners of the world as the consequences of this launching unfold. Another of the "giant leaps", first taken on behalf of mankind by Astronaut Neil Armstrong on the surface of the moon, has been entered into the record, evidenced by the international and multi-disciplinary concentration of knowledge, skill and financial resources in this new satellite. When one considers the grim conditions under which operational rockets were first developed and used, the Delta launching vehicle clearly represents the plough fashioned from a sword. The satellite which it meticulously positioned in orbit personifies the peaceful uses of outer space and is a tribute to those responsible for its creation, as man begins to look upon the planet Earth in serious contemplation of the problems of survival for himself and his fellow beings.

* The newspaper reports of the launching are included in the Appendix

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INTRODUCTION

The visual, auditory and thermal sensing organs with which human beings are born function in a relatively narrow response area, providing each person with information required to continually evaluate the surrounding environment and make the necessary adjustments to survive in it. At the primary level, reaction to heat, cold, light, darkness are instinctive to a large degree. These sensory devices, at a more elevated level, also operate to bring information to each individual which adds to experience, knowledge and, hopefully, intelligence. However, people are not able to record the impressions or facts they receive beyond their conscious ability to remember, and this is subject to a limitation on capacity and to the distortions produced as a result of previous judgements, experience and facts. The legal profession is well aware of the possibility of differing impressions "remembered" by various people exposed to the same situation at the same time.

In the effort to improve the environment and conditions of human life through technology, it seems logical that a great deal of attention would be given to extending the ability to perceive natural phenomena as well as to the devising of methods more permanently and more objectively recording that which is observed. Elementary examples of this activity result in enabling people to remember friends through photographs, to

recall a symphony by replaying a record and to know the outdoor temperature one year ago because it was written down.

Curiosity and the desire for knowledge have motivated the search for improved techniques to sense the details of man's environment and to preserve them, while other needs provide the impetus to utilize the information obtained as the basis to satisfy those needs. While the mystery of what yet lies outside of current knowledge has turned new sensing devices towards regions remote from the earth, there has equally been the motivation to direct them microscopically as well. The extension of human activity to outer space has been subject to both of these same influences. While travelling away from the earth, astronauts frequently look back, forming impressions of the appearance of the planet they are leaving. As these impressions are examined it seems they may be useful in providing new information about the Earth, about its composition, size, shape and particularly about the treasures and the power concealed at and just below its surface of rock, soil and water.

"Perspective" can be a valuable ingredient of the information being considered by anyone involved in making decisions of national importance. From a position of ten centimeters in front of a fire, only the searing heat and potential destruction are evident. Moving a few meters away the fire becomes a vital and necessary source of warmth for the home

and perhaps the facility by way of which the family's food is prepared. Moving again a distance of two or three kilometers, one can see the fire, in its environment of the hearth, the home and the family, as part of the community process in which it exists, contributing to the welfare of all. "Perspective" is also the valuable ingredient to be gained from outer space remote sensing activities. An impressive and powerful waterfall may be awe-inspiring to an observer on the shore. An engineer in an aircraft can determine the potential value of a lake some distance away. The view from space of the relationship between waterfall, lake and land may, however, be required to fully understand and capitalize upon the possibilities for power, irrigation, new urban and arable land use, perhaps leading to the establishment of a new community.

This new perspective differs radically from those provided by previous technological advances. It can be obtained only from a location which is free from the claims of sovereignty. International law has declared outer space as being capable of ownership by no state - and therefore, one may conclude as owned by all. Those who enter this domaine do not however, have the freedom of recklessness. On the contrary, they have the privilege of using this new medium, but they have also the responsibility to use it carefully and in the interest of all nations. It was in this spirit that the General Assembly of the United Nations by its Resolution 2778 (XXVI) of 29 November 1971[1], convened a Working Group on Remote Sensing of the Earth by Satellite as

an organ of the Scientific and Technical Sub-Committee of the UN Committee on the Peaceful Uses of Outer Space (COPUOS), and which had been foreseen in its earlier Resolution 2733C (XXV) of 16 December 1970. In formally establishing the Working Group, the General Assembly expressed itself as "Sharing the view ... that the potential benefits from technological developments in remote sensing of the earth from space platforms could be extremely meaningful for the economic development of all countries, especially the developing countries, and for the preservation of the global environment." The generally enthusiastic comments of the delegates to COPUOS following the establishment of the Working Group suggest the importance attributed by members of the world community to this new application of space technology.[2]

In the same way that satellites have extended the mobility of human beings, remote sensing devices aboard these vehicles can extend the range of their eyesight. This thesis attempts to outline briefly the nature of these devices and to explore the potential as well as the problems which lie in the vision they may provide. As these new "eyes" of man are turned inward upon his home, it may be possible to reap significantly far-reaching benefits. With the judgement born of wisdom and clear minds, the peoples of all nations may share these benefits.

CHAPTER I

THE ROLE OF REMOTE SENSING FROM SPACE IN NATURAL RESOURCE DEVELOPMENT

1. United Nations Interest

A report of the Secretary-General, introducing a study on the subject of natural resource satellites drew the attention of the Economic and Social Council "to resource satellites in the belief that they represent a potentially important, additional tool for the survey, development and management of natural resources ... So far, the work on resource satellites is in the research and development stage and not operational. Developments are, however, moving rapidly, as illustrated by the United States expectation of sending the first experimental resources satellite (ERTS-A) into Space in 1972. The time has definitely come to prepare internationally for the new era, to involve the user community and to guide developments so that needs are recognized and met."[3]

The participation of the UN in solving some of the problems facing developing countries, and in the elaboration of a legal regime for outer space within a framework of international co-operation, brings the world body into a unique position in relation to remote sensing of the earth by satellite. Many of the anticipated benefits to be realized from data produced by space surveys may be of great potential benefit to

developing nations. The application of the new techniques at an international level will, however, require a penetrating knowledge of national needs and of the ability of individual nations, in terms of financial resources and technically trained personnel, to make use of space-derived data, in order that realistic priorities can be established.[4] UN assistance to many of these countries in the past, and its awareness of co-operative programs undertaken by some of more prosperous countries, has created an invaluable fund of knowledge within the United Nations Organization.

The interest taken by the UN to date will be given added impetus through the capability to conduct useful surveys of the earth from outer space. This will add an important tool to those already available, often permitting more rapid development to be achieved.

The notion of a state using devices located in outer space to "survey" all parts of the globe is sufficient to quickly arouse the concern of many, if not all, of the members of the world community. Although a nation may have very little to hide from its neighbours, the presence of remote sensors orbiting over its territory is perhaps only a step removed from "spying" and can be grounds for a country to fear that its national sovereignty may be violated, its defences weakened, its economy exploited and its government interfered with.

It is, therefore, not surprising that while the techniques of remote sensing of the earth are still in the early

experimental stage, members of the United Nations are expressing the need for international regulation of the application of this new use of outer space. In its first formal reference to this activity in 1969, the UN General Assembly expressed the desire that "earth resources survey satellite programs be available to produce information for the world community as a whole."[5]

The delegate of Sweden to Committee on the Peaceful Uses of Outer Space (COPUOS) in April, 1970 emphasized that earth surveying from space merited unique institutional arrangements, and he recommended "Steps should be taken to study the possibilities of internationalization of earth resources satellites. That would be the only way to avoid offending national sensitivities, prevent discrimination and ensure free access to the data obtained."[6]

In July of 1970, Argentina presented a draft agreement which suggested that "Until such time as some other appropriate body is available, the United Nations Secretariat shall be responsible for the functions of planning, consultation, information, inventorying and co-ordination of such activities [i.e. remote sensing of earth resources by satellite] in the initial stage to meet immediate needs, with a view of internationalizing overall surveys of resources".[7]

U Thant in his 1970 "Introduction to the Annual Report of the Secretary-General on the Work of the Organization," referred to the fact that "the United Nations has become increas-

ingly concerned with the new techniques of surveying earth resources by satellites."[8] The former Secretary-General discussed the efforts of COPUOS to ensure availability to all nations of the practical benefits to be achieved, and he noted that "When this technology is fully developed, it will be one of man's most effective devices for surveying the Earth and utilizing its resources."[9]

The General Assembly turned its attention to the subject again in Resolution 2733 C (XXV) of December 16 1970, and referred with approval both to the efforts of COPUOS to encourage international programs and to those of UN members "to share with other interested member States the practical benefits which may be derived from their programs in space technology, including earth resources surveying."[10] This led to the convening of the Working Group as noted above.

These references highlight the attention which has been focussed on the international values of remote sensing from space. It appears that, regulatory and institutional arrangements cannot, in this case, await the maturing of technology, but must precede it, if the United Nations are to adhere to its declared purposes which include, inter alia, "To achieve international co-operation in solving international problems of an economic ... character" and "To be a center for harmonizing the actions of nations in the attainment of these common ends."[11]

The UN Department of Economic and Social Affairs recently stated that the world organization hopes to extend

the advantages of space technology to the developing countries during the Second United Nations Development Decade. The action which was suggested to achieve this includes general planning and co-ordination, studies by experts, assistance for training, establishment of the legal, political and social framework and support through the specialized agencies.[12]

In October 1970 the UN General Assembly adopted the strategy for the Second Development Decade which began January 1971. The strategy sets goals, the basic ones being an average growth of 6% in developing countries and an action program broadly covering the spectrum of economic and social development. The techniques of satellite surveys may well reach a stage of technical perfection to be of major assistance in these objectives before this Decade is completed.

The rationale for United Nations interest in the new techniques being developed and the benefits they may provide is implicit in the summary by U.S. President Nixon, in his Aeronautics and Space Report of 1971 activities, referring to Earth Resources Survey (ERS): "This program represents an attempt to combine aerospace technology and interdisciplinary science in developing a new capability for rational management of the limited resources of the earth. The major emphases of the program are two: to learn how to gather data about earth accurately and efficiently from a variety of surface, airborne and space platforms, and to learn how to extract

from these data new information to support environmental decision making. The goal of the current experimental ERS program is to move to a point at which a national decision on the advisability of developing an integrated operational earth survey system can be made."[13]

2. The Importance of Natural Resource Development

On 22 November 1966, the United Nations General Assembly, in Resolution 2155 (XXI) expressed its grave concern "at the growing food shortage in the developing countries which is due to a decline in their production of food-stuffs accompanied by a high population growth rate." The critical relationship between the rapidly increasing numbers of people and the reduction in available resources to provide for their needs has been the subject of many detailed studies. Attention was directed to this relationship in the Declaration on Population by World Leaders made at the UN in 1966,[14] which noted the significance of the increase in the world's population from one billion in the middle-1800's to over three billion today, and the projection to nearly 7 billion by the year 2000. The Declaration emphasized that "Too rapid population growth seriously hampers efforts to raise living standards, to further education, to improve health and sanitation, to provide better housing and transportation, to forward cultural and recreational opportunities, and even in some countries to assure sufficient food".

The Pearson Commission on International Development, sponsored by the International Bank for Reconstruction and Development stated that "No other phenomenon casts a darker shadow over the prospects for international development than the staggering growth of population. It is evident that it is a major cause of the large discrepancy between rates of economic improvement in rich and poor countries."[15]

In outlining the evolution of resource scarcity, Dr. P. Castruccio pointed out "Eventually the product of population times demand became so great that it began to tax existing resources. In the past when local resources were occasionally inadequate to cope with demand, additional goods could always be imported from neighbouring regions of plenty ... Now, however, we are transitioning from local acute crises to a global chronic inadequacy."[16]

The serious nature of the problem of insufficient resources has been highlighted in The Limits of Growth by Professor D.H. Meadows of M I T[17] which casts strong doubts on the possibility of sufficient technological progress in the next 100 years to support the earth's population. The study graphically illustrates the insufficiency of present reserves of natural fuel and mineral resources, taking into account normal growth in consumption and notwithstanding the discovery of substantially increased supplies.

There is no single all-embracing solution to the question of inadequate raw materials facing an almost expotential

rise in population. Clearly, however, one aspect of the solution lies in rapidly increasing the known stocks of natural resources. Another aspect is to develop more efficient methods of utilization of those presently available, and working towards the goal of making conservation an integral part of the pattern of consumption.

This goal also has its multispectral elements, and one of these is the role to be played by the use of space-borne remote sensing devices. The projected benefits from satellite surveys tentatively indicates their potential to assist man in the discovery of new resource locations, as well as to manage known, non-renewable resources with greater effectiveness.

For the industrialized nations, such results can be of importance in maintaining growth in national productivity and standards of living.[18] For developing countries, this technology may also be of great value. These states are, in many cases, in the process of making choices as to how capital - both human and financial, both of which may be quite scarce - is to be invested. Wrong decisions may not only be costly, but may severely impede the development of the economy. It is, therefore, essential, that any new technology which can assist in reducing both the time spent in resource location and development, as well as the costs associated with these, be made immediately available to these nations. For a developing economy to grow and mature, the products of its own resources

must become part of the commercial stream as rapidly as possible, thereby enabling it to provide for the needs of its own people, as well as to engage in world trade.

3. Earth Resources Satellites

The photographs taken by astronauts during the early Gemini and Soyuz missions indicated a potential value in observation of the earth from space.[19] Newly revealed geologic structures, more efficient surveying procedures and better earth resources management techniques were only some of the advantages which sparked early enthusiasm over this application of the use of outer space to the daily living problems of mankind.

Impetus for the development of this application continued strongly in the United States from 1964.[20] Further investigation was carried out through the use of meteorological and geodetic satellite observations. Promising results led to the preparation of a program for the launching of two Earth Resources Technology Satellites (ERTS A and B) in 1972 and 1973 respectively,[21] as well as for an Earth Resources Experiment Package (EREP) for inclusion in the proposed Skylab manned orbital workshop.[22]

When submitting his report to the US House of Representatives Committee on Science and Astronautics, J.E. Karth, Chairman of the Subcommittee on Space Science and Applications stated his opinion that an Earth resources satellite system "represents the largest potential return on

investment of any space project to date", that such a system was then feasible and "that it has the potential for making major contributions to the solution of mankind's food, water and mineral resource problems."[23]

The Soviet Union has expressed interest in the potential of satellite surveys as evidenced by the reports of the Soyuz-6 and Soyuz-9 manned spacecraft activities.[24] In 1970, Boris Petrov wrote that as a result of these studies "completely new prospects are being opened up in the study of our native planet."[25]

a) Remote Sensing Technology

The high level of sophistication of remote sensing devices presently in use and those proposed for future experimental study point out the reliance of space surveying programs on the most current of technological skills combined with interdisciplinary scientific and engineering knowledge of their use. Without attempting to discuss the electronics, optics or other complexities of the hardware used in satellite surveys, a brief review follows of the equipment which carries out the observation function.[26]

A sensor is a detector of some physical phenomena. It converts natural stimuli into signals, usually electrical, that can be transmitted to the scientist by the spacecraft communications sytem. These devices make use of a wide variety of sensing processes, including: panchromatic photography for

low cost, readily available sensitivity to light of all colours; multispectral photography for identification and classification using black and white pictures taken with various filters and then using colour printing techniques to obtain stronger contrasts; infra-red photography to distinguish land masses from water; colour photography which clearly shows hydrological features and assists in water analysis; infra-red colour photography for detecting algae and concentrations of chlorophyll; false colour infra-red photography; infra-red radiometry which measures temperature changes and aids in detection of mineral deposits through sensing of heat from oxidation; infra-red imagery, useful in mapping snow and ice covering the earth; and radar imagery, which can penetrate foliage and be used in all weather conditions. Every chemical element or compound has a characteristic "signature" like a human fingerprint. It radiates and reflects not only visible light but also radiations of wavelengths not visible to the naked eye - such as ultra-violet, infra-red, microwave, radio, etc. Simultaneous photography with film sensitive to radiation in different parts of the spectrum gives promise of revealing much information not previously available.

Both aircraft surveys and meteorological satellites have made use of high resolution infra-red (HRIR) imagery, passive microwave radiation and radar reflectance to determine physical conditions of the sea, as these procedures overcome the problems which arise in using optical systems, through their

ability to operate effectively in storms and through cloud cover. Spectroscopy has been used to locate fishing grounds through detection of fish oils. Other remote sensing devices include: television cameras to map and track sea ice; side-looking radar; single and dual channel infra-red scanners; radar scatterometer; and a twenty-four channel multispectral scanner used to classify various earth resource phenomena. Proposals for the use of laser equipped devices are also being considered.

In the ERTS-A the sensing equipment was planned to be narrow angle to ensure orthography of the imagery and to include a three camera high-resolution return-beam vidicon (RBV) television system to record images in three regions of the visible and near visible infra-red spectrum. This system will have a 100 x 100 nautical mile square picture format. The second remote sensing device will be a five band multispectral scanner which extends the coverage to the longer IR wavelengths and covers a 100 nautical mile-wide swath. The ERTS-B will add to these a thermal IR channel. In both satellites the sensors are combined with a system of wideband video tape recorders (WBVTR) and a data collection system. The current plans for the EREP in the Skylab project call for use of : six bore sighted cameras; IR spectrometer; 13 band multispectral scanner; radiometer - scatterometer; radar altimeter.

b) Potential Benefits of Remote Sensing of the Earth by Satellite

In the process of arriving at a decision to part-

icipate in a venture related to earth resource surveys or to claim the right to share in data being obtained about its territory, a nation will explore the extent to which such information may be of practical value. A wide variety of claims have been proposed as to the type of data survey satellites can produce and the benefits resulting from its application on the earth. The following enumeration, derived from a review of the literature, indicates the potential uses which have been contemplated.[27] It should be emphasized that remote sensing of earth resources from space is still an experimental technique[28] and that the claims below are largely the results of projections.

It is important to keep in mind when considering the potential use of earth resources satellites the comment made in a 1968 US report that their use "will not do away with the need for remote sensing from aircraft or personal investigation by men on the ground".[29] Aerial observations have not rendered field measurements by men on the ground obsolete, for although the men on the ground have always been able to see the trees, with aircraft they obtain a much better view of the forest. Sensors on board satellites cannot collect high-resolution data comparable to what can be obtained using instruments on the surface of the earth or in aircraft. But satellites can view the earth in a new way, observing large areas under constant lighting conditions at a single glance, taking a series of pictures with unprecedented speed and making such observations repeatedly over

long periods of time from a stable and vibration-free platform.

i. *Agriculture*

Potential uses include: identification of vegetation; measurements of land, soil moisture and salinity; warning of impending plant disease; determination of areas under crop; mapping of bare soil areas, grazing areas, and fence lines; soil and rock classification; assessment of crop health, yields, and losses due to insects or disease; evaluation of irrigation, soil conservation and weed control programs; study of permafrost, wildlife habitats, flood control measures and location of new arable land.

ii. Cartography

Satellite surveys may contribute to greater accuracy in topographic mapping at lower cost and may provide constant and rapid updating. Detailed maps might also be prepared showing roads, rail lines, waterways and continued surveillance could help chart demographic changes.

iii. Environment

Remote sensors may be used to evaluate environment quality, identifying pollutants in the air and in fresh as well as sea water, and in monitoring the changes in the global environment. This data might assist in locating sources of pollution, early detection of gas and oil leaks and in the preparation of preventative programs. Surveys of natural disasters may enable remedial

measures to be planned and implemented more effectively than in the past, while warnings of impending floods, fires and earthquakes can be invaluable in saving lives and property. Environmental management satellites may be used to supplement other acquisition systems in providing information which will enable users to construct, improve and apply real-world predictive models.

iv. Forestry

Forest protection programs might be significantly improved through preparation of a world forest inventory and accurate timberline measurements; identification of forest species; providing advance warnings of attacks by insects or disease; early detection of forest fires; improved recreation site planning and preparation of harvesting maps.

v. Geodesy

The application of satellite observations to the science of geodesy dates from 1958.[30] Space derived data has since been extensively used in a worldwide program to establish a highly accurate geodetic reference network and to obtain information on the shape of the earth, the interaction of the crust, mantle and core, as well as about the gravitational and magnetic fields.

vi. Geology

Potential applications include determination of geological and geophysical features of the earth which might

assist in the location of new sources of oil and mineral deposits; obtaining information on structural units of the earth, glaciers, volcanoes, earthquake sources, continental drift, and ocean floor behaviour.

vii. Geography

Satellite surveys may provide more accurate definition and location of land masses, islands, coastal areas, rivers and lakes, as well as data relating to population location and movements.

viii. Hydrology

Only a small part of the water which covers 70% of the earth's surface is fresh water. Remote sensors in space may improve man's ability to plan the use of water more effectively by providing data from which maps of the world's ice and snow cover can be made and assessment of run-off characteristics. This information will relate to the amount and distribution of water stored in the form of snow; potential flood areas; ice field formation and breakup and sea-ice drift. Space surveys may also be used to measure rainfall, lake and stream levels and yield information on the overall water balance and its changes, which could assist in decision-making related to the construction of hydraulic engineering projects.

ix. Oceanography

Remote sensing devices may be used to determine sea surface temperatures, water analysis, iceberg locations, presence of fish, currents, sea state, bottom vegetation, and could assist in location of improved transportation routes.

c) International Aspects

The foregoing review, and more particularly the detailed literature which it only briefly summarizes, emphasizes the multi-national character of many potential uses of earth resource satellites. Rivers and lakes often flow through two or more countries, and effective use of them could be improved through information obtained by broad repetitive space surveys of their total length. Mineral and petroleum deposits as well as forests and mountain ranges also cross national boundaries, and development or management of these important common resources may bring valuable benefits to the economies of the states in which they are located.

A synergetic effect may be found in an overflow of the momentum given to resource development and management techniques from one country to another more easily, if they collaborate within the framework of an organization concerned with remote sensing from space, sharing and exchanging data related to common resources.

As a result of the limited geographical area of some countries and the rapidity with which survey

satellites pass over their territories, it may only be feasible for them to participate in resource surveys in conjunction with programs planned on a regional or multi-state basis.

CHAPTER II

INTERNATIONALIZATION AND POTENTIAL ORGANIZATIONAL STRUCTURES

1. The "Subject of Internationalization

The consideration of the use of remote sensing devices in an international context requires that some thought be given at the outset to a clear determination as to the extent of any proposed international control. Two possibilities exist: One would include all equipment, satellites, sensors, programs and data, while the other would refer only to the product of satellite surveys, i.e. the information produced. It is the first of these which is adopted for the purpose of the ensuing discussion, due to the many problems inherent in the second alternative, which would leave ownership and control of the hardware in the hands of one nation while expecting that other states will not be seriously concerned over possible pre-censorship, withholding of data obtained, or, undisclosed survey objectives. Although there may be limited opportunities for particular bilateral agreements under such conditions, it is submitted that any effort to extend this approach would meet with almost insurmountable political obstacles at a very early phase, thereby seriously restricting, if not eliminating, the possibility of world-wide participation.

The question as to what is to be subjected to internationalization appears to be recognized in the draft agreement submitted by Argentina in the Legal Subcommittee of COPUOS,[31] however, no significant effort is made to present a solution. The draft refers, in Article 1, to use of the "techniques" of remote-sensing of earth resources "in close international co-operation". The second article foresees a future "appropriate body", but for the present, proposes that the UN Secretariat be responsible for "planning, consultation, information, inventorying and co-ordination", with the eventual objective of "internationalizing overall surveys of resources" at such time as they have been "placed on an international footing" (Article 5).

The substance of the Argentinian proposal is the creation of a data bank to which all States will have access (Article 3). The obligation to deposit information in the data bank would arise when surveys deal with the areas of the sea, ocean floor and subsoil beyond any state's jurisdiction and, when they involve the national territory and jurisdictional waters of a state (Article 6). The draft does not suggest any time for such information to be forwarded to the data bank beyond that implied in the word "promptly", which raises echoes of the United Nations General Assembly Resolution 1721,[32] regarding registration of satellites, with the result that some

launchings are not recorded until months or even years after the fact, if at all. Article 7 of the draft obliges states to exchange information among themselves on the discovery of new areas, apparently a reference to findings within the borders of the nation orbiting the satellite, and also to transmit this information to the data bank.

The draft agreement is an important document in that it presented a concrete proposal, in 1970, regarding this vital subject which had been receiving growing attention since 1964. Beyond this, however, it loses value in that it does not recognize the limitations arising from the self-interest of States, their fears and protectionism, which would work against both the implementation of this suggestion and the realization of any real benefits from it. It is not likely, under present conditions, nor was it in 1970, that the socialist countries would be prepared to make available detailed information from the surveys carried out by their satellites. To do so would reveal to the trained investigator the capabilities of the space-borne instrumentation and an uncomfortable amount of detail as to the general level of technology. This is contrary to present Soviet policy, and rather than remain open to charges of only partial compliance with the terms of the agreement, it would seem reasonable, under the circumstances, to expect a complete absence of participation by nations of the Socialist group. The sens-

itivity which some nations might feel as resources satellites orbit over their territories is attributed by T.J. Gordon and S. Enzer to the possibilities that these spacecraft may "Provide economic or agricultural information which could be used politically to the disadvantages of the country which is overflown; Provide military information about the country; Bring profits which are not shared with the country overflown."[33]

The developing countries would have little, if any information to add to the data bank. Having access to it, on the other hand, would have little meaning, for the raw unprocessed data would be of no use. Without facilities for interpretation, trained personnel, and the means to exploit the results of resource surveys, they could only stand on the sidelines of such a project. The draft agreement emphasizes in Article 5, the principle of equality between the States, however, it does not offer details as to how the often-mentioned "co-operation between States" is to be translated into hard reality. From the time of the first serious comments, more than a generation ago, in the effort to evolve a legal regime for outer space, the broad concepts of benefits for and availability to all nations, has been frequently repeated. Current agreements, it is submitted, must confine these terms to their preambles, to illustrate the spirit in which they are drawn, but their substance should embrace clearly defined objectives and envision projects which not only can be brought into existence, but also will produce tangible benefits through the

achievement of co-operation in which the keynote is a constructive interchange between working partners. Against the background of this reasoning, the use of earth resources satellites within an integrated operational system is considered below as the subject matter of the procedures for internationalization, outlining the reasons which underlie the importance of following this direction and the modalities which might be used to bring it about.

2. Single-Nation Operational Control

The literature published to date makes it clear that the techniques of earth resources surveying by satellite has been pioneered by the United States. In the last few years the U.S. has extended its interest in this field, requesting other nations to submit plans for sensing devices and experiments, holding panel discussions, making parts of their experimental program available to observers and students, and establishing treaty agreements with certain States to further develop and use this technology. It appears that a comprehensive program in this field is also well advanced in the Soviet Union, although there is little to suggest the extent to which remote sensing, apart from its military values, is being applied to the evaluation of terrestrial phenomena. As indicated in a previous study, the conclusion is inescapable that "the first to employ the new systems and the first to

derive whatever benefits can be achieved from their use, will be technologically advanced States, for only they have the engineering and financial resources as well as the skills indispensable for the implementation of an operational system."[34]

It might seem reasonable, in view of the extensive investment to be made by these space powers, that they undertake such a program unilaterally, carrying out observation of their own and other territory in accordance with the requirements established by their administration.

There are at least two reasons why this approach should not be seriously considered. The first of these lies in that it would contravene self-imposed treaty obligations which are part of the national law, and also violate the provision in the second paragraph of Article I of the Space Treaty which requires that any use of outer space comply with international law, of which the Treaty is now a part.

The second reason relates to the nature of remote sensing devices. The difficulty of drawing a clear line between peaceful, scientific satellite observation and that which is of military value has often been noted.[35] From the time of the first reconnaisance activities, international relations have had to cope with the tension created by the uncertainty of both East and West as to what strategic activities were being exposed by the spaceborne sensors of

the other. Undoubtedly, their observational experience heightened the stimulus to advance technology - not the result of the objective search for knowledge, but rather in response to the fear of falling too far behind and the anticipated military consequences of such a gap.[36] The activities carried out by future earth resources satellites, operated by one of the space powers unilaterally can only bring further tension to this area. At least one Soviet author has already stated his opinion that the U.S. is using its earth resources program as a facade to legalize espionage conducted from outer space.[37] It would indeed be difficult to formulate such a charge before any legal tribunal and perhaps more difficult to present valid legal arguments in support of it, in view of the free access to enter space granted to all nations in the Space Treaty, the non existence of espionage as an international crime, and the equivalent activities likely being conducted by the accusing state itself. However, the point to be noted here is that a unilateral approach provides another block which would be added to the wall separating the two major idealogies, a wall the world can little afford to have made stronger.

A national public or private organization would, in the opinion of Gordon and Enzer require some form of monopolistic guarantees due to the large amount of capital required

and the uncertainty of profits and would therefore emerge either as a government agency, which would face such accusations as using data as an international bargaining tool, or having a military purpose, or as a government regulated corporation which would also be subject to "large-scale political and legal problems."[38]

A unilaterally operated system would, moreover, provide no opportunity for nations not active in space to learn about and adopt the benefits which might otherwise be available, except in the few cases of assistance offered in the interest of obtaining knowledge from ground observations needed by the operating state.

3. Bilateral Agreements

A network of bilateral agreements between one of the major space powers and other countries would overcome some of the objections raised in opposition to a single state proceeding on its own behalf. Bilateral treaties are well known to international law covering such fields as trade, finance, extradition and the more than 1,200 agreements by which states exchange air traffic rights. More specifically participation in outer space programs has been the subject of individual treaties between the United States and other countries[39] dealing with geodetic measurements, observation

and ground station placement and operation.[40] Among these have been included arrangements with Brazil and Mexico covering co-operative research in remote sensing for earth surveys by aircraft with the aim of developing joint programs to determine the potential utility of spacecraft applications of the techniques of acquiring, interpreting and utilizing earth resources data.[41]

One of the agreements with Canada deals with remote sensing from satellites and aircraft.[42] It sets out the broad outline of a four-year joint program in experimental remote sensing of environmental conditions, crop and forest conditions, ice movement and ocean currents in waters contiguous to both States, and the carrying out of thematic mapping of geology, hydrology, vegetation and soils. Under the agreement, Canada will receive data from the U.S. Earth Resources Technology Satellite (ERTS) at Canadian ground stations, which will be used to determine the ecological damage caused by such massive projects as the James Bay hydroelectric development and the Bennett Dam.[43] An official of the Canadian Department of Energy, Mines and Resources stated "Canada places a high value on ERTS and is committing herself with long-term projects in the millions-of-dollars bracket to build facilities to track the satellite and receive and process the data it transmits."[44]

It is possible for this approach to be continued when the U.S. has completed the present experimental phase of satellite survey development. A co-ordinating office, established within the NASA framework, working with the Department of State as well as with the Office of Department of Defence and Interagency Affairs could select a wide number of countries with which to conclude treaties establishing co-operative remote sensing projects. Building ground receiving stations, training data processing personnel and consultation with local scientists would assist the individual nations to gain important talents and would provide employment for its citizens.

There is an advantage to bilateral agreements in the relative facility in arriving at an understanding between only two parties, with a clear statement as to the rights involved, the apportionment of costs, and the effects of and procedures for termination. However, while the space-power involved would likely advance its capability to conduct remote sensing activities and promote the development of new techniques during the life of the agreement, this would probably occur at the expense of increasing the gap between the two states in terms of their technical abilities in space. For the smaller country would face the additional problems of a lack of <u>a priori</u> knowledge as to its own needs and potentials, and frequently also the inability to translate

the final information into working programs due to the unavailability of personnel, equipment or finances to undertake resource development, conservation or management activities. Another drawback would lie in the practical difficulties of co-ordinating proposed surveys to cover areas which lie beyond the two states involved where important data might be available, but not obtainable due to the high cost and initial technical limitations of the hardware, or the absence of agreement with a third country.

It has been stated elsewhere that the UN has long sought to encourage co-operative space programs "presumably in the expectation that they would bring together in a joint effort a large number of states, hopefully all member states. Through such programs the developing countries would have a better chance of becoming equal partners in the space venture and at the same time be afforded the opportunity to master the advanced technology, a sine qua non of their economic and social advancement. These expectations should be particularly strong in regard to earth satellite surveys, not only because bilateral space programs have markedly failed to narrow the gap between the advanced and developing countries, but also because of the suspect nature of resource surveying techniques."[45]

Shortly before his election to the post of UN Secretary-General, Kurt Waldhein, as Chairman of COPUOS,

emphasized at the Committee opening meeting of the 1971 session the long-range inadequacy of bilateral agreements: "The increasing co-operation, especially between the major space powers, on a bilateral basis is a long-expected and most welcome development. I think, however, that this cannot and should not replace multilateral arrangements, but should rather be aimed at complementing them. Multilateral co-operation in space is today undoubtedly the best and only possibility for all non-space powers, and in particular, for the developing countries to share the benefits from this new field of man's activity."[46]

4. Rationale For An International Approach

It is in imperative terms the Space Treaty declares in Article I that "The ... 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 shall be the province of all mankind". If this expression of the consensus of world intent is to be given more than token respect, its application to space for remote-sensing surveys of the earth calls for careful analysis.

The use of space for investigation of natural resources involves a wide variety of activities, ranging from the planning, design and construction of satellites and sensors, to launching of the vehicle, through collection

storage, processing and interpretation of the data, and might be considered to include application of the knowledge gained to achieve beneficial results on the earth. In view of the complexity of these activities, the high degree of skill and technological progress needed, and the vast financial resources they require, it might seem incongruous that emerging nations must be given the benefits when the input comes from fewer than a half-dozen States. However, if the Space Treaty, adopted as part of the national law of almost all members of the United Nations, is to be regarded as creating valid, binding obligations, the import of Article I is inescapable. Professor I.A. Vlasic wrote that "It could be argued that this provision places a legal (as opposed to merely a moral) obligation upon technologically advanced countries to shape their space programs in a manner which will be conducive to the fulfillment of the objective stated in Article I."[47]

In affixing a signature to the Treaty and in completing its ratification, every State has specifically undertaken that its use of outer space shall be for the benefit of all countries and has made this obligation part of its national law. To assign any other meaning to this substantive provision would be to apply interpretations of convenience and undermine, if not destroy, the validity of the Treaty.

Professor A. Ambrosini has stated that "there is reasonable doubt that any state would carry out its activities, and expend the enormous funds necessary for them and, above all, for the eventual exploitation of whatever resources are to be found in space - for the exclusive benefit of all countries. Nevertheless, we may reasonably assume that a State, while pursuing its Space activities, must comply with morals and law, in order to allow peaceful co-operation in this new environment, for the welfare and good of all inhabitants of the earth."[48]

However, the Space Treaty was created after ten years of early space activity. It was exposed to the scrutiny and opinions of all nations. Its terms are necessarily general due to the embryonic state of the art. Other than its provision relating to weapons of mass destruction in Article IV, it did not attempt to do more than establish a framework within which all future space activities could be regulated. To disregard its provisions on the ground of their use of non-specific terminology would be to ignore the obligations incumbent on each ratifying State by virtue of its own domestic law. These obligations are reinforced by the many resolutions of the UN General Assembly which recall the importance of international co-operation in reference to outer space activities, and repeatedly refer to the benefits for all peoples. It cannot be suggested that these resolutions create binding duties for UN

members, however, neither can they be overlooked. At the very least they merit the close attention of states and their repetition builds a strong proposition that the family of nations places important values on the direction in which they so clearly point. The note of warning sounded by Professor Vlasic in 1968, and which remains equally valid today, drew attention to the fact that "For the majority of mankind the promise of a new era of greater abundance and equality as a result of the advent of space technology may remain no more than a promise unless bold and imaginative programs of international co-operation are devised and implemented without delay."[49]

The Space Treaty must be viewed as a beginning - not as an exhaustive expression of space law. That this has been recognized by the world community is evident from the subsequent elaboration of Article V in the Agreement on the Rescue and Return of Astronauts,[50] and of Article VII in the Liability Convention. As new fields of activity and interest manifest themselves, the appropriate areas of the open network of space law will be overlaid by the more closely woven fabric of specific regulatory provisions - founded however on the original principles. It is submitted, therefore, that the manner in which outer space is to be used for earth resources surveys has been broadly pre-determined. Every nation is equally free to use outer space, but any such use must be con-

ducted in the interest of all countries. The route toward international co-operation is shown clearly. There remains only to explore and define the manner in which it can be achieved.

5. Multilateral Co-operation and International Organizations

The indicators pointing to the potential effectiveness of a multilateral organizational structure would seem to be quite persuasive. Several states may be active in the use of space, however, their capabilities may differ. Some natural resource areas, such as oceans, mountains and forests, may be common to many countries. Repetitive surveying procedures may be of value to all states whose borders they touch or cross. As well, resource satellites may be constructed with multiple functions, and although the cost of building and launching a space surveying system may be diminishing, it will always be out of reach in terms of the economies of some states. It is therefore important to take the greatest possible advantage of opportunities to maximize the benefits to be realized from an earth resources satellite system. To do this in such a way that underdeveloped countries can share in the benefits achieved will require the participation of a large number of states in order to justify the high capital cost of implementing the system, designing the programs, training the personnel and maintaining

data interpretation, processing, storage and retrieval facilities.

Multilateral co-operation might be characterized by one of three possible approaches. It may be realized entirely apart from the formal structure of the United Nations, following the example of the telecommunications consortium, INTELSAT.[51] In a second form, satellite surveys might be made the responsibility of a specialized UN agency, with the world body taking on, for the first time, the development, financing and operation of a functional system. A third type of multilateral organization would be a hybrid of the first two, envisaging a structure established outside UN framework, but having direct working relationship with and possibly representation from one or more UN organs and/or its specialized agencies. Before examining these modalities in detail, it would be useful to look for guidance in the opinions expressed by various countries which have turned their attention to the question.

a) The Attitudes of States

It is only with caution that individual opinions and the intentions expressed by government leaders or representatives can be considered in seeking to determine the course of action a state might pursue within the context of a multinational activity.

Such statements may be integrally related to a particular or sensitive area of concern, or may be influenced by subsequent changes in government policies or control, or radically altered by the emergencies of new facts or situations. With this in mind, however, it may be possible to foresee the nature of the consensus which may be arrived at in relation to the eventual world-wide use of earth resource satellites through a brief review of comments which repeatedly reflect similar opinions.

The remarks of U.S. President Nixon in his address to the 24th session of the UN General Assembly on September 18 1969, would seem relevant in this light.

> "Of all man's great enterprises, none lends itself more logically or more compellingly to international co-operation than the venture into space ... we are just beginning to comprehend the benefits that space technology can yield here on earth, and the potential is enormous.
>
> "For example, we are now developing Earth resources survey satellites ...
>
> "I feel it is only right that we should share both the adventure and the benefits of space; and as an example of our plans, we have determined to take action with regard to Earth resource satellites as this program proceeds and fulfills its promise.
>
> "The purpose of those actions is that this program will be dedicated to produce information not only for the United States but also for the world community ...

> "These are among the positive concrete steps we intend to take towards internationalizing man's epic adventure into space -- an adventure that belongs not to one nation but to all mankind...[52]

R.F. Packard has stated that "earth resources surveying from satellites has far reaching implications which are not only scientific, technical and economic, but also political ... this new capability will offer substantial international values and opportunities."[53] Referring to declared U.S. policy, he noted that "We are committed to develop our earth resource program openly, and to make available to other countries the data and experience which it produces."[54]

In 1971, Leonard Jaffe and R.A. Summers of NASA, wrote that "Data acquired from ERTS A AND B will be made available to the user community throughout the world."[55] They concluded with the comment that "All the results will be published in the open literature and all acquired data will be made available, thus ensuring that the benefits of this program are available to the world community."[56]

The 1968 bilateral agreements which the United States concluded with both Mexico and Brazil[57] contain the commitment that the scientific results of the co-operative research programs in remote sensing for earth surveys will be made freely available to the scientific community. The U.S.-Canada Treaty of 1971, relating to data to be received from

the ERTS program, states "It is further understood that ERTS data acquired by EMAR (the Canadian Department of Energy, Mines and Resources) and NASA will be made available as soon as practicable to the international community,"[58] and "Results of investigations in this joint program will be made available in general through distribution centers and through publication in appropriate journals".[59]

The statements by representatives of the Soviet Union have been far less categorical and enthusiastic about the prospects for earth resource surveys. Although it seems that this technology is being actively developed in the U.S.S.R.,[60] the keynote of most comments is the need to proceed slowly and carefully study the implications of such programs. Speaking to COPUOS, Soviet representative Piradov referred cautiously to the potential influence of space studies on earth resources developments and stated that "... it is important to study carefully all aspects of this new problem -- in examining this problem we should bear in mind that for the time being the use of satellites for surveying the resources of the earth is still merely at the experimental stage of study and processing and that for the time being there is no practical application for such activities."[61]

At the COPUOS Scientific and Technical Subcommittee Meeting of April 16 1970, USSR representative Blagonravov agreed that the use of satellites opened up new prospects for the study of the earth's natural resources or for prospecting for mineral

deposits and that the study of the Earth's surface by multi-spectral photography appears very promising. However, he noted that there was still a great deal of scientific work to be done before the problem could be solved entirely.[62] A few days later in the subcommittee Mr. Blagonravov spoke in reference to the Swedish proposal to establish a working group on remote sensing.[63] He agreed with the importance of surveying earth resources by satellite but questioned whether any useful purpose would be served by establishing a working group at that stage, as knowledge in the field was still fragmentary and unsystematic, and methods of collecting and processing information, though emerging, were still very tentative. Mr. Blagonravov concluded that it seemed that the establishment of a working group would be somewhat premature, however useful it might prove in the future.

It is of interest to review these statements alongside an extract from an article written by Mr. Blagonravov in 1971 in his capacity as Chairman of the USSR Academy of Science's Commission on the Study and Use of Outer Space.

> "The study from outer space of the composition of Earth's crust, of the inhomogeneities of its mass, of the gravitation and magnetic anomalies will be helpful in prospecting for new mineral deposits. Even the photos made from aboard the spaceship yield highly interesting materials on the structure of the planet and its separate areas. For instance, it is well-

known fact that various minerals are confined to certain structural types of earth curves: oil and gas to convex curves, water to concave ones. Although geologists, making use of the ground exploration means, do delineate such structures, at times it remains doubtful whether this has been done accurately enough. Aerial techniques however, are not helpful in every case, because the altitudes attained by an aircraft may be inadequate.

"Based on the system of orbital platforms, a worldwide hydrological service will make it possible to obtain comprehensive information on the planet's water resources and to draw up scientific recommendations on the best utilization of them.

"Almost every type of relief is discernible in the photos obtained from space. Even the submarine relief is visible. The topographers aboard the orbital platforms will be able to locate accurately the coordinates of islands, reefs and sand bars.

"Probably everybody knows about the photo of Earth received from the space probe Zond 5. It gives a particularly clear-cut view of Africa which is slightly concealed behind clouds. By analyzing the photo the scientists compiled a geobotanical map of the continent, i.e. the distribution of vegetation. The new map happened to be much more accurate than the one based on the data rereived by numerous expeditions that studied Africa for dozens of years. The reason is quite simple: Despite numerous expeditions, the scientists were unable to study thoroughly some impervious regions of the continent.

> " About three-fourths of the world is covered by seas and oceans. Thus, oceanological activities call for the use of global observation means. Space platforms could be useful in obtaining information on the temperature and condition of the sea surface, water color, the pattern of sea currents from drifting velocity of different floating objects, either natural or artificial.
>
> " Apparently no direct finds of fish can be made yet from a space vehicle at the present stage of space engineering progress. But work on these lines appears to be quite promising. An idea of the region's biological activity can be adequately formed from an analysis of the water surface, temperature and color. Therefore most practicable appears to be a combination of space and aviation observation means, with the space satellites used to identify and predict regions of most likely fish accumulations and the aircraft locating fish shoals in these regions.
>
> " True, the planning and realization of an all-round and economically feasible scientific program for analysis of Earth's natural resources with the aid of space platforms cannot yet be undertaken until quite a few problems are solved. It is necessary to pick out some priority targets in contemplated investigations and the parameters to be measured, to determine accuracy requirements for measurement procedures and to develop the relevant equipment."[64]

Y. Kolosov wrote that "Prospecting for natural resources via satellite also involves a whole complex of political, economic, technical and legal questions. Consequently, any recommendations in this area can be accepted only after careful study of all aspects of this problem."[65] Russian space lawyer V.S. Vereshchetin referred to space surveying, saying

"... we should not go too far in fixing legal regulations. It's premature while we're in the experimental stage."[66]

Following the establishment of the Working Group on Remote Sensing, Soviet delegate Piradov spoke in COPUOS of the important program of space activities being carried out in the Soviet Union and other socialist countries, especially in research on earth satellites.[67] He called attention to the fact that "so new a field ... as that of remote sensing of earth resources, in addition to technical aspects, gives rise to many other political and economic problems. It involves, above all, the matter of respect for the sovereign rights of States. A State has the exclusive right to do what it deems fit with its own natural resources and with information concerning them. We must not forget that any abuse in the field of the application of space techniques could result in dire consequences. It is obvious that the only lasting basis possible for the application of artificial earth satellites to remote surveying of earth resources must be grounded in large-scale international co-operation, its foundation must be strict legal regulation of activities in space."[68]

The Bulgarian representative to the COPUOS subcommittee, Mr. Kostov, also thought it would be premature to establish a working group at that time. However, he pointed out, the use of earth resources survey satellites would give rise to major legal problems which should be solved at the

international level before a solution of the technical problems was attempted.[69]

The potential interest which China may have in the values of remote sensing can only be a subject for speculation at the present time. It can, however, be assumed that there has been some minimal study of current experimentation and that interest will increase with the acquisition of the technical ability to participate, as evidenced by the February 1971 sale to Peking of a $2.9 million communications satellite ground station and other equipment by the RCA Corporation of the USA.[70]

The Italian delegate to COPUOS has referred to the great importance of spreading this new space technology mainly among developing countries.[71] The Swedish representative said that survey satellites would be a powerful tool in the hands of those who can wield it, and that they should be used for general benefit in accordance with internationally accepted rules.[72] Speaking for the U.A.R. the delegate noted that the legal aspects of earth resource satellites should be considered in the light of the principle of the sovereignty of states over their natural resources.[73] The Japanese member supported the idea of exploring the possibilities of applying space science and technology for the maximum utilization of resources of the earth.[74]

Canada's Minister of Energy, Mines and Resources, J.J. Greene, speaking in March 1971 referred to resource surveys from space in the context of Canadian-US relations, indicating the confidence Canada has in the US promises to share data. "As far as the release of satellite data is concerned, NASA plans to treat all nations alike. They will publish the data and make it universally available. So far as we know, we are the first outside nation to suggest putting up our own receiving station and data handling center. I understand any other nation can do the same if it wishes to. Other nations will get their data directly from NASA."[75] Dr. L.W. Morley, director of The Canada Centre for Remote Sensing, recently pointed out that "we must know what resources we have and what condition they are in. And we must have a constant and accurate supply of information to work with. With the Satellite [ERTS] we will get a "before and after" look, a comparison of the state of the environment now, with a view of the ecological effects of development each season ... ERTS will give a big over-all look - a kind of reconnaissance of the earth - while other methods [ground surveys and aerial photography] can provide the details."[76]

Canadian representatives at the UN 1968 Vienna Conference on Space Exploration and Applications concluded that the only practical procedure for the wide use of

resource satellites would be through international co-operation following the example of the field of meteorology; they delineated four broad areas which could effect co-operation in the field of remote sensing as "The presumed need for some security of the data; the need to transfer the technology from countries with the "know-how" to less developed countries; the desire and need for participating countries to have technological input into programmes; the matter of cost sharing."[77]

In the Scientific and Technical Subcommittee of COPUOS the Japanese delegate, Mr. Yoshida stressed the importance of co-ordinating the activities of UN bodies which might be concerned with earth resources surveying techniques.[78] The remarks of Mr. Skala of Sweden, referred in detail to the steps he considered relevant to this particularly important subject.[79] He stated that earth resources satellite technology was obviously important for all countries, but could be fully useful only at the international level; it was therefore essential to try to organize the use of such satellites by the appropriate international bodies without delay, and for the Committee to evaluate the technical and institutional aspects of the existing situation.[80] He suggested that steps should be taken to study the possibilities of internationalization of earth resources satellites, as that would be the only way to avoid offending national sensitivities, prevent

discrimination and ensure free access to the data obtained.[81] The subject of resource satellites seemed to be the most important question before the subcommittee, said Mr. Skala, and it had a duty to provide adequate guidance for the development of the technique in the interests of all countries.[82] Four days later, in the same subcommittee, Mr. Skala, referring to the working paper on earth resources prepared by his delegation, noted that as there seemed to be general agreement as to the importance of remote sensing techniques, it would be appropriate to establish a special working group to prepare a comprehensive report, and to study new international measures for perfecting the techniques and utilizing their results for the benefit of all mankind.[83]

The Swedish proposal was supported by the delegates from Mexico, who considered that the working group should be set up as soon as possible;[84] Austria, who said the technology of earth resources survey by satellite had reached the stage where the establishment of a working group on the question was a necessity,[85] United Kingdom, stating that it would not be premature to establish a working group[86], India, pointing out that the developing countries should train the scientists and technologists necessary to develop and apply remote sensing techniques and that those specialists should start working before methods become too complex,[87] and Canada, who referred to the urgency of the problems involved.[88]

The US representative suggested that since the techniques were still at an experimental stage, his country was not yet in a position to provide the data needed by such a working group which might be more usefully considered for the following year after the symposium on earth resources satellites to be held in the United States in 1971, although a majority preference for the immediate establishment of a working group would have US co-operation.[89] As noted earlier, the Working Group was convened by the UN General Assembly by Resolution 2778 (XXVI) of 29 November 1971.

The Chairman of the Working Group, Mr. Franco Fiorio of Italy sent a request in January 1972, to all UN members for their comments on remote sensing by satellites under four specific headings. Twenty-two states had replied when the responses were published in April.[90] Austria, noted that in view of its small geographical area "the utilization of remote sensing by satellites could only be taken into consideration by means of agreements with all those countries situated under the orbit of the satellite in question."[91] The Netherlands referred to the need for international co-operation due to the "high demands upon funds and technical capability and flexibility".[92] Poland replied "We foresee an extensive use of satellite remote sensing within the frame of international co-operation."[93]

The response from Sweden evidenced the considerable thought which representatives of this country had been giving to the subject for some time and referred to the need to dispel fears of infringement of sovereignty, the legal and organizational questions, the international implications, the possibility of giving the UN - "or a United Nations-type organization - a central role in the international use of earth resource satellites," the financing of proposed alternatives, and concluding that the task of the Working Group was to undertake consideration of the "political, legal and organizational problems inherent in the remote sensing of the earth by satellite, i.e. problems relating to the protection of national interests and suitable arrangements for international participation and management, including project control and access to data received from earth resource satellites."[94]

The foregoing review of comments made by individuals expressing, in their official capacities, the views of their governments, leads to the conclusion that apart from the arguments on both sides of particular proposals, there is virtually unanimous agreement that eventual responsibility for the application of satellite surveys of the earth should be international in scope. The infrastructure upon which this agreement rests is constructed of widely varying

motivations. The consensus having been achieved, the world community can forge it into an effective organization with a potential for yielding tangible benefits which may significantly improve the conditions of life for the people in many, if not all, countries.

It is submitted that there is a strong logic to international regulation in the use of resource surveys. Ground and aerial observations, which can only be carried out with the consent of the sovereign nations who control the territory or airspace, provide two vital stages of the overall perspective necessary in resource development and management. Repetitive satellite data can complete this perspective, resulting in new information and potential economies not previously available. With acceptance of the free use of outer space, the direction that it be used to benefit all peoples, the important potential which satellite surveys appear to have, and the evident need for the realization of this potential, a form of internationalization appears to be the only reasonable and responsible way for the nations of the world to proceed.

The consideration of any form of multilateral organization to be created for the use of earth resources satellite surveys, necessarily begins with a determination of the role which the United Nations Organization will have, and the extent to which it will be involved. The extensive work done by, inter alia, UNESCO, FAO and as part of the

United Nations Development Program (UNDP) has created a fund of knowledge which would be indispensable in the planning of surveys related to the needs of many countries where these working arms of the world body have been functioning actively for many years.[95]

b) An Operational System Within the United Nations

The multidisciplinary aspects of remote sensing by satellite, coupled with the advanced techniques and knowledge required for effective use would provide a unique challenge, should the United Nations Organization undertake the establishment and responsibility for an operational system of earth resources satellites.

Although the UN has, through various of the specialized agencies, frequently participated in carrying out functional programs, contributing talent, financial assistance, technical information and co-ordinating leadership, it has not taken on the task of operating an autonomous, technological system on a continuous and permanent basis. It would be of great importance to maximize this knowledge and experience currently available within the organization, to conduct effective liason with the specialized agencies and various national governments, as well as to control the financial requirements. This could be realized best through the creation of a separate entity, responsible to the General

Assembly through the Economic and Social Council. Because of the many diverse aspects in the establishment of an operating system, for at least the first five years of the existence of this entity, it would not be brought into the family of specialized agencies. In this way there would be easier access by its personnel to all the UN branches with which it would be working in a co-ordinating capacity, and also a closer supervision of its activities at a senior level.

The new entity, which might be known as the World Resources Investigation Organization (WRIO) would be open for membership to all UN states. The cost of such participation would include two elements. One, fixed for a two year period, covering administration, equipment essential to the operation of the organization, satellite construction, remote sensing devices, launching, technical personnel, training and the facilities required for the central collection, processing, storage and retrieval of data. The second element of cost would be determined by specific uses a country makes of the services of WRIO, such as individual surveys of its territory, those covering a regional grouping of states of which it forms a part, or those designed to evaluate particular resources or resource areas.

The general membership would establish an

operating committee to carry out the activities by the organization through three main branches responsible for the functions of planning, operations and data handling.

Planning would be the responsibility of the Survey Development Division which would be responsible for liason with other UN agencies interested in using the techniques and would co-operate with the governments of individual countries to develop survey programs, suited to their needs. All requirements for remote sensing by satellite would be co-ordinated and planned to accomplish the maximum of productive activity on each mission.

The Sensor and Satellite Operations Division would draw from the requirements for surveys details pertaining to the nature of the sensing devices needed, and would be responsible for their design and construction, as well as for that of the satellites. This Division would plan orbital patterns and arrange with one of the countries which have launching capability to put satellites into orbit, as it is not likely that the organization would be able to justify the cost of its own launching facilities.

All data from the operation would be owned by the organization and the Information Services Division would be responsible for collection, interpretation, processing, and storage and dissemination of all information obtained. It could offer a consulting service to enable nations to determine

what details in its data bank would be of value for specific purposes, and set up a program to enable sharing of the information currently on hand as well as that which is collected in future programs.

One difficulty which might arise with this form of organizational structure would be in the area of financial arrangements. This agency should be in a position to render completely separate accounting, as well as to enforce payments to it by the members. The UN would be required to finance the capital cost of sensors, satellites, personnel training etc., and this would represent a major financial responsibility for an economic activity which should be able to stand independently.[96]

The questions which have to be carefully considered in this context include the logic of the world organization undertaking responsibility for a functional operating unit. It has been pointed out that the UN has historically confined itself to the functions of co-ordinating, planning and offering assistance,[97] whereas through WRIO it would be involved in major financing which might severely tax the credit of the organization, if not its limited supply of working capital, should there be periods during which WRIO is unable to meet its operating expenses. The potential for the application of political influences and for "horsetrading" between payment of assessments,

survey priorities, geographical distribution of both personnel employed, contracts given for development and construction of the hardware and procurement policies, could well add political, competitive and personal pressures which would strain relations between UN member states, as well as encroaching upon the time of UN personnel.

An important consideration would be the time required for agreement to be reached on the organizational framework, operation procedures and financial structure. The experience indicated by the discussions leading to the Space Treaty, the Agreement on the Rescue and Return of Astronauts and the Liability Convention, suggest that there might be a delay, during which some areas of the world could profitably take advantage of remote sensing by satellites, and would be deprived of the opportunity to do so.

It has been pointed out elsewhere that "The leading spacepowers, often supported by other developed countries of diverse political orientation, seem to be particularly opposed to the idea, occasionally advanced by some states, of creating within the United Nations an operating space agency, endowed with the necessary capital and hardware, and above all, administrative and managerial independence."[98] Furthermore it has been stated that although "non-spacepowers may come to the conclusion that only the establishment of a strong operating agency within the UN can

provide them with adequate guarantees that their resource-survey needs will be impartially assessed and effectively attended to and their sovereign equality respected," there is also a strong possibility that such a solution will encounter strong resistance reflecting "the fear of the unknown; a sincere belief that the scheme is unrealistic because the United Nations is not equipped to manage such a major project; and the conviction that better and more efficient uses of remote sensing techniques can be achieved through less ambitious structures. Some opposition, of course, will be based on narrow nationalistic grounds, not entirely absent from decision-making relating to space technology."[99]

Gordon and Enzer suggest that "it may be most acceptable for the resource satellite corporation to be a world organization, possibly even an integral part of the United Nations. But even the world organization is faced with certain problems which are as yet unanswerable. Perhaps the most critical problem is discovery of a practical means of bringing such an organization into being on a fair and equitable basis;" - they note that questions involving military instrumentation would not arise and that most of the economic issues would be avoided but that other difficulties could arise related to fees, the political issues of overfly, the use of publicly funded developments and

meaningful guarantees to nations insuring that data collected during sensitive intervals would be destroyed.[100]

Article I of the Charter of the United Nations declares, as among the purposes of the UN, "To achieve international co-operation in solving international problems of an economic ... character" and "To be a center for harmonizing the actions of nations in the attainment of these common ends." Thus, if the use of earth resources satellites for survey purposes is characterized as being of such nature as to contribute to the solution of international economic problems, the UN may find it has a duty to promote international co-operation in this field. There would be no requirement to undertake the operation of the commericial entity established to carry out the actual functions. To do so might set a precedent which, in itself, or in its catalytic effect, could seriously weaken the United Nations or detract from its efforts to effectively deal with matters of somewhat greater importance in the broad perspective, considering that Article I of the Charter opens the statement of purposes with "To maintain international peace and security" and that there yet remains substantial problem-solving to be accomplished to that end.

c) An Operating Organization Outside the UN Structure

Any consideration of an objective, multinational operating organization can gain from a study of existing entities, established for other similar purposes. It has been pointed out elsewhere that an Earth Resources Satellite System will have a number of features in common with one designed for the use of outer space for telecommunications, "In both cases one or more orbiting satellites with advanced scientific equipment on board is the heart of the system. Both depend heavily on use of the radio frequency spectrum and cannot satisfactorily function without supporting earth stations. Benefits available from either technology are recognized as being substantial, and as having special application to developing countries. They also have in common the unfortunate potential to be regarded by some states as a threat to their important national interests. And last but not least, both these technological achievements have been the subject of great attention by the UN General Assembly which has repeatedly urged all nations to co-operate in making the benefits of these systems available on a broad, global basis."[101] Thus a useful degree of guidance may be found especially from the experience of the International Telecommunications Satellite Consortium known as INTELSAT.

Many of the objectives of internationalization could be achieved through a separate structure, open to participation by all nations of the world. It would clearly require the initiative of one of the space powers responsible for the development of earth resources surveying technology for this organization to be established. The basic assets would be the talent, equipment and facilities which the originating nation - either USA or the USSR - would contribute either as part of, or in addition to, its initial investment. This might, however, lead to insistence by this state on a dominating role in the organization, which in turn, could deter other nations from participation as characterized the early years of INTELSAT.

World-wide participation, at the outset, might not be as important, in an operational context, to a telecommunications entity as it would to an earth resources survey organization. The requirements of the former related to construction, launching charateristics, orbital position and ground stations do not alter substantially as a function of the number of users. Resources satellites, on the other hand, will not initially make use of the geo-stationary orbit, and will be planned and built to carry out relatively specific missions. Within the scope of a particular program will be the opportunity to survey certain territory, however, if the territorial sovereign is not part of the

organization, neither the survey plans, nor the use of remote sensing devices will include the needs of this territory. Once a mission is completed, and particularly if the life of the satellite is short,[102] there might be long delays and extensive financial investment before the same part of the earth is surveyed again for the same purposes.

d) Proposal for the Internationalization of Remote Sensing of the Earth by Satellite

The discussion in the previous two sections suggests that there could be some difficulties in establishing an operational earth resources survey system either entirely within the United Nations Organization or completely outside of it. This leads to the consideration of an entity which might draw upon the advantages offered by both alternatives, and although not without inherent problems, could minimize the effect of those which have been referred to earlier.

R.F. Packard of the U.S. Department of State concluded that resource satellites will have "far-reaching implications" and will offer "substantial international values and opportunities," but that "New arrangements and new international institutions will be required, since none of the existing international mechanisms for dealing with

other scientific and technical activities appear to be entirely adequate as models for the handling of earth resource surveying."[103] In a subsequent statement, Packard looked briefly at the advantages and disadvantages of co-operation in space activities, finding the need for "a world with a sense of community" and that these activities "tend increasingly toward interdependance and internationalization" require that "co-operation in space should be seen as clearly a necessity."[104]

It is submitted that in view of the nature of the intended use of satellites for remote sensing, the most effective organizational structure would be one which would ensure the continued presence and co-operation of UN agencies, enable these agencies to have an important role in determining the use of remote sensing from space with particular reference to accomplishment of the relevant objectives of their programs, achieve the maximum in international co-operation, participation by the widest number of sovereign states, avoid the burden of UN involvement in ownership and operation of the system, and ensure complete international control over the ownership and dissemination of all data obtained.

This structure, it is suggested, would be created so that the formal organization and the mechanics of its operation would exist as a separate entity outside

of the United Nations, but open to membership by all countries of the world. It would, however, be the product of the efforts of a new UN agency which would initiate the discussions, provide the ground for them to take root, and would then remain as a special status committee, perhaps eventually becoming a specialized agency, charged with the collection and co-ordination of information related to resource survey needs from among concerned UN organs, and liason between the United Nations and the operating organization.

i. The Importance of UN Presence

Resolution 1721B (XVI) adopted by the UN General Assembly on 20 December 1961, stated the belief that the UN "should provide a focal point for international co-operation in the peaceful exploration and use of outer space". This reflected opinions expressed by various governments from the time of the earliest discussions on the subject of the role the United Nations should play in outer space activities.[105] In submitting its report in 1959, the Ad Hoc Committee on the Peaceful Uses of Outer Space had recommended the establishment of a special committee "to provide a focal point for facilitating international co-operation with respect to outer space activities undertaken by governments, specialized agencies and international scientific organizations."[106]

It seems clear that the expressed intention of UN members favours active participation by the organization in international co-operative arrangements, taking the initial role where it seems appropriate to do so, or at least providing the forum where discussions to this end might be carried on. To function effectively as a focal point, the General Assembly, in Resolution 1963 (XVIII) of 13 December 1963 noted "the benefits which all Member States would enjoy by participation" in outer space cooperative activities. It welcomed the decision of COPUOS to document the activities and resources of the UN and other competent international bodies relating to outer space, to summarize national and co-operative space activity, list the available bibliographic services in space and related areas, compile information on educational facilities in this field. It would be difficult to find, in this or other statements of the world body, the kind of language which suggests more than a co-ordinating function and a channel through which co-operative activities can be encouraged at all levels. The same resolution, however, "Encourages Member States to continue and extend co-operative arrangements so that all members can benefit from the peaceful exploration and use of outer space."

In 1969, the UN requested COPUOS to continue

its studies regarding further international co-operation "in the framework of the UN system" as related to remote surveying techniques.[107]

Subsequently, the General Assembly welcomed the efforts of COPUOS in the encouragement of "international programs to promote such practical applications of space technology as earth resources surveying" and drew the attention of Member States to such programs as the organization of technical panels, the use of internationally sponsored education and training opportunities and the conduct of experiments in making non-space applications of space-generated technology.[108]

Emphasis has thus repeatedly been placed by the General Assembly on the importance of COPUOS being a center of information as well as a stimulus for the exchange of information and the furtherance of co-operative activities on the part of UN members. These functions will continue to be necessary in relation to remote sensing of the earth by satellite, even after the achievement of the initial goal of full multilateral co-operation, resulting in the creation of a world-wide operational organization to carry out remote sensing surveys. COPUOS would continue to encourage discussion of new and related technology, and could offer substantial assistance to the organization on particular problems or needs. This channel would be

available, however, only if a formal link was created, and through which the dialogue could easily and frequently take place.

A correlative importance of the active presence of the UN lies in the vast amount of background, experience and knowledge through which the agencies have become quite expert in offering assistance to many countries. These valuable assets have been referred to earlier and reports as to their extent have been given at meetings of COPUOS[109] and at the 1968 Vienna Space Conference.[110] Unless a direct working relationship was established at the outset, considerable time would be lost and enormous duplication of effort would be required by working entirely outside the United Nations, in order to arrive at the point where the same knowledge was in hand. In addition, the years of working background which has been accumulated by the agencies in assessing needs of developing countries and relating these to potential of development, and the existing personal contacts in all corners of the world, should be considered essential to the new organization.

A report on natural resource satellites stressed the need for UN participation as "a matter of necessity" pointing out that "co-operation on earth-observation satellites to accelerate social and economic development

clearly falls within the mandate of the United Nations, as expressed in its Charter and in policies concerning Space and resources. Much less clear, however, are the administrative position and arrangements for the multi-disciplinary applications. Many agencies of the United Nations family have interests and capabilities related to such satellites. These interests and capabilities must be unified to direct the planning and ultimate operation of resource satellites for the benefit of all mankind."[111] The opportunity to consult with and obtain guidance from the Secretariat departments which are concerned with both outer space and the economic needs and natural resources of various countries, would be an important asset to an operating entity.

In a report to the Working Group on Remote Sensing of the Earth by Satellite, the Centre National d'Etudes Spatiales (CNES) outlined its activities in this field and included comments on the role of the UN and the establishment of an operational system.[112] As a first step, an effort at co-ordination is proposed. "Il est souhaitable qu'une coordination entre les différents Comités ou Organismes de l'Organisation et ses Institutions spécialisées concernés par les ressources naturelles, soit effectuée au préalable ne fût ce que pour permettre une estimation

raisonable des moyens nécessaires à l'organisation du rassemblement et de la diffusion des renseignements. Il sera sans doute nécessaire de codifier ou normaliser les informations recueillies relatives soit à la gestion des ressources (inventaire, amènagement, contrôle, exploitation), soit à l'analyse et au classement des besoins (disciplines scientifiques et techniques permettant la gestion), soit aux moyens de résoudre les problèmes posés (analyses in situ, télédétection, collecte de données...).

"Cette première synthèse interne pourrait permettre l'établissement de dossiers soit par pays ou régions, soit par besoins exprimés permettant de définir le plus judicieusement possible, notamment sur le plan financier, les moyens de résoudre les problèmes posés. Les dossiers, complétés à cadence fixe par l'apport d'informations nouvelles, pourraient constituer la base d'un système opérationnel de coordination ou d'harmonisation des actions entreprises dans les Etats."[113]

There exists, therefore, both a need for and a significant importance to a readily accessible channel of communication between several branches of the United Nations and an operating organization carrying out remote sensing by Satellite. The more effective this channel, the closer the UN will come to fulfilling the purpose for which it was founded, in relation to earth resources

surveying, as declared in Article I of the Charter "to achieve international co-operation in solving international problems of an economic ... character ..., to be a center for harmonizing the actions of nations in the attainment of these common ends."

ii. Relative Freedom from Disturbing Political Influences

Within the administrative organs of an objective resources surveying organization, it can be expected that the effect of political debates will be minimized. It would be idealistic, to suggest that such considerations will not, from time to time, motivate some proposals or objections. However, the complete separation of the organization from the political forum, in both structure and personnel, will likely dilute efforts to transplant controversial issues, which will be obviously out of context in discussions taking place within the organization.

iii. Participation of Independant Scientific and Legal Bodies

Remote sensing of the earth is essentially an instrument, or a means, rather than an end in itself. It may be used to produce data which will constitute the basis for other decisions. Being an instrument of technology, it is subject to refinement, modification and new applications as it continues to be re-examined and used by the scientific and

engineering communities. This technical search for improvement should be encouraged to the greatest extent and an opportunity provided at a high level, for consideration of new methods and uses which might be proposed through international scientific bodies active in space research such as the Committee on Space Research (COSPAR) of the International Council of Scientific Unions (ICSU),[114] the International Astronautical Federation (IAF), the European Space Research Organization (ESRO), the International Academy of Astronautics (IAA), and the European Launcher Development Organization (ELDO). It will be suggested that these organizations are represented on an advisory council, fulfilling a staff function, to ensure the availability to the survey organization, of the most current technical information at all times.

The field of space law, particularly as it relates to earth resources surveying, exists as a general framework, with specific areas being slowly elaborated. The impact of new developments on space law, and the use of outer space for remote sensing activities, is increasingly the concern of international legal bodies. A useful exchange of views in this important area could take place between representatives of international legal bodies which might include IAF's Institute of Space Law (IISL), the International Law Association (ILA) and the Legal Subcommittee of COPUOS. The presence of

such groups could assist in the interpretation and application of existing principles of space law, and in formulating statements designed to contribute to future legal development related to the specific context of remote sensing of the earth by satellite. Lay and Taubenfeld conclude that "These organizations, together with national groups, are important for the exchange of information and for the generation of ideas; being nongovernmental, they do not create international norms directly, although in some cases their studies and activities may be highly relevant to the positions assumed by governments."[115]

iv. Resources Survey Co-ordination - A UN Agency

Outer space activities will be only one part of a total program of earth resource surveys. The term "resources", in its broad sense, will include subjects of investigation and study by several scientific disciplines, as well as areas in which there is important work being done by the Specialized Agencies of the UN. Any function which will operate across all these fields must do so in such a way as to harmonize with existing activities, adding to the total body of knowledge and facilitating the work currently being done with little, if any, duplication.

An effective method of achieving this would be the establishment within the United Nations, of a Resource

Survey Co-ordinating Agency (RSCA). This would be responsible to the Economic and Social Council of the UN and would have direct working relationship with the Secretariat, the United Nations Development Program, the interested Specialized Agencies as well as other UN offices which could usefully contribute to or gain from a world-wide program of remote sensing of the earth.

The UN's Administrative Committee on Coordination (ACC) has pointed out that the task of inter-agency co-ordination is unavoidably affected by the marked tendency for activities in similar or closely related fields to be called for independently by different intergovernmental organs and that the Secretary-General had indicated this concern over the growth of the number of co-ordinating bodies due to the complexities and duplication they involve.[116] The proposal for the establishment of the RSCA is made in order to avoid compounding the problem referred to by the ACC. This new agency would centralize all requests for use of space-borne remote sensors from the different branches of the UN, thereby making available to them data which would otherwise be too expensive or otherwise unfeasible to obtain.

It was recommended in a report prepared under the auspices of the UN Economic and Social Council, that "a United Nations office with the initial functions of planning, consultation and education would meet immediate world-wide

needs. It could provide invaluable, and perhaps otherwise unattainable, aid to the development of a future operational system of international resource satellites", and the report outlines the establishment within the United Nations, of an office responsible for the application of resource satellites to social and economic development.[117] An additional value of the RSCA would lie in its ability to extend beyond the United Nations Organization as a result of a broader mandate, and its continuing role in the use of satellite surveys after the establishment of an operating organization.

A.H. Abdel-Ghani, Chief of the UN Outer Space Affairs Division, speaking to COPUOS in 1970 referred to the increasing necessity for co-ordination in this area in view of the ECOSOC decision authorizing two of its subsidiary bodies to continue their consideration of earth resource satellites.[118] To co-ordinate the work of these bodies with that of COPUOS and its Scientific and Technical Sub-Committee, a proposal had been made by the Inter-Departmental Group on Outer Space Matters to establish a panel of representatives of the various Secretariat units.[119]

The RSCA would familiarize itself with the programs of the various agencies and departments of the UN, and the information and experience available on resources surveying. It would determine the plans and objectives these agencies have for future survey activities. It may be found

necessary for the RSCA to be given terms of reference which go beyond space surveys, in order that multi-national regional or continental aircraft surveys might be considered by it as well, although this would not directly concern its relationship with an operating space surveying entity.

The primary function of the RSCA would be to co-ordinate the various requirements for remote sensing surveys across the world. This would ensure the maximum value from each satellite orbited and from each orbit completed. Interest in remote sensing activities has been expressed by UNESCO, FAO, UNDP and the Department of Economic or Social Affairs, as noted earlier.[120] Certain data may be of common interest to them, or the same equipment may be of use in gathering different information required by one or more of them. A co-ordinating agency, aware of their needs and working closely with survey planners would serve to avoid duplication and to maximize every opportunity to obtain the data sought.

An unusual function, for a UN branch, would be ascribed to the RSCA. It would have an official status, and the right to accept such status, with an organization established entirely outside of the UN structure. This would be within the operational survey organization, the formation of which would be initiated by the RSCA. The latter would be charged with convocation of the organizational meetings after distribution of a comprehensive review outlining the experience

which had been acquired and the anticipated advantages of a world-wide operating structure. With the co-operation of the office of the Expert on Space Applications and through the Points of Contact Program which has been established by the current holder of this office, Professor Humberto Ricciardi of Argentina, detailed clarification of the objectives foreseen by the RSCA could be undertaken. The expenses involved in this promotional phase might be recovered as part of an allocation charge to be paid at a later date by nations sending representatives to the initial sessions.

During this time a strong effort would be required by the RSCA, working closely with COPUOS and the Secretariat, to bring this program to the attention of every UN member, with special emphasis on the developing countries, and to secure the participation of the nations active in the use of space, particularly the USA and the USSR. A reasonably firm schedule would be required for completion of the promotional phase and the beginning of the organizational phase.

Prior to the early organizational sessions, there may be nations wishing to prepare outline or detailed operating structure proposals for consideration. These could be made the focus of the first meeting, to be considered along with membership, costs, financial participation, name and headquarters location. At the completion of the second or third session, the organization should be rooted firmly enough for

the RSCA to give over its active function to an interim executive committee and turn to its future concern as a co-ordinating agency for remote sensing survey requirements. In this important advisory capacity it should be considered for permanent non-voting membership in the organization at two levels - senior administration and survey development.

The overall perspective available to the RSCA would make it a highly valuable member of the administrative body, providing a balanced view, particularly at times when national concerns might become paramount or unduly emphasized. The knowledge of regional or continental needs, combined with awareness of the activities and objectives of other UN agencies should enable RSCA to be of substantial assistance in the planning of surveying missions. Inherent in both these spheres of activity would be the liason function carried out by the RSCA in its ability to act as an effective channel of communication between the organization and UN branches, obtain information and opinions, react to suggestions and proposals, and advise on the efficient use of the organizational resources in answering the needs for remote sensing surveys by satellite.

Another important function which could be assumed by the RSCA would be the development of programs to disseminate information on this application of space technology giving special attention to the developing countries. Mr. A. Horn has noted "It is recognized that to date [1970] the ability

of technical and scientific meetings to disseminate such information outside their own circles, effectively, has been limited" and he suggested that "an information programme should be undertaken in order to create an awareness among states particularly those of the developing areas of the potential of practical applications of space technology. Such a programme should promote activities that are feasible and relevant to these states in terms of their own national priorities."[121]

v. The Operating Organization

The adminstrative and operational structures open to adoption by an earth resources surveying organization admit to the application of differing management philosophies. As suggested earlier, guidance can be sought from among the experience of other national, international and supranational bodies, extracting general principles.[122] However, the particular character of remote sensing surveys, their application over broad areas of the surface of the earth and the potential importance of the data they will produce, must be the primary underlying factors in shaping any emerging organization. Thus, the broad policy objectives of the organization should be formulated before any effort is made to set out a structure of the operating entity.

A. Objectives

The preparation of general objectives and

principles for an operating organization might begin with relevant statements appearing in Resolutions of the UN General Assembly, and in the Space Treaty, as these have the consensus of the majority of the nations of the world. Some of the statements made in UN debates may provide direction for other sound objectives, while policies related to effective management could be the basis of additional points. It is submitted that the following might be a suitable point of departure in establishing such a list of objectives.

1) The use of outer space for remote sensing of the earth by satellite should provide the widest possible benefit to mankind; activities should be conducted, as far as possible, in the interest of all countries.

2) The greatest effort should be directed towards achieving a maximum of international co-operation, with broad, active participation by all nations of the world.

3) The benefits of satellite surveys must be available to all states, with particular consideration given to the developing countries. In addition to the requirements of individual states per se, their needs should also be regarded in a regional or continental context to ensure the maximum value from remote sensing surveys.

4) The sovereignty of each state must be fully respected at all times, in accordance with international law and the Charter of the United Nations. Special attention must be

given to the sovereignty of nations over their natural resources as an integral and essential component of their territorial sovereignty.

5) The United Nations generally and the Committee on the Peaceful Uses of Outer Space in particular should be considered as the focal point of international space activities, and kept informed as to all undertakings carried out by the organization as well as the general scope of future plans.

6) The most effective use should be made of the knowledge and experience of United Nations agencies, and efforts made to co-operate in the achievement of their programs wherever this is feasible through the planning and operational functions of the organization.

7) Data gathered over the territory of any state should be readily available to the government of that state upon application and payment of the appropriate minimal costs. International control of all data produced by satellite surveys must be assured at all times.

8) In view of the high cost of planning and executing survey missions, careful attention should be given to avoid duplication, obtain the greatest possible value from each program carried out, and spread the cost of hardware and operation as broadly and equitably as possible to minimize the financial burden on member nations.

B. Membership, Costs, and Revenues

The opportunity to participate in the earth resources satellite organization should be made available to all sovereign states of the world. The Space Treaty declares outer space to be free for "use by all States without discrimination of any kind and in accordance with international law" (Article I). Thus there can be no reason for membership to be subject to pre-requisite acceptance by the UN or other multi-national organization. Such procedure has the effect of shifting the burden of determination as to the persons holding effective control of a country to other shoulders; it can also be a bar to participation by a state which voluntarily chooses to abstain from membership in the body selected as a criterion.[123]

To avoid possible political polarization within the organization, in the event of internal national shifts of power, a secondary criterion might be used, providing that recognition by the UN of changes in governmental control of any state will be accepted without the need for the matter to be put on an agenda for discussion.

It has been stated previously that "When technical progress makes earth resources systems fully operational, it may no longer seem reasonable for the state controlling the technology to continue shouldering the major part of the cost

of the programs which yield substantial benefits to third states or other foreign entities.[124] At this point, it should not come as a surprise if the operating state decides to urge a policy of equitable cost sharing for uses made of the system by third parties. The exact content of such claims cannot, of course, at this time be predicted with great accuracy, for they would depend on the nature of the services rendered and the type of co-operative arrangements involved."[125]

Many of the essential and interrelated elements which form a remote sensing system are described in the report of the first UN Technical Panel on the practical applications of space technology and indicate the transition from data acquisition to data utilization, in which process "each element is a discrete aspect of the system and has specific costs, problems, skills and personnel associated with it."[126]

The expenses of the organization will originate from three basic areas of its activity. The first of these will be the administrative overhead and initial capital costs of sensing devices, satellites and launching facilities. Actual expenditures on hardware will not be required for some period of time after formation, the payment of these costs by members can be spread over the anticipated delay, where this would be of assistance to countries with limited financial resources. This payment will take the form of an investment in the assets

of the organization, and acquire for the state a percentage of its ownership calculated in accordance with a formula comprising such elements as territorial surface area, population, linear ocean coastline and gross national product. After determining a total for all participating nations, each would be required to make an investment based upon its percentage of the total. Each year the elements would be revalued to permit entry of new members at an equitable rate. The percentages arrived at would be applied to a maximum figure allocated for initial capital expenses with adequate allowance for similar additional expenses generally foreseeable during the first ten years of the organization's existence. This investment would be the recoverable portion of a nation's financial commitment in the event of its withdrawal, but would be repaid in such case in up to ten annual non-interest bearing installments. This provision is suggested in order to avoid potential financial strain becoming an instrument of persuasion, as well as to permit orderly refinancing when required.

The second area of expense will arise from the need for replacement of capital assets from time to time, primarily related to satellites which do not achieve orbit on launching, or those which do not maintain their orbit and decay earlier than planned. It would be unduly optimistic to anticipate that adequate profit will be earned from

operations, at least in the first few years of existence, for normal depreciation techniques to adequately provide for the necessary replacement costs, as these costs would thereby be indirectly transferred to operating expenses, which should be considered separately. Replacement costs, assessed each year, would represent a non-participating investment for each state, and would be collected from new states entering the organization. This payment would not increase equity, would not bear interest, nor would it be recoverable upon termination of membership.

The costs involved in operations, research and development, training, maintenance, data acquisition and processing, etc., would be grouped to form a third factor which would be paid by members as an annual fee. This would represent the expenses incurred in the general interest of all states and not covered by payments made for information or services purchased by the members.

It would be expected that as membership grew to include all the nations of the world, combined with increased use of the facilities of the organization and new methods of utilizing resource satellites for earth surveying, that the revenues would increase to the point where the second and third areas of cost could be adequately covered by income, and be reduced or eliminated as charges to the member states by the organization.

The cost of ground receiving stations would be paid for by those nations on whose territory they were constructed, or by nations sharing a station built cooperatively for regional use. Specifications and sources of supply for specialized equipment would be available through the organization for countries without the personnel or technical facilities to build the necessary receiving and data storage devices.

Operation of ground stations would be carried out by national personnel in each case. The organization would establish a training program to be carried out partly at an established location and finally at the trainee's own base. The cost of this program would be paid for by the country employing the trainee.

The United Nations and its agencies, in addition to individual UN member states, have frequently provided assistance in the past to nations which had an obvious need in such fundamental areas as education and economic advancement. This has taken the forms of providing teachers, training scholarships, materiel and finances. Such programs could be effectively utilized to enable developing countries to become part of the earth resources operating organization. The importance of the early participation of all nations cannot be too greatly emphasized, both from the point of view of the individual country as from that of the organization itself. As satellite

remote sensing begins to provide more tangible and practical benefits, the value of these must be available to all states - not merely in theory, but as functioning, integral parts of their national economies. To permit the absence of states due only to current financial inability to carry the burden of expense, would seriously interfere with the operation of programs, and with full usage of the available equipment, as well as create gaps in the acquisition of data on a world-wide basis.

The operating revenues of the organization would be provided by charges to members and user charges. The latter would include two major elements. A program specifically planned for an individual state, and carried out to provide information useful to that state alone, would be subject to a comprehensive program charge. To the extent that the devices built or data obtained are of value to other interested nations, this charge could be reduced and shared, or allocated to the general operating expense for programs valuable to all members. The other revenue producing area would result from fees charged to provide raw or processed data to user agencies, states, commerical or scientific bodies. For this purpose, a fee structure would be based upon costs of data storage and retrieval, the amount of processing, interpretation, transcription or other modification required, and the form in which it is transmitted to the user (tape, print-out, publication, etc.)

C. Creation and Structure of The Operating Organization.

There are obvious risks inherent in the proposal of an organization structure for any entity which has not yet come into existence, and it is not without a realistic awareness of this fact that the following framework for an earth resources operating organization is set forth. To simplify reference to it, the abbreviation RESAT will be adopted in this section, to indicate an International Resource Surveying Satellite Organization. A schematic representation of the RESAT structure and of the relationship with the United Nations, as proposed below, is included in the Appendix.

In Dr. J. Meitner's report on plans to be made for a developing country to participate in an operational earth resource survey satellite system, he stated the objectives of the study as including the definition of necessary steps, of the personnel, the facilities required, the ground support hardware and the relation of these needs to the plan through a review of the more likely options which will be available.[127] These basic decisions will undoubtedly constitute the initial groundwork in the formulation of any operating structure.

The UN Committee on the Peaceful Uses of Outer Space (COPUOS) should be considered as the logical ground in which the beginnings of RESAT are to be founded. On completion of the report by the Working Group on Remote Sensing established under the Scientific and Technical Sub-Committee of COPUOS, the

study of this topic by the Legal Subcommittee should enable a consensus for progress to be reached within COPUOS. At this point, a joint program by COPUOS, the Administrative Committee on Co-ordination (ACC) and the Inter-Agency Working Group on Outer Space should be undertaken, with the aim of creating the Resources Survey Co-ordinating Agency (RSCA)

The General Assembly resolution designed to bring the RSCA into existence could indicate the agency's responsibility to the Economic and Social Council (ECOSOC), the direct working relationship to be established between the RSCA and the Specialized Agencies, COPUOS, the appropriate departments of the Secretariat, and the United Nations Develoopement Program (UNDP) administration. The same resolution could outline the primary responsibilities of RSCA as (1) including the creation of an international organization to plan and implement remote sensing surveys of the earth by satellite, and (2) the general co-ordination of resource survey needs, with the aim of making more effective use of world-wide surveying facilities and reducing duplication to the greatest possible extent. As an indication of the direction to be taken towards achievement of this latter objective, there might be specific reference to the responsibilities which the RSCA will assume from other committees, departments and agencies currently concerned with the need for resource surveys. Although initially some resistance to the diminution

of the scope of some of the affected branches might be encountered, persuasion might be exercised through a program planned in advance to explain that the concentration of these activities into a single agency will assist them by making available information and feasibility studies as needed, with less delay and cost than in the past.

The RSCA would conduct a study over a six to twelve month period, following which it would convene a conference of all interested nations and present a report of its findings. This report, inter alia, would present an outline of anticipated areas of satellite survey activity, an assessment of both capital and administrative cost requirements, and a program dealing with the dissemination and publication of information. This report could serve as a point of departure for the Conference to establish the objectives of RESAT, the limits of funding which will be necessary and convoke committees to prepare detailed plans as to allocation of assessments, participation in ownership and a comprehensive administrative structure. This conference would consider the benefits to be derived from the operation of RESAT, the importance of these to all nations of the world not only in relation to their individual needs, but in the perspective of world-wide resource development, and conclude with adoption of an action plan and a convention to be ratified by all members, which would be the

founding document of RESAT. The UN General Assembly could take note of the Convention and recommend its approval by all member states, instructing the RSCA to assist in making available information which might be required by nations prior to their ratification of the agreement. The filing of a minimum predetermined number of ratifications would set into motion the machinery to bring RESAT into operation, or the establishment of interim working committees might be made before the Conference adjourns.

The Convention, signed and ratified by sovereign states would require the designation by each signatory of a national committee and its chairman as the active participant in RESAT, such designation to be made within a three month period following ratification. The chairman of these national committees, with representation from the RSCA, would constitute the governing Administrative Board of RESAT, responsible for the operation of the organization, its financial structure and for adoption of all management policy. An Operations Director, appointed by the Administrative Board, and directly responsible to it, would co-ordinate and supervise the day-to-day activities, implementing the policies enunciated by the Board. The line organization would flow from the Operations Director to the three functional branches of RESAT, the Survey Development Committee, an Operations Committee and the Data Division.

It is suggested that permanent representation by the RSCA on the Survey Development Committee would be an important asset and a necessary factor. This Committee would participate in the task of determining survey needs through UN branch liason as related to each of the categories of resources and could assist in planning combined surveys, to be carried out by particular missions. Attention would be given to those remote sensing programs to be conducted by limited-life satellites, those to be continued on a constant repetitive basis in near-earth orbit, those to be suggested for inclusion in experimental national space programs of individual states, and the eventual use of space platforms including those which may be placed in the geo-stationary orbit.[128] With the growth of satellite survey applications, the level of specialization within the Survey Development Committee would increase to comprise technical experts in each field. An interim grouping of disciplines likely to be seriously interested in this application of space technology is suggested in the accompanying schematic representation.

The second functional branch of RESAT would be the Operations Committee, responsible for the sensor, satellite and communications hardware. Separate subcommittees, each charged with development of their respective equipment and with supervision over construction of the operational hardware

could work in concert to achieve maximum compatibility of all components. The Operations Committee's function would thus lie in directing the work of its three Branches, responsible for remote sensor development, vehicles and communications.

Dr. P. Castruccio raises a number of the questions which would occupy the attention of the Operations Committee relating to the types and numbers of sensors to be used, the orbit inclination and altitude, the timing of missions and "the more fundamental questions: What is it that should be observed ? When is it best to observe ? What do the desired observables "look" like within the electromagnetic spectrum ? In short, what knowledge is the space system required to gather."[129]

The Remote Sensor Development Branch of the Operations Committee could co-operate with scientists and engineers of individual countries to perfect sensing devices, innovate new concepts, explore suggested modifications, work towards improved resolution, orthography and techniques of identification of three-dimensional features, prepare specifications for procurement tenders, consult with contractors chosen to build sensing devices for use in space surveys, design testing procedures, set standards which the various sensors must meet and establish suitable methods of quality control for these. The different categories of sensing devices proven effective in satellite surveys would be developed in the departments of this Branch devoted to the areas of

of technology into which they are classified.

The Vehicle Branch would be responsible for the design, construction and orbiting of the satellite vehicles required to carry out the surveying activities. This would involve determination of size, shape and weight of the vehicle, power supply, placement of sensing devices, and selection of materials. The altitude and orbital characteristics would also be determined by this department, as would the selection of launching rocket and site of the launch.

The transmission equipment on board the satellites and that used on the ground for reception of survey data would be the responsibility of the Communications Branch. The relation between the various objectives of each survey mission and the sensor capabilities and satellite design will constitute important considerations in this area, as will the design and locating of ground receiving stations to be built by individual states, and their data collection facilities.

The third essential department of RESAT would be the Data Division, with its functions considered under three headings related to data handling methods, transformation of the raw data into usable, practical information, and the accessibility to such information. This branch, dealing with the eventual consumers of the product of remote sensing from space would have to concern itself with security of information in

certain cases, and with charges made for data and the forms in which publication is to be made.

It has been stated that "Handling the large quantities of information that will become available from remote-sensor Earth Resources Survey in outer space presents a challenging problem of international dimensions" requiring careful attention to the complex techniques of data transmission from spacecraft to ground and data handling on the ground, with the more practical solutions to the problems to be "sought through the medium of international co-operation" given the ability to overcome such political questions as cost sharing as well as ownership and control of the satellite and data.[130]

Some authors have considered a potentially difficult problem will be the method of utilization of the data produced by satellite surveys without providing an unfair economic advantage to speculators. G. Alexander finds that some classifications of space-derived data pose such technical and legal problems, as the effect of reliable crop yield predictions on the commodities market, or that of soil analysis and potential mineral deposits on land speculation. He concludes that the most effective means of minimizing these problems would be to make information available to all interested parties on an equal basis, and processed so that no further interpretation would be necessary.[131]

To support the activities of RESAT, it is suggested that three staff functions be part of the operating organization. At a senior level, an Associates' Council could represent an important source of advice related to remote sensing technology, practical methods of using this technology to achieve the objectiveness of RESAT and to determination of the need for space surveys. As remote sensing is a relatively new subject of scientific discovery, it will likely remain the subject of continued experimentation for some years after RESAT adopts its proven areas of effectiveness, and great importance should be attached to possible new developments and new applications. As a world-wide international organization, RESAT will have the unique opportunity to invite representatives to the Associates Council from select national or international scientific and engineering bodies, and through RSCA, from UN agencies and departments, on a short or long term basis, or even for a single session. This Council could meet once a year, or more often if necessary, with members of the functional branches of RESAT, to exchange information, strengthen individual relationships and add another working dimension to the concept of international co-operation.

The finances of RESAT would be the responsibility of the Financial Control Division, under the direction of a Comptroller. The policies established by the Administrative

Board would be translated into members' charges and those related to the sale of RESAT's space-acquired data.

A Legal Officer would head the Legal Committee, as a third staff department, working closely with the executive of the Adminsitrative Board and the Operations Director. Some of the questions suggested for consideration by this Committee are discussed in the section which follows.

CHAPTER III

LEGAL CONSIDERATIONS RELATED TO THE USE OF EARTH RESOURCES SATELLITES

When the present experimental programs in the development of earth resource satellites have proven their effectiveness, it may be anticipated that the space powers capable of their use, will not await the creation of an international organization, but will plan their use for national purposes, with perhaps a few bilateral arrangements with selected partners. Whether or not an organization such as RESAT exists at that time, it is not too soon for nations to begin serious consideration of a specific framework of law, elaborated upon the principles outlined in the Space Treaty, and designed to enable this use of outer space to be undertaken in orderly compliance with an agreed international regulatory framework.

A 1968 U.S. report stated that "An operational ERS [earth resources satellite] system unquestionably will give rise to a variety of difficult and complex problems, including those related to frequency allocation and management, international relations, data handling and dissemination among users."[132]

There can be no doubt that political consideration will frequently intervene in this process, as they have in the past,[133] due to the different national backgrounds, objectives, economic structures and legal systems extant in various parts of the world. C. Horsford of the International Institute of Space Law wrote in 1968 that "Outer Space is unfortunately a field which has become involved in international politics and military strategy, and it is consequently not always easy to extract and define legal principles which are likely to be universally acceptable".[134] Professor Estep commented that "Remote sensing is just beginning to appear of importance to the general public, but in some ways presents the most difficult policy and legal problems ... because of the kind of information that may be obtained in this way, usually without the knowledge of those being observed ... it is the potential human abuse that creates problems."[135]

The benefit to be sought at an early stage is to bring the differences to a conference table, enabling all parties to understand where the issues lie which may require hard negotiation to resolve, and permit the cooperative give-and-take processes to seek the necessary solutions at an international level in advance of the creation of an operational framework and the need for regulatory provisions. This section will point to some of the legal

considerations related to the use of earth resources satellites which, it is submitted, should be placed on the agenda for discussion, and will raise some of the arguments which are deemed relevant.

1. National Sovereignty Over Natural Resources

The United Nations Charter, in Article 2, states that the first principle to be followed in seeking to achieve the purposes which the Charter sets out is that "The Organization is based on the principle of sovereign equality of all its members." Subsequent references in many UN Resolutions have affirmed that the permanent sovereignty of countries over their natural resources is clearly included in the general notion of sovereignty.

During discussions at COPUOS, the question of respect for the sovereignty of nations has been frequently mentioned in relation to the use of earth resources satellites.[136] It is clear that the question as to the relationship between these must be examined carefully in order to dispel the fears of some states that remote sensing from space might constitute a threat to their sovereign rights.

There are at least three aspects to this question which should be considered: the content of sovereignty, the legality of observation from space under international law, and the right to orbit satellites equipped with remote

sensing devices. This will lead to a conclusion as to whether the long-accepted concept of state sovereignty can constitute a restriction or a bar to the use of earth resources satellites.

a) The Content of Sovereignty

As noted earlier, the United Nations hasfrequently declared itself on the issue of the sovereignty of nations over their natural resources. On 21 December 1952, the General Assembly adopted Resolution 626 (VII) stating that "... the right of peoples freely to use and exploit their natural wealth and resources is inherent in their sovereignty and is in accordance with the Purposes and Principles of the Charter of the United Nations. .. recommends all States to refrain from acts direct or indirect, designed to impede the exercise of the sovereignty of any state over its natural resources." The words to which attention should be directed are "use and exploit", to determine the extent to which these comprise the right to knowledge of all aspects of such resources, such as location, quantity and accessibility, and whether they apply both to those resources which are known as well as to those yet undiscovered.[137]

By Resolution 1314 (XIII) of 12 December 1958 the General Assembly established a Commission on Permanent

Sovereignty over Natural Resources. Resolution 1803 (XVIII) adopted 14 December 1962 declared that "The free and beneficial exercise of sovereignty of peoples and nations over their natural resources must be furthered by the mutual respect of States based on their sovereign equality." In a report on this question, the Secretary-General stated that "Sovereignty over natural resources, which is essential to economic independence, is functionally linked to political independence, and consolidation of the former inevitably strengthens the latter."[138]

Other UN Resolutions have also referred to the right of peoples and countries to control their natural wealth. The apparent intention of these statements is to ensure that the material benefits to be derived from the "use" of a nation's resources are not lost to that state, in view of the importance of such benefits to the country's economic development. General Assembly Resolution 2158 (XXI) of 25 November 1966 stated that "The natural resources of the developing countries constitute a basis of their economic development in general and of their industrial progress in particular". In Resolution 2692 (XXV) of 11 December 1970, the General Assembly recognized "that the exercise of permanent sovereignty over their natural resources by developing countries is indispensible in order that they may, inter alia, accelerate their industrial development, ..."

Although UN General Assembly Resolutions cannot be regarded as categorical statements of international law, they do represent a consensus as expressed by a large number of the nations of the world and as such, should be considered as highly authoritative recommendations on the matters they deal with.[139] There seems little doubt that states regard the right to control and exploit their natural resources as an integral part of their territorial sovereignty.[140]

Another facet of national sovereignty still awaiting a decision from the international community is the demarcation between air space and outer space. The need for a solution to this frequently discussed problem becomes more evident as outer space becomes the locale for more complex and numerous activities.[141] A wide range of suggestions has been made in recent years[142] as to the positioning of a boundary line. L.P. Bloomfield points out, inter alia, that "The lowest height at which artificial unpowered satellites can be put into orbit at least once around the earth has frequently been urged as a possible boundary. This is somewhere between 70 and 100 miles".[143] The forthcoming discussions in COPUOS will hopefully resolve this question at an early date, for as Professor A. Meyer stated, "such limit can only be a legal one; for it will

not be possible to draw geographically or topographically an exact border line ..."[144]

b) Observation from Space

The unauthorized observation of the territory and the activities of one state by the nationals of another has the propensity of creating a presumption of intended harm on the part of the observer. Only if the suspicions thereby aroused can be satisfactorily set aside can there be sufficient objectivity to consider other values which might result from the observation. It is, therefore, important to consider the legal status of observation from space and establish whether international law permits such activity, for if not, the question, for example, of a right to share in data would not arise.

The Space Treaty represents the fundamental consensus arrived at by the world community regarding the legal regime to govern the use of outer space. It invokes, in Articles I and III the application of international law and the Charter of the United Nations, both of which clearly recognize as a primary principle the sovereign equality of all states. The lawful crossing of international borders carries with it permission for a foreign national to observe and record anything which his host sovereign has not declared to be restricted. The Space Treaty provides that

outer space is "not subject to national appropriation by claim of sovereignty, by means of use or occupation or by any other means" (Article II), and that it shall be "free for ... use by all States" (Article I).

The legal consequences of these provisions would appear to permit any activities, including observation of the earth, to be carried on from outer space, subject only to such restrictions as are found in the Treaty and in international law.[145]

In 1963, L.C. Meeker suggested that "observation of the earth from space is a legitimate and permissible activity in the peaceful exploration and use of space. Observation neither works nor threatens injury or damage to any persons or things on earth."[146] He concluded that such observation comes within the freedom for exploration and use which is now declared in Articles I and II of the Space Treaty.[147]

In considering the probabilities of economic deprivations which might be claimed by countries observed from space, McDougal, Lasswell and Vlasic suggested that "The unauthorized photographing, televising or telemetering of the physical properties of the territory of any state or of the activities which are carried on in its territory will, in all likelihood, be considered detrimental by such a state."[148]

The crime of "espionage", or the unlawful gathering of information, is not <u>per se</u> an international delict, in that there are no generally accepted rules of

international law which prohibit such activity, nor are there Treaties dealing with the subject. This is likely due to the reluctance of nations to admit that they might be involved in these matters, although each will readily agree that it is being carried on by all others. When spies are captured, they are tried and punished by national courts for having violated the national law of the target state. Reconnaissance from space, therefore, could not be considered as contrary to international law unless it contravened some other provisions thereof.[149]

C.S. Sheldon II stated that the Space Treaty permits the gathering of information from space by implication because the topic is not made explicit. However, he notes that "until observation from space is as openly routine as innocent passage on the high seas, some untoward incident could exacerbate international relations."[150]

The lack of a line of demarcation between air and outer space was pointed to by Gordon and Enzer as an obstacle to a clear statement on the matter of observation. Due to the possibility of low orbits being used for earth resources surveying, they find that having not yet established a definition as to where sovereignty begins and ends may seriously aggravate national sensitivites about orbiting survey satellites.[151] E. Brooks, on the other hand, does

not find any serious problem. He states "As with military surveillance satellites, no legal interdiction accompanies mere transit in outer space by the remote sensing earth satellite of one state across the borders of another state even if the purpose is discovery of resources or ascertainment of the condition of terrain, population, crops or water resources."[152]

In a background paper prepared by the Secretariat, the Legal Sub-Committee of COPUOS[153] was apprised of the results of an inquiry conducted amongst international organizations both within and outside the UN. The paper concluded that the legal regime of the airspace above the high seas is similar in principle to that of outer space insofar as freedom of use or flight is concerned.[154]

Following a comparison of military and non-military observation systems, Lay and Taubenfeld state that "it is far from clear that collecting information in peacetime is an international crime"[155] and that "Observation for any nonagressive purpose is then permissible in the American view."[156] They conclude that since "no international tribunal will find that the collection of military information by satellite provides a basis for collecting damages, it is no more probable that a tribunal will award damages for the collection of information of economic value."[157] The legality of geodetic survey satellites is regarded by C.W. Jenks as not open to question, for although the knowledge secured might be of

military value, the making of a geodetic survey by satellite is in itself a peaceful use of space, he concludes, and therefore no state is entitled to regard such a survey of its own area as an illegal or unfriendly act.[158]

The restrictions on the use of space which are found in the Space Treaty include non-appropriation, and the requirement to act in accordance with international law, as mentioned earlier. Article IV prohibits the orbiting of nuclear or other mass destruction weapons, but does not extend the prohibition to reconnaissance or observational satellites. Article IX provides that activities must be conducted with due regard to the corresponding interests of all other states, avoiding harm being caused to the Earth or its environment, and without interference with the activities of other states in their peaceful uses of space. The duty to inform the Secretary-General of the UN, and the public, as to their activities is imposed by Article XI. A nation which is orbiting a satellite, for the "peaceful" purpose of obtaining information about the resources of the earth, would not be prevented from doing so by any of these restrictions.

The Parties to the Space Treaty agreed that they would "regard astronauts as envoys of mankind in outer space" (Article V). At the time the Treaty was signed and ratified, all Parties were well aware of the reconnaissance

activities which had been carried on by the major space powers during the first decade of space technology development - or if not specifically aware then certainly alert to the possibilities which it presented for covert observation. If unmanned satellites had the capabilities to observe weather patterns, rocket launchings, military and naval manoeuvres, etc., it could hardly be ignored that manned spacecraft could carry out at least the same activities, if not other more specific ones. Professor Vlasic has emphasized this in his comment about the lack of objections which have been heard regarding meteorological satellites, "Even though their purpose is to take pictures of the underlying cloud cover, the cameras they carry do not stop recording when there are no clouds beneath," and considering the potentialities for observation by manned spacecraft, he continued "Both the Soviet and the American astronauts have been taking from orbit excellent photographs of the continents over which they were navigating. However, no one protested against their activities. Possibly nothing short of prohibiting photographic equipment in outer space could alter the situation. Similarly, satellites designed to aid civil communications and navigation are virtually undistinguishable from those used to serve identical military purposes."[159] Notwithstanding their awareness of these facts, the nations of the world gave their consensus that the pilots

and occupants of space vehicles were to be regarded as "envoys of mankind".

The conclusion which would appear to flow from Article V and from the lack of formal protests by sovereign states to the orbiting of admitted reconnaissance satellites, is that there is full agreement amongst states that they are not unduly concerned about the possible danger, if any, which might result from the watchful eyes of satellites orbiting above their territories. Perhaps this is also a comment on the fact that man's current capability for destruction is so great that there is little that can add to it further -- at least, not observation from space.

c) The Right To Orbit Earth Resource Satellites

Earlier reference has been made to the Space Treaty declaration that outer space is free for the use of all, and that this freedom must be exercised within the framework of the legal restrictions imposed by the Treaty. Against this background, it has been argued above that orbiting satellites equipped with remote sensing devices designed to explore the geographical features of the earth and obtain data regarding its natural resources, is an obviously permissible use of outer space. When considered within the framework of an international organization which exists to further

co-operation between nations, exercise international control over the activity, and obtain information useful for the economic advancement of all states, the use of earth resource satellites would seem to be further brought within the meaning of "peaceful uses of outer space."

There is, however, another side to this argument which must be carefully looked at. As the techniques of satellite surveying of the earth mature into operational programs, and nations formulate attitudes with respect to this use of outer space, these will crystallize into specific claims.[160] The substance of such claims will probably be linked both to the political relationship between the claimant and the operating states, and to the level of economic development of the country making the claim. Some of the claims anticipated from non-space nations might be termed "negative", in that they will ask for a restriction on, or cessation of the observational activity. Others could be called "positive", requesting participation in, or a share of the benefits resulting from the programs undertaken.

i. Negative Claims

An early example of the expression of concern arising out of satellite observation was formulated as part of the first draft declaration on outer space proposed by the Soviet Union in 1962.[161] It stated, in paragraph 8:

"The use of artificial satellites for the collection of intelligence information in the territory of foreign states is incompatible with the objectives of mankind in its conquest of outer space." It must be assumed that the words "intelligence information" contemplates data relating to military activities, as it is probably unlikely the USSR would take this stand in relation to information useful in agriculture, for finding iron deposits or for fighting forest fires. In 1970, Soviet writer Y.Kolosov was critical of the United States for its proposal of a resolution to the UN General Assembly suggesting that member states "join in investigating the various aspects of data received" from earth resources surveys.[162] He concluded from this that the U.S. was attempting to "receive international recognition for the lawfulness of photographing foreign territory" in order to "make it easier for it to carry on military reconnaissance activity."[163]

Thus a state that considers itself threatened through being subjected to observation may claim that this is a use of outer space which is not "peaceful" within the terms of the Space Treaty. It may support this claim further by reference to the declaration of the United Nations General Assembly that "Violation of the rights of peoples and nations to sovereignty over their natural wealth and resources is contrary to the spirit and principles of the Charter of the

United Nations and hinders the development of international co-operation and the maintenance of peace."[164]

As a result of these claims, the state may request that the observation be terminated and that no further sensor equipped satellites be orbited over its territory. If not prepared to go this far, it may request that permission be obtained prior to the use of such spacecraft, and possibly request full details as to the proposed programs and the sensing devices to be carried on board the vehicle. A further claim could insist that transmission of all data collected over its territoy be made exclusively to one of the observed state's own ground receiving stations, and perhaps the extension of this demand to all subsequently interpreted data as well.

The terms in which the Space Treaty has been drafted are sufficiently broad to permit differing interpretation and application by states. The precise meaning of the words "peaceful uses" has already led to such a situation, resulting in a conflict of definitions adopted by two major spacepowers.[165] Other phrases used in the Treaty may be susceptible of similar differences as for example, those which direct that outer space shall be used "for the benefit and in the interests of all countries;" that space is the "province of all mankind"; is "free for use by all States"; is to be used to "maintain international peace and security"; to

promote "international co-operation and understanding"; and with "due regard" for the "corresponding interests" of other states.

The possibilities for ambiguity in these terms may well touch sensitive areas on the part of some nations, arousing concern over the use to which data collected from space may be put. Peaceful observations from space and military reconnaissance by spacecraft may differ only as a matter of interpretation. Weather satellites may photograph not only cloud patterns, but also ground defense installations visible from cloudless skies; resource satellites may be designed to track sea ice, but may also "see" naval manoeuvres; and remote sensors intended to measure heat emissions for forest fire control or other scientific purposes, might, in addition, record missile launches.

The principle of national sovereignty permits a state to close or restrict areas to both its own and foreign nationals, wherein it determines that observation might prejudice its interests, either on the ground or in its airspace. It cannot, however, restrict more than the physical entry of persons or machines, under current international law. The observation of a nation's territory, the "peaceful" collection of data about its activities or its natural resources from the high seas, from the airspace over the high seas and from outer space, considered apart from the <u>use</u> to which

data may be put, continue to be considered as fully permissible by the law of nations.[166]

Professor Estep suggests that the current program of bilateral agreements may be the best course to avoid objections by those countries who wish to refuse any surveillance of their natural resources without their permission, as this provides for agreement on the observations to be conducted and would obviate objections from those who want to control the release of information about their natural resources.[167]

ii. Positive Claims

A second group of claims which may be anticipated in relation to remote sensing of the earth by satellite may be categorized as positive claims. They will not take objection to the use of the technology, but rather will seek a measure of regulation to be applied to its continued use and participation in the survey programs. The basis of the controls to be suggested by states will be rooted in their desire to protect their sovereignty and to ensure that they are in a position to be assured a reasonable proportion of the benefits which will accrue from this use of a res communis omnium.[168]

An excellent example of this type of claim is to be found in the draft agreement proposed by Argentina,[169]

and the reference in its Preamble to the "urgent need" for earth resources surveys which will "act as an effective stimulus to economic and social development, and materially contribute to the welfare of all mankind" through the exploitation of natural resources "on the basis of international co-operation". In order to assure "close international co-operation" (Article 1), the draft agreement proposes the establishment of a databank to which all states shall have access and which shall "disseminate on a world-wide basis the findings and practical results" of space surveys (Article 3). In Article 5 the draft invokes "the principle of equality between states and of the honourable fulfilment of international commitments" which are to govern remote sensing of earth resources until such activities "have been placed on an international footing".

Positive claims to "internationalization" and for increased "international co-operation" will form the broad base from which other, more specific claims may arise. These will include sharing of the data obtained, the right to train photo-interpreters and other technical personnel in the use of space derived data, equal participation with the spacepowers in international regulation of earth resource surveying,[170] the opportunity to be an equal member of any organization established to design and operate survey satellites, the implementation of a more effective and informative

method of registration of spacecraft than is presently in force,[171] specific elaboration of the regime of liability beyond impact damage to cover economic deprivation and unfair exploitation achieved through the use of data obtained from remote sensing surveys, and clearly accepted channels for the redress of grievances.

d) An Evaluation

It is submitted that the relationship between sovereignty, observation from space and the right to orbit earth resources satellites indicates that international law does not raise any barrier to this use of outer space, and that the emphasis on the benefits to be derived from cooperation between nations is, in fact, an incentive to states to engage in activity of this type. This conclusion, however is valid only if qualified by a clear distinction made between information obtained by remote sensing satellites and the use to which such data is put. The law of outer space can operate only to regulate the use of space to obtain information. The subsequent utilization of the information obtained is a secondary consideration falling outside the provisions of the Space Treaty, at least until there is further clarification of the meaning of the words "with due regard to the corresponding interests of all other Sates" found in Article IX and "to the greatest extent feasible and

practicable" as descriptive of the duty imposed by Article XI on space-active nations to inform the public of their activities.

2. The Right to Share In Survey Data

In any review of the debates, Resolutions, drafts and proposals in United Nations documentation, it is unlikely that a more frequent reference would be found than that to "international co-operation". This phrase is, for example, included in the Resolution which adopted the Space Treaty,[172] and is part of the Preamble as well as of five Articles of the Treaty itself.

The subject of sharing information to be gathered by remote sensing satellites affords the world community an opportunity to give tangible expression to the concept of "international co-operation", in the sense of nations working together in a common purpose. The sharing of data could be one phase of a broad program which might include training of personnel, assistance in practical application of the results of space observation, and planning of future programs, to name only some of the elements which might be included in a bilateral, or preferably a multilateral agreement relating to the use of earth resources satellites.

The frequent references to and encouragement of co-operative programs between nations by the General Assembly of the United Nations would undoubtedly form the basis of

support for a state to claim a right to share in earth resource data. There is no categorical provision of international law granting the right to share in the information obtained by spaceborne remote sensors. Thus, if such right is to be found, it must be ancillary to or implied from existing law governing the use of outer space. Once identified, consideration may then be given to further clarification of the extent of the right, and to the possible justification for elaboration of the law relating to its exercise.

The obligation is imposed upon a "user" of outer space, by Article I of the Space Treaty, to share the benefits thereby derived and to exploit this new medium with the interests of other nations paramount at all times, without regard to the "degree of economic or scientific development" of the states benefited. Lay and Taubenfeld state their opinion that "the observing state would be subject to no enforceable obligation to share its knowledge in order that the nations could bargain on an equal basis, for the law concerning taking unfair advantage of one state by another remains at best embryonic."[173] It is respectfully submitted that this opinion reflects a confusion of the use of earth resource satellite surveying techniques with the use of the data derived from the application of such technology. The consensus represented by the Space Treaty and

evidenced by its adoption into national law of more than 100 sovereign states should clearly be regarded as acceptance of the obligations it enunciates. For nations orbiting satellites to deny or disregard these provisions could, with time, dry out the vital meaning of the Space Treaty and create another international legal dead-letter.

The Space Treaty was not created in haste nor by a small closed drafting committee. It was the product of extensive preliminary work and discussion, and based upon a pre-existing Declaration of Legal Principles Governing Activities of States in the Exploration and Use of Outer Space,[174] which was adopted in the belief, as stated in the Preamble, that the "... use of outer space should be for the betterment of mankind and for the benefit of states ...". If the opportunities for discussion by the nations of the world in committee and in the General Assembly are also taken account of, the words of the Treaty must be treated with great respect as a result of being the careful decision and representing agreements between the members of the world community. The comments of Judge Manfred Lachs then Chairman of the Legal Sub-Committee of the General Assembly were indeed relevant when he pointed out that a state's freedom of activity in outer space was limited by the requirement that its exploration and use must be for the benefit and in the interest of all countries, irrespective of their degree of economic or scientific development.

Not only must states not abuse their rights, but they must respect those of others. He emphasized that science should be used for all mankind and those unable to explore or use outer space should not be deprived of its benefits.[175]

The right of nations to share in data obtained through the use of earth resource satellites therefore, appears to have substantial support grounded in international law and in the general consensus of world opinion as expressed to date both within and outside of the United Nations. The actual achievement and exercise of this right in the present context, beyond that declared in bilateral agreements, must await the organizational developments of international cooperation and the functional operation of a resource survey satellite system.

3. The Right of Unilateral Experimentation

The perfection of a technological achievement cannot be claimed merely as a result of the initial successful tests. Continued development will generally add, improve or modify the original concepts, with new or different techniques and applications emerging. It may be expected that this pattern will apply to remote sensing of the earth by satellite. In order to encourage the experimentation which may lead to better utilization of this technology, it will be important to ensure that nations active in the use of outer space, as well as those with whom they collaborate on

a bilateral basis, have complete freedom to carry on this activity. The creation of an international organization to exploit space surveys should not restrict the right of individual states to continue their experimentation, whether or not they are members of the multi-national enterprise. The general principles contained in the Space Treaty must still be regarded as providing the legal guidelines within which earth resources satellites are to be used. Further elaboration of space law in this field may, however, make more precise the obligation to share data obtained through this use of space, and may clarify rules for the use of radio frequencies, particular orbits, registration of satellites and their identification as well as with regard to liability which may result from this use of outer space.

4. Liability for Damage

Article VI of the Space Treaty declares that states bear "international responsibility for national activities in outer space," whether carried on by governmental agencies or non-governmental entities. With respect to space activities carried on 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." Under Article VII, states are held internationally liable for damage caused

on the earth by objects launched into outer space.

The recently completed Liability Convention[176] establishes the international rules and procedures governing liability for damage caused by space objects and for the payment of compensation to victims of such damage, thereby elaborating the provisions of the Space Treaty. Article I (a) defines "damage" as including "loss of life, personal injury or other impairment of health; or loss of or damage to property of states or of persons, natural or juridical, or property of international intergovernmental organizations". Under Article II a state is held "absolutely liable to pay compensation for damage caused by its space object on the surface of the earth or to aircraft in flight." Two or more countries who jointly launch a satellite are made jointly and severally liable for any damage caused. (Article V).

International organizations incur the same responsibilities as states under the Convention (Article XXII) if they declare their "acceptance of the rights and obligations" it provides for, and if the majority of the state members of the organization are parties to the Convention and to the Space Treaty. Such organization would therefore require an internal policy establishing the extent to which its members would participate in discharging any liability incurred.

The provision of both the Treaty and the

Convention appear to contemplate physical damage caused by the collision of spacecraft or their parts with other objects, either in outer space, in airspace or on the earth. With respect to the use of space for remote sensing, a clear distinction must be called for, once again between the use of satellite for data gathering purposes and the subsequent use of the data itself. The activity of remote sensing will use devices which either sense and record natural emissions from the earth, or first send a signal to the earth and record its return.[177] In the first case, there will arise little, if any, question of liability, assuming the relevant space mission clearly has earth resources surveying as its object. This is clearly characterized as a peaceful use of outer space, the undertaking of which is freely available to all states. In the second case, however, there may arise the possibility of injury to persons or damage to property, should the waves or beams sent from the spacecraft be sufficiently intense, either through being designed as such for use in remote uninhabited areas or as a result of equipment malfunction, notwithstanding that adequate safety standards will be established before sensing devices using laser, microwave and radar with such capabilities are put into regular use for earth survey purposes. Although powerful laser beams may be directed at the surface of the moon with relatively little fear, it is difficult to be sure

of avoiding the presence of hunting or exploration parties at any point on the earth. Although only a remote possibility, the question may be raised as to the legality of the use of such devices in space under the first paragraph of Article IV of the Space Treaty.

It is to be noted that Article VI of the Liability Convention precludes exoneration from the absolute liability declared by Article II where the damage results from activities not conducted in conformity with international law, specifically including the Charter of the United Nations and the Space Treaty. The definition of "damage" and of "space object" in Article I is sufficiently broad to include damages arising through use of the type of remote sensors contemplated here, although it was obviously not drafted with this potential application in mind. However, under Article II of the Convention it may be open to argument that damage due to the operation or malfunction of devices on board the spacecraft are not "caused by" the space object and therefore not within the scope of the Convention. This matter should be the subject of discussion in the Legal Subcommittee of COPUOS in the near future and a determination made as to whether the further development of remote sensing devices used on space platforms has made necessary the addition of such words as "or devices installed on board such spacecraft" after "space object" in Article II.

Should it be considered advisable to include this as a specific reference, it may be easier to obtain international agreement on a protocol to the Convention, or an amendment, before a case in point arises which might serve to polarize national positions.

The use of data obtained from earth resource surveys must be regarded quite differently than the use of satellites or on-board sensors. Depending upon the organizational structure within which remote sensing of the earth is conducted, the question may arise as regards other than physical damage -- i.e. damage to the economic operations of a state, caused by what is deemed to be the unauthorized use or release of information about that state by another. This situation is more likely to arise when nations are proceeding with satellite surveys on a unilateral basis, and perhaps also if carried out by a small group of nations. The possibility of such claims would be considerably lessened with surveys conducted by an international organization. Such claims would, however, not fall within the scope of current international space law. With respect to torts other than damage by space vehicles, C.W. Jenks states that "any ... tort committed in space but taking effect on Earth would appear to be governed, subject to the general rules of international law and any applicable international agreements, by the law of the jurisdiction within which it takes effect."[178]

The Liability Convention does not bring the unauthorized or unjustified use of space derived information within its scope, and it is submitted, rightly so. A nation which considers that it has suffered damages in consequence of the mishandling of information which is under the control of another state, would have regard to other remedies available under international law. Such damages would refer to an activity at a secondary level, too remote from the function of initially obtaining the information to be properly considered as a direct consequence of space activity, in view of the interposition of political decisions and judgements based on grounds unrelated to the use of outer space.

5. Radio Frequency Allocation

Communications will be an important aspect of any operational earth resources surveying system, regardless of the framework within which it functions. International Telecommuncations Union (ITU) has been extensively concerned with allocation of radio frequencies for the exploration and use of outer space and will be an integral part of future plans for remote sensing by satellite. As there may be special technical requirements for this application, careful consideration will have to be given to the frequencies devoted to it. Sensing and transmitting devices must be constructed and monitored to ensure that the bands assigned

are adhered to,[179] and provisions made for more efficient use of the radio spectrum, which is itself a resource with finite limitations, although not one which is consumed through use.

Various features such as orbital position and radio frequency are used to identify satellites in space, and despite their increasing number, it has been pointed out "it is highly improbable that two or more spacecraft will have a sufficient number of identical features for an acquisition error to occur. However, similar orbits and identical or neighbouring frequencies may result in considerable interference and the loss of data."[180] The communications problems associated with scientific earth satellites also relate to the need for two classes of telemetry functions, one being the ordinary telemetric transmissions of data provided by on-board sensors and the other being the "maintenance telemetry" which periodically or on telecommand, transmits data on the performance of a satellite's various subsystems.[181] Interference can arise from other services such as telemetry, tracking, voice and video links directed into the same earth receiving station, and this has been termed the most harmful interference to an unmanned scientific earth satellite system.[182]

One hundred and thirty-nine countries, Members of ITU have signed or acceeded to the International Telecommunications Convention and the Radio Regulations, which constitute

the rights and obligations of the governments of the countries concerned for all radio services and have the force of an international treaty.[183] The Preamble to the Convention fully recognizes "the sovereign right of each country to regulate its telecommunication", however, it is agreed that the ITU is to have special responsibilities in this context. The function of "allocation of the radio frequency spectrum and registration of radio frequency assignments in order to avoid harmful interference between radio stations of different countries" which is assigned to the ITU in Article 4, is exercised exclusively by the Administrative Radio Conference. After the extension of the Table of Frequency Allocations in 1947, there was further extension in 1959 with the allocation of 13 frequency bands to space research service, representing approximately one per cent of the available spectrum. The first allocations to the various space services were made in 1963, by which time terrestrial services were well installed, resulting in the need for them to share certain frequencies with the space services and abandon certain narrow bands entirely.[184] These allocations increased the frequencies available for space uses to about fifteen per cent.

Professor E. Pépin, in reviewing the procedures of the International Frequency Board (IFRB) under the Radio Regulations questions "whether the provisions of the Regulations

are really effective and whether they will be sufficient to prevent and eliminate harmful interference" and points out that "In the case of interference caused by a frequency assignment not in conformity with the Regulations the IFRB has no means of constraint if the station concerned does not cease the harmful interference."[185]

He also notes that "There is no doubt that ... special and often delicate legal problems will arise in connection with ... the assessment of the earth's natural resources by means of satellites".[186]

The 1971 World Adminstrative Radio Conference for Space Telecommunications (WARC-ST), held in Geneva and attended by delegates from one hundred and one countries was a sequel to the 1963 conference to allocate exclusive or shared frequency bands to the various space services. "Some of these services ... require special attention", said M. Mili, Secretary General of ITU, "because we believe that in a few years they will be of fundamental importance for the world's economic and social development. This is true ... of satellites for the exploration of the earth's resources."[187]

The results of the 1971 WARC-ST become effective January 1 1973, and provide a foundation for the application of space communications for the next decade. They include a full revision of the Table of Frequency Allocations in which there are additions "to those which were made in

1963 thereby multiplying by about 35 the portion of the radio frequency spectrum usable for space radio communications."[188] One of the ten new services to which these allocations were made is the "earth-exploration satellite service."[189]

6. Orbit Allocation and Protection

There are almost an infinite number of orbits available for use, taking into account altitude, shape of orbit and inclination. The ERTS, as proposed by the U.S. was planned to be injected into a 496 mile, sun-synchronous, near polar orbit.[190] For remote sensing, at least initially, it is anticipated that such relatively low altitudes will be used in general. As long as a particular orbit is not occupied, the state is free to use it.

It has been suggested that at some future time an additional segment of a fully operational Earth Resources System may include the utilization of a geo-stationary space platform.[191] When this occurs, the claim may arise to a specific position in the earth synchronous orbit -- 22,300 miles above the equator, which enables the satellite to remain virtually stationary over a predetermined point on the earth. This particular orbit can accommodate only a limited number of satellites, as the spacing between them will affect their communication facilities. There have been no international legal principles established regarding what may come to be a "Scarce" resource, and therefore a nation which occupies a

position in this orbit, does so by right under the Space Treaty and can continue to do so.

A state requiring a position in the geo-stationary orbit which is already occupied would be required to present its arguments to the occupant in an effort to establish either that the claim of the second state is more valid or that it can occupy that location to the mutual advantage of both.

The content of such argument could include a reference to the use being made of the orbital position, and a comparison of the utility of the functions in terms of the "common interest of all mankind". If it can be established that the second claimant proposes a use which is for the greater "benefit of all peoples" than the current user, then reliance upon the desire for "broad international co-operation" could lead to the agreed abandonment of the orbit by the occupant, in return for suitable compensation, relocation of the satellite to another equally suitable position if there is one, or amalgamation of the two functions in the second vehicle and its joint use by both states or entities.

The General Assembly of the UN has recognized the concern shown by COPUOS, in considering the practical interests of all states, regarding the efficient use of the geo-stationary orbit. In Resolution 2733 A (XXV) of 16 December 1970 it requested the ITU "to transmit, when available, to the

Committee on the Peaceful Uses of Outer Space all information about the use of the geo-stationary orbit ...". At the 1971 WARC-ST a procedure was adopted by the ITU to achieve co-ordination between geo-stationary satellite space systems on a frequency assignment basis.[192] The scientific community has begun to delineate some of the special problems of space telecommunications related to the use of the earth-synchronous orbit.[193] J.K.S. Jowett of the British Post Office pointed out that this orbit has been established as a "primary, very acceptable and growing means of providing long distance tele-communications services"[194] and that there are a number of important limiting factors which determine the maximum use to which the orbit may be put for satellite communications including the frequency spectrum made available, the need for spacing of satellites using common frequencies, potential interference with the terrestrial radio service and economic constraints.[195] He concludes that as there yet remains a great deal of work to be done to ensure efficient use of the geo-stationary orbit for communications purposes, the ITU should establish a sound basis for international agreement to regulate its use.[196]

The 1963 World Administrative Radio Conference considered a definition of "stationary" satellites. Professor Pépin refers to the possibility of a legal claim that such satellites "occupy" a part of outer space in a way which might

be characterized as a national appropriation and therefore a violation of Article II of the Space Treaty.[197] Although he finds no real problem as regards unmanned communications satellites, he leaves open the case of a permanently established manned station above the territory of a State.[198] Brooks, on the other hand, states "There is no fundamental legal distinction between manned earth-orbiting stations and remote-sensing satellites actually in operation in earth orbit ... A manned earth-orbiting station may in fact function as an earth resources satellite."[199]

Professor Pépin suggests it may be necessary to provide a system of "international agreements for satellites' positions in geo-stationary orbit, in which case frequency assignment notices would have to give very accurate information on the positions and other characteristics of these satellites for the purpose of obtaining official international recognition."[200]

It is clear that the synchronous orbit requires special consideration from the point of view of space telecommunications.[201] Its regulation may, however, require the understanding and the analysis of many other criteria, of which some will undoubtedly be related to the use of remote sensing devices. It is also possible to foresee other orbits becoming critical for certain uses. There is no question that the participation of ITU in any regulatory mechanism established will be essential.

Such regulation should nevertheless, be in the hands of a separate international commission which might be created by COPUOS and brought into existence by the United Nations.

It was reported recently that there are currently in excess of five thousand objects in orbit around the earth.[202] With the development of new uses of space, this number can be expected to increase. With the arrival of the space-shuttle, and with the requirement for specific orbits for specific uses, it may be useful to consider at this early stage, a measure of international regulation in this realm. The agency charged with the regulatory function would consider current, imminent and potential future uses of space and their orbit requirements. Application should be made sufficiently in advance of a planned launching to permit orbit allocations to be made in an orderly manner. This control must be exercised on an international basis by the United Nations. It should begin with the synchronous orbit and be extended as it appears necessary to do so.

7. Protection of Intellectual Property

The problems arising from the unauthorized reception and use of telecommunications directed to the earth from a satellite source are more easily explained in the context of radio and television programs where the rights of performers and producers may be involved. It is submitted, however, that this matter must be considered in relation to data

from remote sensing satellites as well. One might be tempted to counter this suggestion with the words of the Space Treaty which refer to "the benefit and in the interests of all countries" and the "province of all mankind" (Article I). From this point of view, the argument might be raised that data which is the result of using outer space in the interests of all countries should not be given protection and be available to any nation interested in it and with the capability of receiving the signals.

It is suggested that the better view would be one which yields to the need for order in the handling of space derived information and for ensuring an opportunity to requite the very substantial investment to be made in the establishment of an operational earth resources satellite system, whether provided by one country, a multi-state organization or the United Nations.

The question of the rights related to the transmission of radio and television broadcasts via communication satellites was first raised by a Working Group of the International Bureaux for the Protection of Intellectual Property (BIRPI) in 1968. In 1970, BIRPI was succeeded by the World Intellectual Property Organization (WIPO). The rights to remote sensing data might be considered by this organization, in consultation with UNESCO and ITU, since it could not be considered within the 1961

Rome Convention which deals with protection of performers, producers and broadcasting organizations.

C. Masouyé of WIPO points out that the International Telecommunication Convention, administered by ITU, guarantees the secrecy of international correspondence and that the Radio Regulations prohibit the interception, without previous authorization, of radio communications not intended for the general use of the public.[203] He states, however, that neither the Convention nor the Regulations provide for any sanctions against infringement or refusal to recognize the obligations undertaken, and suggests therefore, that either conditions under which interception is prohibited and penalized be specified, or a new international instrument be created to guarantee the protection of signals tramsitted by satellite.[204]

Article VI of the Space Treaty provides that "States Parties to the Treaty shall bear international responsibility for national activities in outer space" and Mr. Masouyé suggests that this Article can be the basis of state responsibility in the case of earth stations which violate the rules of the law.[205] It is submitted that this view could not prevail in relation to remote sensing activities in view of the fact that ground receiving stations are not an active part of the "space segment" of outer space activities and their misuse could not incur liability under the Space Treaty to any greater extent

than a domestic broadcaster would be held responsible under the broadcasting regulations if an individual comes into possession of and uses a device which enables him to receive classified or restricted transmissions. The ITU should have the necessary authority to establish the enforcement machinery which is clearly required, and serious consideration should be given to its early implementation.

8. Redress of Grievances

Disputes relating to the operation of a remote sensing survey system or to the use of information from the system are likely to arise regardless of the framework within which the procedure is used. In an international organization there would seem to be a much greater opportunity for the easy settlement of differences. The structure of the organization would provide for various levels through which problems could be channeled, and it is likely that most would be solved within the structure itself. Countries not members of such an organization, or prior to its establishment, those unable to engage in space activities directly, will, in the opinion of R.F. Packard, "look to collective action to assure that they receive benefits of space technology and that the space powers do not work contrary to their interest."[206]

a) Data Sharing

The most serious complaint which might be heard

would be that a state has been denied information or data which it claims is necessary to it. It is important that this situation be provided for in any organization, enabling the widest possible sharing of available information to avoid this claim from arising, as far as this is practical. In an international organization, where each member has a financial commitment and a share in the operation, the rights would be relatively clear, established by the written agreement outlining its structure.

b) Priorities

Another possible complaint could relate to the priorities assigned to programs requested by members of the organization, each wanting to have specific surveys conducted as quickly as possible. Decisions will be based on the available technology, satellite capacity and would extensively involve both the planning and operational divisions.

c) Invasion of Privacy

An interesting alternative to the thrust of the discussion concerning national sovereignty was offered by A.H. Abdel-Ghani at a recent Congress of the International Astronautical Federation (IAF). Although Chief of the UN Outer Space Affairs Division, he was speaking for himself when he remarked "I'm not sure that the problem is a problem of sovereignty -- it is a problem of intrusion on private affairs ... Sovereignty exists when control exists, when a state can exercise

this sovereignty. Outer space does not belong to a certain state. Intrusion in private affairs is involved here."[207]

If this view should find favour among states seeking the right to share in satellite resource data, it might be further supported by the prohibition in the UN Charter against intervention in "matters which are essentially within the domestic jurisidiction of any state" (Article 2 (7). McDougal, Lasswell and Vlasic state that a country might regard "any unauthorized space observation of its territory or peoples as a deprivation" even if the observing state acquires no more information than the underlying nation already has.[208] The authors note that states might demand freedom from unauthorized observation from space which would result in specific damage such as economic loss due to gaining unfair competitive advantages.[209] They conclude that "Even in the absence of such specific damage, some kind of payment may be demanded in compensation for invasion of privacy".[210]

It is submitted that a claim in this form is implicit recognition of the benefits which could be available from space surveys, and that rather than demanding monetary compensation a nation would achieve more effective results through using this situation to secure for itself the opportunity to participate in future programs of earth surveying which could be of importance to its national economy.

In urging an early start on the identification of new international arrangements to develop and use this technology, R.F. Packard of the U.S. Department of State indicates that such arrangements would provide an opportunity "to alleviate the sensitivities of other countries concerning the invasion of their privacy and the threat to their national interests" as there may be some adverse feeling that "repetitive and close observation from space intrudes upon national privacy and proprietary interests."[211]

Having accepted the concept of national territorial sovereignty, and given world consensus as to the permanent sovereignty of nations over their natural resources, it may be difficult to separate invasion of privacy as a legally non-inclusive aspect of this concept. It would seem more likely that the right to privacy will be considered as one component of the sovereignty which international law grants equally to all states. Mr. Abdel-Ghani's comments are clearly valid in reference to damage or intrusion which may be caused in outer space; however, the relevant concern in the present case is to that which occurs on the surface of the earth, where the natural resources are located and where sovereignty is of paramount importance.

d) Abuse of Rights

A nation claiming the right to share in data

from earth resource satellites might imply from the refusal of an orbiting state to grant this right, that there is a prima facie intention to use the data in some way contrary to the interests of the requesting country. This would be even more evident if the claim were accompanied by an offer to contribute to the financial costs involved in the undertaking and/or provide personnel to aid in its implementation. The existence of such an intention on the part of a spacepower to obtain an exploitative advantage would contravene the letter as well as the spirit of the Space Treaty which declares in Article I that "Outer space ... shall be free for ... use by all States ... on a basis of equality and in accordance with international law". The refusal to share resources data might also be interpreted as an abuse of the rights granted in this Article of the Treaty. There appears to be little doubt that the doctrine of abuse of rights has been received as an integral part of the general body of customary international law.[212]

e) Unjust Enrichment

It may be anticipated that in making a claim to share in space-derived data, a nation will find that information concerning its natural resources has been used by the operators of a satellite survey system, or has been disseminated to other of their partners. If there is clear proof that such data was

used by another state to its advantage, and that no benefit was received by the underlying country, a claim might be argued on the grounds of the private law concept of unjust enrichment.[213] Although the claim could result in, in this case, a demand for compensation, it would seem more reasonable for the aggrieved state to use the occasion to assure its share of data resulting from future programs.

f) Procedures

The recently concluded Convention on International Liability for Damage Caused by Space Objects includes a provision whereby a claim, presented through diplomatic channels, which is not settled within a period of one year, may be submitted to a Claims Commission (Article XIV). It is suggested that a similar procedure be considered for those claims relating to remote sensing from space which cannot be arbitrated from within any operating international organization. Further guidance in establishing suitable machinery for the settlement of differences could be sought from an examination of the methods evalued within the United Nations, and particularly that of the International Civil Aviation Organization (ICAO). As far as possible, the procedure adopted should function within the organization, granting to the members assembly the right to make final decisions on disputes, after complete hearings before any technical committees involved.

The Liability Convention provides for the Claims Commission decisions to be final and binding only if the parties have so agreed, failing which "the Commission shall render a final and recommendatory award, which the parties shall consider in good faith" (Article XIX). It is to be hoped that with increased international co-operation in many fields, the growing bond of confidence between nations which this agreement on arbitration procedures represents, will mature further, perhaps to the point where the important potential values of the International Court of Justice will be recognized, enabling ICJ to be revitalized and play its proper role in the solution of international differences. An optimistic view of the fulfillment of this hope was voiced by Astronaut Rear Admiral Alan Shepard in Committee I (Political and Security) of the UN General Assembly as US Representative, in reference to the recommendatory awards, "We believe there is reason to expect that parties will in fact comply with awards because they will recognize that it is in their own self-interest to do so."[214]

The results to be achieved by remote sensing programs will have broad implications and reference to many nations. Delays in the implementation of satellite survey missions could reduce their effectiveness if full advantage cannot be taken of seasonal or weather conditions. Grievance procedures must be designed to avoid such delays.

CONCLUSION

The foregoing pages have examined the nature and proposed uses of remote sensing devices on board spacecraft, the modalities within which this technology, when fully operational, may be utilized to achieve the benefits projected, and related areas of law where further legal developments may be necessary to ensure the protection of rights and the equal participation of all states. Although in the course of this dissertion a number of conclusions have been expressed, it would be unrealistic to suggest that, granted their acceptability, ready or rapid implementation could be expected. Decision-making in the international arena is a lengthy process, frequently interwoven with influences far removed from the questions to be decided. A degree of consensus has, however, already been reached. The importance of natural resource development is clearly recognized, and the need for improved ecological management techniques becomes more apparent daily.

The attention given to satellite surveys of the earth by individual countries and the United Nations focus on both the problems and advantages of this new technique. The launching of ERTS-A on July 23, 1972[215], and the preliminary successful functioning of its sensing equipment[216]

puts into relief the importance of making an early start towards decisions on the question of internationalization. The US program of experimentation will provide the basis, by the mid-1970's, for determination of the effectiveness of a fully operational, world-wide resources satellite system. By that time a vast amount of data will have been collected from the ERTS-A and -B experiments as well as from the EREP on the Skylab mission. The spacepowers will not likely cease their use of these methods of data-gathering to await organizational developments, particularly if a significant measure of success has been achieved not only in the use of the technology, but also in the application of the information it has provided. If the values ascribed to international co-operation are to be translated into tangible effects, beyond the assembly halls, it is perhaps not too soon for serious consideration of the necessary institutional arrangements.

The Working Group on Remote Sensing of the Earth by Satellites is in an excellent position to initiate the discussions leading to further steps in the process of internationalization. Some thought might be given, upon termination of its present mandate, to the constitution of this Group as a UN resources survey co-ordinating agency, charged with the preparation of a report on organizational

development. At the same time the Legal Sub-Committee of COPUOS might be asked to study and prepare recommendations for the accompanying clarification and further development of international space law as it affects earth resources surveys. The object of these efforts should be to establish the feasibility of creating an international operating organization related to the United Nations through a coordinating agency and responsible for satellite resource surveys on a world-wide basis. The eventual achievement of this objective would ensure orderly progress towards full international measures and the continuation of the UN and COPUOS as the focal point of activities in outer space. It would also bring about a co-operative relationship based on inter-dependence, in the sense of the distinction made by J.N. Behrman, Professor of International Business, between inter-dependence, which conserves the sovereign rights of all parties and dependence, which implies a loss of sovereignty.[217]

The right to do something requires a framework of law within which the right arises, and the corollary to every right is a form of obligation. The most fundamental expression of such obligations is that the right must be exercised in accordance with the law which created it. In its more complex forms it may require the payment of money, the giving up of other rights, the sharing of benefits which

result, and may extend as far as the partial or complete surrender of sovereignty. Instinctively, ancient fears frequently give rise to distrust of new techniques and skepticism as to their utility. Perhaps one of the emerging values of the space age is the transition to a new phase in the attitude toward invention. The need for a wider perspective dictates that this new prospecting tool, remote sensing of earth's resources from outer space, be characterized not as the bread, for it is, in fact, only the spade which ploughs the ground where the wheat will be planted. If maturity can eradicate the primitive reaction to reject, and overcome the fear that all efforts are directed towards the reduction of sovereign rights, the positive values inherent in the new technology may be more effectively assessed.

The benefits to be derived from satellite surveying methods may affect the traditional notion of sovereignty, where the tight, closed control of everything within the national territory can be maintained if desired. The problems of declining resources and increasing populations emphasize that it is becoming more difficult for people to live in separate or isolated national compartments. As the problems grow more pressing the nations of the world will find the need for interdependent activity will grow as well. Effectively co-ordinated, this can assist in the solution of many difficulties which may be ahead. It will require not an abandonment of the traditional

content of sovereignty, but rather new forms of controls combined with the acceptance of the strong values to be found in international co-operation.

If there is a measure of wisdom to be gained from the experience of the past half-century, it may lie, in part, in a more mature awareness of "common ground" as an essential element of effective discussion between sovereign states --- supported by a need rather than merely a desire, to achieve meaningful results. The current and impending problems of both prosperous and developing nations related to the supply and management of the earth's resources may provide both the common ground and the need, enabling states to collaborate as partners, working to provide better care for that fragile craft in space -- the planet Earth.

> "We travel together, passengers on a little spaceship, dependent on its vulnerable reserves of air and soil; all committed for our safety to its security and peace, preserved from annihilation only by the care, the work, and, I will say, the love we give our fragile craft."
>
> Adelai E. Stevenson [218]

NOTES

1 The text of this Resolution is included in the Appendix.

2 COPUOS, U.N. Doc. No. A/AC.105/PV 98-106, passim (10 November 1971).

3 Development of Natural Resources, Natural Resource Satellites, Report of the Secretary-General, Economic and Social Council, U.N. Doc. No. E/4779, pp. 1-2 (4 February 1970).

4 A review of the activities of UNESCO in the field of hydrology, FAO in the use of Earth resource surveys and in the acquisition of agricultural data, the Resources and Transport Division in cartography, WMO and UNESCO in oceanography and participation in the International Hydrological Decade was published as an Addendum to Development and Coordination of the Organizations Within the United Nations Family, Thirty-Fifth Report of the Administrative Committee on Coordination, Economic and Social Council, U.N. Doc. No. E/4668/Add.1 (16 May 1969). These activities were also reported to the Scientific and Technical Sub-Committee of COPUOS in U.N. Doc. No. A/AC.105/55/Add.1 (8 July 1969) and Add.2 (11 July 1969). The further views of UNESCO are expressed in "Views and Comments of United Nations Bodies, Specialized Agencies and Other Relevant International Organizations on Remote Sensing of the Earth by Satellite", Note by the Secretariat, COPUOS, Working Group on Remote Sensing of the Earth by Satellite, U.N. Doc. No. A/AC.105/C.1/WG.4/CRP.1, p. 20 (24 March 1972).

5 U.N. General Assembly Resolution 2600 (XXIV) of 16 December 1969. The text of this Resolution is included in the Appendix.

6 U.N. Doc. No. A/AC.105/C.1/SR 66, p. 43 (16 April 1970).

7 Argentina: "Draft International Agreement on Activities Carried Out Through Remote Sensing of Earth Resources", U.N. Doc. No. A/AC.105/85, Annex II, p. 2, Article 2 (3 July 1970). Relevant articles from the text of the Draft Agreement are included in the Appendix.

8 U.N. Monthly Chronicle, Vol. VII, No. 9, p. 40 at 47 (October 1970).

9 Ibid.

10 The text of this Resolution is included in the Appendix.

11 Charter of The United Nations, Article 1(3) and 1(4).

12 "Views and Comments of United Nations Bodies, Specialized Agencies and Other Relevant International Organizations on Remote Sensing of the Earth by Satellite", supra, note 4, at p. 5.

13 Aeronautics and Space Report of the President, 1971 Activities, U.S. Government Printing Office, Washington, D.C., Stock Number 4103-0002 (March 1972), p. 4.

14 Official Records, 45th Session, 8July - 2 August 1968, Annexes, Economic and Social Council, U.N. Doc. No. E/4551, p. 1 at 2 (21 June 1968). The Declaration was presented to the Secretary-General 10 Decenber 1966.

15 As quoted in U.S. Department of State Bulletin, p. 231 (August 24, 1970).

16 Use of Remote Sensors in Earth-Orbital Space for the Discovery, Inventory, Evaluation, Development and Conservation of Earth's Natural Resources, Note by the Secretariat, U.N. Doc. No. OSAG/Background Paper 13, p. 2 (15 April 1968). This study was prepared by Dr. P.A. Castruccio.

17 As reported in The Montreal Star, p. D-1, col. 1 (January 29, 1972); p. 1, col. 1 (January 31, 1972); and p. 1 col. 1 (February 1, 1972). The study was due to be published in March 1972.

18 Professor S.D. Estep has suggested, in a paper dealing with space surveys, that the goal of organized world society should be that of providing "A decent condition of living for all the peoples of the earth.", and that U.S. foreign policy should be conducted accordingly in developing programs for the use of remote sensing techniques. "Legal and Social Policy Ramifications of Remote Sensing Techniques", in Proceedings of the 5th Symposium on Remote Sensing of the Environment, p. 197 at 198-9 (1968).

19 S.H. Lay and H.J. Taubenfeld, The Law Relating to Activities of Man in Space, pp. 26 and 186 (1970). International Affairs, [Moscow], No. 12, p. 88 (1969) and No. 9, p. 100 (1970).

20 Report for the Subcommittee on NASA Oversight of the Committee on Science and Astronautics, U.S. House of Representatives, Ninetieth Congress, Second Session, Series W, U.S. Government Printing Office, p. 25 (1968).

21 As indicated in the Preface, ERTS-A was launched 23 July 1972. The newspaper reports of the launch and of the first successful photographs have been reproduced and are included in the Appendix. The initial contract for the ERTS hardware development was awarded by NASA to the General Electric Co. in the amount of $61.6 million on May 19, 1971. NASA News Release No. 71-89 (May 19, 1971).

22 L. Jaffe and R.A. Summers, "The Earth Resources Survey Program Jells", Astronautics & Aeronautics, p. 24 (April 1971). The initial group of experimenters are from 28 of the United States and from 22 foreign countries. An outline of the first U.S. experiments as well as the initial group of scientists and the experiments proposed for both ERTS-A and EREP is listed in NASA News Release No. 71-202 (October 20, 1971).

23 Report for the Subcommittee on NASA Oversight of the Committee on Science and Astronautics, U.S. House of Representatives, supra, n.20, at p. III.

24 International Affairs, Moscow, No. 12, p.88 (1969) and No. 9, p.100 (1970). A report of an article in Pravda which noted the value of remote sensing by satellite is found in D. Howard, "Notes on Space Applications", Further Outlook on Space, No. 8, p.12 (January 1969). The Soviet interest in resource surveys is reported in "Space Scouts Made in the USSR", Novosti Press Agency, Space World, Vol. G-7-79, p. 26, (July 1970). A recent Soviet publication dealing with space methods of physical geography is B. Vinogradov and K. Kondratyev, Kosmicheskie Metody Zemlevedeniya, Gidnometeoritat, Leningrad (1971).

25 Quoted in F. Kohler and D. Harvey, "The Soviet Space Effort - An Analysis", Air Force & Space Digest, p. 54 (June 1971).

26 Information relating to remote sensing devices which is summarized in this section has been based on the following literature: U.S. Activities in Spacecraft Oceanography, prepared for the National Council on Marine Resources and Engineering Development by NASA and the Naval Oceanographic Office (Oct. 1967); Space Exploration and Applications, Vol. I, pp. 33 and 625 - United Nations Conference on the Exploration and Peaceful Uses of Outer Space, Vienna, August 1968, U.N. Publication No. E/69.I.16, A/CONF.34/2; descriptions of sensing devices, see Canadian Aeronautics & Space Journal, Vol.17, No.17, P.407 (Dec.1971); A Survey of

Space Applications, NASA SP-142 (1967); NASA News Releases: Newell, "Current Program and Considerations of the Future for Earth Resources Survey" (April 1968), No. 69-73 (21 May 1969), No. 70-99 (18 June 1970), No. 70-102 (26 June 1970), No. 71-42 (25 March 1971), No. 71-202 (20 October 1971); L. Jaffe and R. A. Summers, "The Earth Resources Survey Program Jells", supra, n. 22; T.A. George, "ERTS A and B -- The Engineering System", Astronautics & Aeronautics, p. 41 (April 1971); Report of the United Nations Panel on Remote Sensing Systems for Earth Resources Surveys, Annexes, COPUOS, U.N. Doc. No. A/AC.105/c.1/VIII/CRP.4 (4 June 1971); W.R. Corliss, Scientific Satellites, NASA SP-133 (1967); C.S. Sheldon II, "Peaceful Applications" in L.P. Bloomfield, ed., Outer Space Prospects for Man and Society, p. 37 at 58 (1968 rev. ed.); Space Station: Key to the Future, (1965); J.M. Denoyer, "Satellites for Observation of the Earth", Telecommunication Journal, Vol. 38, No. V, p. 369 (May 1971); see also: Remote Sensing of Earth Resources, a bibliography prepared by NASA citing references from January 1962 to February 1970, National Technical Information Service (1971); Remote Sensing with Special Reference to Agriculture and Forestry, National Academy of Sciences, Washington, D.C. (1970).

27 The information on potential applications of remote sensing techniques in this section has been summarized from the following literature: Space Exploration and Applications, Vols. I and II, supra, n.26; Selective Bibliography on Remote Sensing, COPUOS, Note by the Secretary-General (18 August 1970); The Application of Space Technology to Development, Parts One and Two, Report prepared by V. Sarabhai, P.D. Bhavsar, E.V. Chitnis and P.R. Pisharoty, U.N. Doc. No. E/AC.52/XV/CRP.1 (9 June 1971) and Add.1 (6 August 1971); COPUOS, U.N. Doc. No.A/AC.105/77, p. 61 (17 March 1970); Earth Resources Survey, Working Paper submitted by the U.S. Delegation to the Scientific and Technical Sub-Committee of COPUOS (April 1970); A Survey of Space Applications, supra, n. 26; U.S. Activities in Spacecraft Oceanography, supra, n. 26; The Role of Earth Satellites in the Study of the Human Environment, Note by the Secretariat, COPUOS, Scientific and Technical Sub-Committee, U.N. Doc. No. A/AC.105/C.1/VIII/CRP.2 (9 March 1971); Development of Natural Resources, Natural Resource Satellites, Report of the Secretary-General, ECOSOC, U.N. Doc. No. E/4779 (4 February 1970); "Prospecting From Space", Space World, Vol. F-6-66, p.14 (June 1969); NASA News Release 70-63 (1970); Report for the Subcommittee on NASA Oversight of the Committee on Science and Astronautics, U.S. House of

Representatives, supra, n.20; The Use of Earth Survey Satellites in Monitoring the Changes in the Global Environment, Note by the Secretariat, COPUOS, Scientific and Technical Sub-Committee, U.N. Doc. No. A/AC.105/C.1/VIII/CRP.1 (8 March 1971).

28 L. Jaffe and R.A. Summers, "The Earth Resources Survey Program Jells", supra, n. 22, at pp. 25 and 40; R.F. Packard, "International Legal and Political Aspects of Earth Resources Surveying by Satellite", AIAA Paper No. 70-331, p. 2 (1970).

29 Report for the Subcommittee on NASA Oversight of the Committee on Science and Astronautics, U.S. House of Representatives, supra, n. 20, at p. 3.

30 G.P. Wollard, "Status of Satellite Geodesy", in Space Exploration and Applications, supra, n. 26, Vol. I, p. 657.

31 Argentina: "Draft International Agreement on Activities Carried Out Through Remote Sensing of Earth Resources", supra, n. 7. Relevant articles from the text of the Draft Agreement are included in the Appendix.

32 U.N. Gen. Ass. Res. 1721 (XVI) of 20 December 1961.

33 T.J. Gordon and S. Enzer, "Potential Institutional Arrangements of Organizations Involved in the Exploitation of Remotely Sensed Earth Resources Data", AIAA Paper No. 70-334, p. 2 (1970).

34 I.A. Vlasic and L.S. Lustgarten, International Law and Cooperation Relating to Remote Sensing of the Earth by Satellite: Prospects and Problems, [Special study prepared for the U.N. Secretariat] , p. 25 (March 1972).

35 S.H. Lay and H.J. Taubenfeld, The Law Relating to Activities of Man in Space, supra, n. 19, p. 97.

36 An interesting and authoritative account of the race to close the gap in space capability is found in P.J. Klass, Secret Sentries in Space, particularly Chapter 11, "The Telltale Satellite Photos", p. 100.

37 Y. Kolosov, "Some Urgent Problems of Space Law", International Affairs, [Moscow] , No. 9, p. 24 at 26 (September 1970).

38 T.J. Gordon and S. Enzer, "Potential Institutional Arrangements of Organizations Involved in the Exploitation of Remotely Sensed Earth Resources Data", supra, n. 33, at pp. 6-7.

39 Examples are: United States, Treaties and Other International Acts Series, (TIAS) 5783 Agreement with Mexico, Space Research Programs (February 1965); 6170 Agreement with Japan, Geodetic Satellite Observation Station (September 1966); 6810 Agreement with Italy, Cooperative Satellite Research Project (September 1969); 6897 Agreement with Australia, Space Research Programs (May 1970); 7131 Agreement with Canada, Communication Technology Satellite (April 1971). A listing of U.S. bilateral space arrangements is included in the Chapter:"International Organizations and Space Activities", in S.H. Lay and H.J. Taubenfeld, The Law Relating to Activities of Man in Space, Appendix D, p. 214 at 233 (1970).

40 An important example of progress in bilateral space agreements, although as yet unrelated to remote sensing activities, is the recent U.S.-Soviet agreement on a basic technical outline for a joint space mission. "Rendezvous in Space Set For '75", The Montreal Star, p. A-2, col. 1 (July 18, 1972). In September 1971, a joint U.S.-U.S.S.R. Editorial Board met pursuant to the NASA-Soviet Academy agreement of October 8, 1965 for the preparation and publication of a joint review of space biology and medecine. Aeronautics and Space Report of the President, 1971 Activities, supra, n. 13, at p. 41.

41 TIAS 6613 Agreement Between United States and Mexico (December 20, 1968); TIAS 6569 Agreement Between United States and Brazil (September 10, 1968).

42 TIAS 7125 Agreement Between United States and Canada (May 14, 1971).

43 "Canada Joins U.S. Monitoring Plan, Satellite Will Eye Effects of James Bay Development", The Montreal Star, p. A-14, col. 1 (July 12, 1972). The program of Canadian participation in the Skylab mission was outlined by Dr. L. Morley, Director of the Canada Center for Remote Sensing, in an interview reported in The Montreal Star, p. 15 (March 1, 1972).

44 Ibid.

45 I.A. Vlasic and L.S. Lustgarten, International Law and Cooperation Relating to Remote Sensing of the Earth by Satellite: Prospects and Problems, supra, n. 34, at p. 65.

46 COPUOS, U.N. Doc. No. A/AC.105/PV 98 - 106, p. 5 (10 November 1971).

47 The Identification of Interests and Needs of Developing Countries, Note by the Secretariat, Study prepared by Professor I.A. Vlasic, U.N. Doc. No. OSAG/Background Paper 12, p. 6 (15 April 1968).

48 A.A. Ambrosini, "The Meaning of the Romantic Enunciations of Article 1(1) of the Space Treaty of January 1967", Further Outlook on Space, No. 11, p. 6 (July 1970).

49 The Identification of Interests and Needs of Developing Countries, supra, n. 47, at p. 33.

50 Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched Into Outer Space. Annex to U.N. Gen. Ass. Res. 2345 (XXII). Opened for signature April 22, 1968.

51 Other examples of international organizations active in the use and exploration of outer space, and existing outside the U.N. framework are Intersputnik, ELDO, ESRO and Interkosmos.

52 Quoted in "Space Resources: Endowment for Sharing", Astronautics & Aeronautics, p. 12 (November 1969).

53 R.F. Packard, "International Legal and Political Aspects of Earth Resources Surveying by Satellite", AIAA Paper No. 70-331, p. 4 (1970).

54 Ibid.

55 L. Jaffe and R.A. Summers, "The Earth Resources Survey Program Jells", supra, n. 22 at p. 35.

56 Id., at p. 40.

57 supra, n. 41.

58 supra, n. 42.

59 Ibid.

60 It has been reported that Soviet deep-space operations are considered to be secondary to near-earth activities. The most recent Five Year Plan, issued in February 1971, focused primary attention on spaceborne communications, meteorology, earth resources survey and geographical tasks. A major concern of the Soviet space program continues to be the establishment of a multi manned orbiting space station system, referred

to in a Russian radio broadcast of May 3, 1970 which said "The total of Soviet space programs is keyed to achieving an orbiting station". M.V. Keldysh, President of the U.S.S.R. Academy of Sciences, saw the orbiting stations as providing a means to solve "cardinal issues of physics, geophysics and astrophysics and promote the most rational use of the wealth of the earth and advance geology, meteorology, agriculture, forestry, fishing and oceanology to new heights...". F. Kohler and D. Harvey, "The Soviet Space Effort -- An Analysis", Air Force & Space Digest, p. 54 (June 1971).

61 COPUOS, U.N. Doc. No. A/AC.105/PV.87, p. 79 (3 September 1970).

62 COPUOS, Scientific and Technical Sub-Committee, U.N. Doc. No. A/AC.105/C.1/SR.66, p. 32 (16 April 1970).

63 COPUOS, Scientific and Technical Sub-Committee, U.N. Doc. No.A/AC.105/C.1/SR.70, p. 72 (20 April 1970).

64 A.A. Blagonravov, "Space Platforms: Why They Should Be Built", Space World, Vol. H-8-92, p. 34 (August 1971). A clearly positive view, based on the results of the Salyut program is B. Rodionov, "Earth Explored From Space", Space World, Vol. I-3-99, p. 16 (March 1972).

65 Y. Kolosov, "Some Urgent Problems of Space Law", supra, n. 37, at p. 26.

66 Quoted in J.J. Harford, "I A F Turns 21, Gets U.N. Credentials", Astronautics and Aeronautics, p. 58 (November 1971).

67 COPUOS, U.N. Doc. No. A/AC.105/PV 98 - 106, p. 57 (10 November 1971).

68 Id., at p. 62.

69 COPUOS, Scientific and Technical Sub-Committee, U.N. Doc. No. A/AC.105/C.1/SR.74, p. 96, (22 April 1972). Emphasis added.

70 The Montreal Star, p. A-4, col. 3 (July 6, 1972), "Boeing Gets Okay for Sale to China". The question of China's participation in space activities as a non-signatory of the Space Treaty is raised by C. Horsford in "Chinese Satellite Poses Legal Problems", Further Outlook on Space, No. 11, p. 7 (July 1970).

71 COPUOS, U.N. Doc. No. A/AC.105/PV.61, p.271 (8 September 1969)

72 COPUOS, U.N. Doc. No. A/AC.105/PV.87, p. 72 (3 September 1970).

73 COPUOS, U.N. Doc. No. A/AC.105/PV.88, p. 101 (3 September 1970).

74 COPUOS, U.N. Doc. No. A/AC.105/PV.89, p. 128 (4 September 1970).

75 Hon. J.J. Greene, "Implications of Remote Sensing", Canadian Aeronatuics and Space Journal, p. 169 at 170 (May 1971).

76 The Montreal Star, p. 15 (March 1, 1972).

77 Fortier, Harrison, Gamble and Morley, "The Value of Satellite Techniques in the Evaluation of Natural Resources of Large Areas", Space Exploration and Applications, supra, n. 26, Vol. 1, p. 669 at 672

78 COPUOS, Scientific and Technical Sub-Committee, U.N. Doc. No. A/AC.105/C.1/SR.66, p. 36 (16 April 1970).

79 Id., at p. 43.

80 Ibid.

81 Ibid.

82 Id., at p. 44.

83 COPUOS, Scientific and Technical Sub-Committee, U.N. Doc. No. A/AC.105/C.1/SR.70, p. 68 (20 April 1970).

84 Id., at p. 72.

85 Id., at p. 73.

86 Ibid.

87 Id., at p. 75.

88 Id., at p. 76.

89 Id., at p. 71.

90 Views and Comments of Member States on Remote Sensing of the Earth by Satellites, COPUOS, Working Group on Remote Sensing of the Earth by Satellites, U.N. Doc. No. A/AC.105/C.1/WG.4/CRP.2 (5 April 1972) and Add.1 (25 April 1972).

91 Id., at p. 5.

92 Id., at p. 10.

93 Id., at p. 17.

94 Id., at pp. 19 - 21.

95 Examples of this activity are found in the documents cited supra, n. 4.

97 E. Galloway, "The Role of the United Nations in Earth Resources Satellites", a paper presented at the Regional Meeting of ASIL, Santa Clara, California, February 4-5, 1972, p. 8 (mimeo.). See also the statement by J.A. Beesley, Canadian Representative to the First Committee of the U.N. General Assembly, December 10, 1970, Canadian Delegation to the U.N. Press Release No. 55, pp. 4 - 6,(December 10, 1970).

98 I.A. Vlasic and L.S. Lustgarten, International Law and Cooperation Relating to Remote Sensing of the Earth by Satellite: Prospects and Problems, supra, n. 34, at p. 33.

99 Id., at p. 72.

100 T.J. Gordon and S. Enzer, "Potential Institutional Arrangements of Organizations Involved in the Exploitation of Remotely Sensed Earth Resources Data", supra, n.33, at p. 7.

101 I.A. Vlasic and L.S. Lustgarten, International Law and Cooperation Relating to Remote Sensing of the Earth by Satellite: Prospects and Problems, supra, at p. 74.

102 The life of an earth resources satellite is currently considered to be about one year. It should be noted, however, that the use of remote sensing for resource surveys from space is still an experimental technology, and with the advent of an operational system, this limited span may increase as a result of modifications in satellite characteristics, altitude and orbital patterns. T.A. George, "ERTS A and B -- The

Engineering System", supra, n. 26, at p. 46. The same author also states, at p. 51, "... it is safe to say that the next generation of Earth-resources-survey spacecraft will introduce substantial refinements over the present design performance". L. Jaffe and R.A. Summers note that "ERTS was designed to transmit its data to Earth via telemetry with an operational life of at least a year, rather than as a film-return satellite with a limited data capacity and lifetime.". "The Earth Resources Survey Program Jells", supra, n. 22, at p. 31. The report of the launching of ERTS-A confirms this lifetime estimate. The Montreal Star, p. A-11, col. 1 (July 24, 1972).

103 R.F. Packard, "International Legal and Political Aspects of Earth Resource Surveying by Satellite", AIAA Paper No. 70-331, p. 4 (1970).

104 R.F. Packard, "Why International Cooperation in Space", Astronautics and Aeronautics, p. 17 at 18 (December 1970).

105 S.H. Lay and H.J. Taubenfeld, The Law Relating to Activities of Man in Space, p. 215 (1970).

106 U.N. Doc. No. A/4141 (25 June 1959).

107 U.N. Gen. Ass. Res. 2600 (XXIV) of 16 December 1969). The text of this resolution is included in the Appendix.

108 U.N. Gen. Ass. Res. 2733 C (XXV) of 16 December 1970). The text of this resolution is included in the Appendix.

109 Examples of this activity are found in the documents cited supra, n. 4.

110 Space Exploration and Applications, United Nations Conference on the Exploration and Peaceful Uses of Outer Space, Vienna, August 1968. UN Publication No. E/69.I.16, A/CONF.34/2, Vols. I and II.

111 Development and Coordination of the Organizations Within the United Nations Family, Thirty-Fifth Report of the Administrative Committee on Coordination, Economic and Social Council, U.N. Doc. No. E/4668/Add.1, p. 31.

112 French Experience and Development Plans Concerning the Use of Remote Sensing. Application to the Needs of Developing Countries. Operational Status Planning. The Need for United Nations Support., Note by the Secretariat, COPUOS, Working Group on Remote Sensing of the Earth by Satellites, U.N. Doc. No. A/AC.105/C.1/WG.4/CRP.3 (12 April 1972). The comments referred to are those of experts and it is stated that they do not necessarily reflect the views of CNES.

113 Id., at pp. 45 - 46.

114 Views and Comments of United Nations Bodies, Specialized Agencies and other Relevant International Organizations on Remote Sensing of the Earth by Satellite, Note by the Secretariat, COPUOS, Working Group on Remote Sensing of the Earth by Satellites, U.N. Doc. No. A/AC.105/C.1/WG.4/CRP.1, p. 30 (24 March 1972).

115 S.H. Lay and H.J. Taubenfeld, The Law Relating to Activities of Man in Space, p. 238 (1970).

116 Development and Coordination of the Activities of the Organizations Within the United Nations Family, Thirty-Fifth Report of the Administrative Committee on Coordination, Economic and Social Council, U.N. Doc. No. E/4668, p. 4 (14 May 1969).

117 Development of Natural Resources, Natural Resource Satellites, Report of the Secretary General, Economic and Social Council, U.N. Doc. No. E/4779, pp.31 -32 (4 February 1970).

118 COPUOS, U.N. Doc. No. A/AC.105/PV.85, p. 19 (1 September 1970). The two ECOSOC bodies referred to are the Committee on Natural Resources and The Advisory Committee on Science and Technology for Development.

119 Ibid.

120 supra, n. 4.

121 An Outline of a Proposed Programme for Dissemination of Information on Practical Applications of Space Technology in the Developing Countries, Note by the Secretariat, COPUOS, Scientific and Technical Sub-Committee, U.N. Doc. No. A/AC.105/C.1/CRP.3, pp. 1 and 4 (2 April 1970). Study prepared by A. Horn.

122 Model of Plans for a Developing Country to Establish Participation in an Operational Earth Resources Satellite System Within the Decade, Note by the Secretariat, Report prepared by Dr. J. Meitner, COPUOS, Scientific and Technical Sub-Committee, U.N. Doc. No. A/AC.105/C.1/CRP.2, p. 4, (23 March 1970). The structure of ELDO is described in detail, including a chart outlining the line and staff functions in The Report to the Council of Europe, (CECLES-ELDO, 1965). For a summary review of existing operating international space organizations, including Intelsat, Intersputnik, ESRO and ELDO see I.A. Vlasic and L.S. Lustgarten International Law and Cooperation Relating to Remote Sensing of the Earth by Satellite: Prospects and Problems, supra, n. 34 at pp. 74-88. Additional information as to the activities of Intercosmos may be found in V. Vereshchetin, "Intercosmos: Results and Prospects", Space World, Vol. I-1-97, p. 38 (January 1972).

123 The original members of the United Nations are states which participated in the United Nations Conference on International Organization at San Francisco, or, having previously signed the Declaration by United Nations of January 1, 1942, also sign and ratify the U.N. Charter. (Charter of the United Nations, Article 3). U.N. membership is further open "to all other peace-loving states which accept the obligations contained in the present Charter and, in the judgment of the Organization, are able and willing to carry out these obligations." (Article 4). U.N. General Assembly Resolution 2654 (XXV) of 4 December 1970 sets out the scale of assessments for members for the financial years 1971, 1972 and 1973. This Resolution lists the names of 126 Member States.

The Agreement Relating to the International Telecommunications Satellite Organization "Intelsat", opened for signature August 20, 1971 (the inter-

governmental agreement), states in its Preamble that the parties to the agreement believe that "satellite telecommunications should be organized in such a way as to permit all peoples to have access to the global satellite system and those members of the International Telecommunications Union so wishing to invest in the system with consequent participation in...and ownership of the system". 10 International Legal Materials, p. 909 at 910. Thus membership in Intelsat is open only to members of ITU. In a recent article A.A. Matthey of ITU's International Frequency Registration Board (IFRB) stated "One hundred and thirty-nine countries, Members of the ITU, have signed or acceded to, the International Telecommunications Convention and...the Radio Regulations annexed thereto.". "International Frequency Management in Bands Between One and Ten Gigahertz Allocated With Equal Rights to Space and Terrestrial Services", Telecommunication Journal, Vol. 38, No. V, p. 380 at 381 (May 1971).

124 L. Jaffe and R.A. Summers of NASA wrote "All of the results [from the ERTS program] will be published in the open literature and all acquired data will be made available, thus ensuring that the benefits of this program are available to the world community.". "The Earth Resources Survey Program Jells", Astronautics & Aeronautics, p. 24 at 40 (April 1971).

125 I.A. Vlasic and L.S. Lustgarten, International Law and Cooperation Relating to Remote Sensing of the Earth by Satellite: Prospects and Problems, supra, n. 34, at p. 38.

126 Report of the United Nations Panel on Remote Sensing for Earth Resources Surveys, COPUOS, U.N. Doc. No. A/AC.105/92, p. 7 (26 May 1971).

127 Some of these will be found in the references cited supra, n. 122.

128 The eventual use of the geo-stationary orbit for earth observation is suggested in Development of Natural Resources, Natural Resource Satellites, supra, n. 117 at para. 72, p. 25; and also in L. Jaffe and R.A. Summers, "The Earth Resources Survey Program Jells", supra, n. 124, at p. 39.

129 Use of Remote Sensors in Earth-Orbital Space for the Discovery, Invemtory, Evaluation, Development and Conservation of Earth's Natural Resources,

Note by the Secretariat, Study prepared by Dr. P.A. Castruccio, U.N. Doc. No. OSAG/Background Paper 13, p. 19 (15 April 1968). Dr. Castruccio has also outlined an example of the Design Procedure for an Agricultural Survey Satellite in this study at p. 22, and for other resource areas at p. 60.

130 Use of Remote Sensors In Earth-Orbital Space for the Discovery, Inventory, Evaluation, Development and Conservation of Earth's Natural Resources, supra, n. 129, at pp. 123 - 132.

131 G. Alexander, "Two Emerging Problems of Space Law Concerning Remote Sensing Satellites", in M.Schwartz ed., Proceedings of the Twelfth Colloquim on the Law of Outer Space, October 1969, p. 258 at 261 (1970).

132 Report for the Subcommittee on NASA Oversight of the Committee on Science and Astronautics, U.S. House of Representatives, Ninetieth Congress, Second Session, Series W, p. 28, U.S. Government Printing Office (1968).

133 Professor I.A. Vlasic has written "...the evolution of a public order in space will continue to be in large measure affected by the developments in the arena of terrestrial politics. The experience of the past decade suggests that it would be unrealistic to expect any major or unique developments in the law of outer space which would not reflect and incorporate the trends characteristic of power politics on the earth.". "The Relevance of International Law to Emerging Trends in the Law of Outer Space", in Falk and Black, ed., The Future of the International Legal Order, Vol II, p. 265 (1971).

134 C. Horsford, "Space Law: The First Ten Years", Further Outlook on Space, No. 7, p. 10 (August 1968).

135 S.D. Estep, "Legal and Social Policy Ramifications of Remote Sensing Techniques" in Proceedings of the 5th Symposium on Remote Sensing of the Environment, p. 197 (1968).

136 COPUOS, U.N. Doc. No. A/AC.105/PV 98-106, pp. 62 (USSR), 79 (France), 226 (Mexico) (10 November 1971).

137 A recent conference in Buenos Aires noted in its conclusions on the subject of remote sensing the importance of this activity to the international community, but that information obtained in this way, without the consent of the interested state constituted a violation of the sovereignty of that state over its natural resources. J. Barboza, "Los Satelites Equipados con Sensores Remotos y Los Recursos Naturales", in M.D. Schwartz, ed., Proceedings of the Thirteenth Colloquium on the Law of Outer Space, October 1970, p. 151 at 153 (1971).

138 Permanent Sovereignty Over Natural Resources, Report of the Secretary-General, U.N. Doc. No. A/8058, p. 7 (14 September 1970).

139 The attitude of states and of some legal authors is discussed in S.H. Lay and H.J. Taubenfeld, The Law Relating to Activities of Man In Space, p. 81 (1970).

140 This is clearly evident from the United Nations study which reviewed the current legislation of many countries. The Status of Permanent Sovereignty Over Natural Wealth and Resources: Study by the Secretariat, U.N. Doc. No. A/AC.97/5/Rev.2; E/3511; A/AC.97/13 (1962).

141 Article 1 of the Chicago Convention declares "the complete and exclusive sovereignty" of states in the airspace over their territory. Article 2 of the Convention on the Territorial Sea and the Contiguous Zone provides that "the sovereignty of a coastal state extends to the air space over the territorial sea."

142 A background paper prepared by the U.N. Secretariat outlines the need for a solution to this question as well as the criteria which may be applied and the various alternatives which are available. The opinions expressed by states, U.N. Specialized Agencies and other international organizations are also included. U.N. COPUOS, Legal Sub-Committee, The Question of the Definition and/or the Delimitation of Outer Space, U.N. Doc. No. A/AC.105/C.2/7 (7 May 1970).

143 L.P. Bloomfield, "The Quest for Law and Order", in L.P. Bloomfield, ed., Outer Space: Prospects for Man and Society, p. 114 at 119 (1968 rev. ed.). For discussion in COPUOS as to the importance of this question, see U.N. Doc. No. A/AC.105/PV 101, pp. 150 - 166 (September 1971).

144 A. Meyer, "Legal Problems of Outer Space", in Space Exploration and Applications, supra, n. 110, Vol. II, p. 1034 at 1035.

145 Dr. O. Brital has analyzed the Space Treaty to determine whether satellite surveys are prohibited by its terms. He finds they are permitted under the provisions of Article I, but only subject to being conducted in conformity with the conditions set out in the other Articles of the Treaty. "Survey From Space of Earth Resources" in M.D. Schwartz, ed., Proceedings of the Thirteenth Colloquium on the Law of Outer Space, October 1970, p. 197 at 198 (1971).

146 L.C. Meeker, "Observation in Space", in M. Cohen, ed., Law and Politics in Space, p. 75 at 76 (1964).

147 Id., at p. 77.

148 M. McDougal, H. Lasswell and I.A. Vlasic, Law and Public Order in Space, p. 540 (1963).

149 "...espionage of itself does not appear to constitute a violation of international law...There is no apparent reason why reconnaissance and espionage activities should not be given similar legal treatment. It would seem that reconnaissance should be held violative of international law only if its means involve an independent breach thereof." "Legal Aspects of Reconnaissance in Airspace and Outer Space", 61 Columbia Law Review, p. 1074 (June 1961).

Professor Estep comments that "there is no significant body of international law dealing with the problem of spying" and that as long as nations are afraid to admit publicly that spying is carried on, and since "there are no international cases of one nation suing another...nor are there treaties about the way in which the 'high contracting parties' shall handle spies...developing the principles to govern nations in such cases is very difficult." "Legal and Social Policy Ramifications of Remote Sensing Techniques", supra, n. 135, at p. 200.

See also referenced cited under "Selected Bibliography" under the head "Observation in Space", in M. Cohen, ed., Law and Politics in Space, pp. 202 - 203 (1964).

The refusal of U.S. government officials to comment on reports of espionage activities is illustrated by the reaction to a recent magazine article. "The Western White House in San Clemente, Calif., the defence department in Washington and a spokesman for the National Security Agency at Fort Meade, Md., would not respond to the article entitled"U.S. Espionage: A Memoir" ". "Lid Blown Off Espionage System. Canada Bilked on Spies Pact?", The Montreal Star, p. C-8, col. 1 (July 17, 1972).

150 C.S. Sheldon II, "Peaceful Applications", in L.P. Bloomfield, ed., Outer Space: Prospects for Man and Society, p. 37 at 63 (1968 rev. ed.).

151 T.J. Gordon and S. Enzer, "Potential Institutional Arrangements of Organizations Involved in the Exploitation of Remotely Sensed Earth Resources Data", AIAA Paper No. 70-334, p. 2 (1970).

152 E. Brooks, "New Developments in Earth Satellite Law", 65 Northwestern University Law Review, p. 759 at 773 (1970-71).

153 U.N. Doc. No. A/AC.105/C.2/7 (7 May 1970).

154 Id., at p. 9.

155 S.H. Lay and H.J. Taubenfeld, The Law Relating to Activities of Man in Space, p. 30 (1970).

156 Id., at p. 31.

157 Id., at p. 143.

158 C.W. Jenks, Space Law, p. 266 (1965).

159 I.A. Vlasic, "The Relevance of International Law to Emerging Trends in the Law of Outer Space", supra, n. 133, at p. 294.

160 The probable claims and counterclaims likely to be made by states and arising from the use of earth resources satellite technology is discussed in I.A. Vlasic and L.S. Lustgarten, International Law and Cooperation Relating to Remote Sensing of the Earth by Satellite: Prospects and Problems, [Special Study prepared for the U.N. Secretariat], pp. 23 - 47 (March 1972).

161 U.N. Doc. No. A/AC.105/C.2/L.1, (6 June 1962).

162 Y. Kolosov, "Some Urgent Problems of Space Law", International Affairs, [Moscow],No. 9, p. 24 at 26 (September 1970).

163 Id., at p. 27.

164 U.N. Gen. Ass. Res. 1803 (XVII) of 14 December 1962.

165 A comprehensive review of this problem in definition is presented in S.H. Lay and H.J. Taubenfeld, The Law Relating to Activities of Man in Space, p. 97 (1970).

166 However, see the comment supra, at n. 137.

167 S.D. Estep, "Legal and Social Policy Ramifications of Remote Sensing Techniques", supra, n. 135, at p. 208.

168 The Chairman of the Legal Sub-Committee of COPUOS has said that outer space must remain res communis omnium and that the benefits of its exploration must be shared by all. U.N. Doc. No. A/8420, p. 22 (1 September 1971). See also the discussion on "Space as Res Communis" in S.H. Lay and H.J. Taubenfeld, The Law Relating to Activities of Man in Space, p. 52 (1970).

169 The text of relevant articles from this Draft Agreement is included in the Appendix.

170 For a discussion of this potential claim see I.A. Vlasic and L.S. Lustgarten, International Law and Cooperation Relating to Remote Sensing of the Earth by Satellite: Prospects and Problems, supra, n. 160, at p. 45.

171 The questions of registration, nationality and identification of spacecraft have been discussed by a number of authors. See, for example, S.H. Lay and H.J. Taubenfeld, The Law Relating to Activities of Man in Space, pp. 87 and 90 (1970); E. Brooks, New Developments in Earth Satellite Law", supra, n. 152, at p. 766; I.A.Vlasic and L.S. Lustgarten, supra, n. 160, at p. 92.

172 U.N. Gen. Ass. Res. 2222 (XXI) of 19 December 1966.

173 S.H. Lay and H.J. Taubenfeld, The Law Relating to Activities of Man in Space, p. 188 (1970). This issue was also raised by Taubenfeld in "Legal

Aspects of the Use of Satellites in Discovering and Exploiting Earth Resources", AIAA Paper No. 68-921, p. 3 (1968), reaching the identical conclusion.

174 Adopted by the U.N. General Assembly as Resolution 1962 (XVIII) of 13 December 1963).

175 U.N. Doc. No. A/C.1/SR 1491 (16 December 1966).

176 Convention on International Liability for Damage Caused by Space Objects, U.N. Gen. Ass. Res. 2777 (XXVI) of 19 November 1971, Annex.

177 J.M. Denoyer has pointed out "Remote sensing includes both active and passive systems. Active remote sensing systems are self-illuminating and use energy reflected from the object. Passive systems measure energy reflected from an object that originated from a natural source or emitted energy from the object." "Satellites for observation of the Earth", Telecommunication Journal, Vol. 38, No. V, p. 369 at 370 (May 1971). See also the discussion in Chapter I, and the references cited supra, at n. 26.

178 C.W. Jenks, Space Law, p. 290 (1965).

179 Recent comments by the I T U relating to earth exploration by satellite are found in Views and Comments of United Nations Bodies, Specialized Agencies and Other Relevant International Organizations on Remote Sensing of the Earth by Satellites, supra, n. 114, at p. 14.

180 L. Trara and G.F. Block, "General Problems in Space Radio Communications", Telecommunication Journal, Vol. 38, No. V, p. 248 at 254 (May 1971).

181 I. Ranzi, "Telecommunications in the Space Research System", Telecommunication Journal, Vol. 38, No. V, p. 261 at 262 (May 1971).

182 Id., at p. 268.

183 A.A. Matthey, "International Frequency Management in Bands Between One and Ten Gigahertz Allocated With Equal Rights to Space and Terrestrial Services", Telecommunication Journal, Vol. 38, No. V, p. 380 at 381 (May 1971).

184 Ibid.

185 E. Pépin, "General Legal Problems in Space Telecommunications", Telecommunication Journal, Vol. 38, No. V, p. 386 at 387 (May 1971).

186 Id., at p. 388.

187 "Address by M. Mili (Secretary-General of ITU) at the 51st Session of the ECOSOC", Vol 38, p. 608 at 609 (September 1971). Telecommunication Journal.

188 "Summary Record by the International Frequence Registration Board", Telecommunication Journal, Vol. 38, p. 677 (October 1971).

189 Ibid .

190 L. Jaffe and R.A. Summers, "The Earth Resources Survey Program Jells", supra, n. 124, at p. 30.

191 Id., at p. 39.

192 "Summary Record by the International Frequency Registration Board", supra, n. 188, at p. 680.

193 L. Trara and G.F. Block, "General Problems in Space Radio Communications", supra, n. 180, at p. 260.

194 J.K.S. Jowett, "Some Technical Problems Associated With the Use of the Geostationary Satellite Orbit", Telecommunication Journal, Vol. 38, No. V, p. 301 (May 1971).

195 Id., at p. 302.

196 Id., at p. 305.

197 E. Pépin, "General Legal Problems in Space Telecommunications", supra, n. 185, at p. 387.

198 Id., at p. 388.

199 E.Brooks, "New Developments in Earth Satellite Law", supra, n. 152, at p. 766.

200 E. Pépin, "General Legal Problems in Space Tele-Communications", supra, n. 185, at p. 387.

201 For a discussion on the management of valuable orbit positions see I.A. Vlasic and L.S. Lustgarten, International Law and Cooperation Relating to Remote Sensing of the Earth by Satellite: Prospects and Problems, supra, n. 160, at p. 97.

202 This figure includes defunct satellites and space debris.

203 C. Masouyé, "The Protection of Signals Carrying Radio and Television Programs Transmitted by Communications Satellites", Telecommunication Journal, Vol. 38, No. V, p. 389 at 392 (May 1971).

204 Ibid.

205 Ibid.

206 R.F. Packard, "Why International Cooperation in Space?", Astronautics & Aeronautics, p. 17, (December 1970).

207 J.J. Harford, "I A F Turns 21, Gets U.N. Credentials", Astronautics & Aeronautics, p. 58 at59 (November 1971).

208 M. McDougal, H. Lasswell and I.A. Vlasic, Law and Public Order in Space, p. 540 (1963).

209 Id., at p. 541.

210 Ibid.

211 R.F. Packard, "International Legal and Political Aspects of Earth Resources Surveying by Satellite", AIAA Paper No. 70-331, p. 2 (1970). A potentially related claim is suggested by H.J. Taubenfeld "...satellites will also inevitably penetrate and lessen the value of one resource prized by most states, though in different degrees, that of secrecy within their own borders", "Legal Aspects of the Use of Satellites in Discovering and Exploiting Earth Resources", AIAA Paper No. 68-921, p. 1 (1968).

212 For a discussion of the remarks of Alvarez, J. in the 1951 Fisheries Case (ICJ) see L. Goldie, "Extra-Terrestrial Privileges, Immunities and

Exposures", 36 Southern California Law Review, p. 396 (1963). This question was also considered in the Trail Smelter Arbitration between Canada and the U.S., decided on 11 March 1941, U.S. Department of State Arbitration Series 8, pp. 36-7; the Corfu Channel Case (Merits), I C J Reports, pp. 4 and 22 (1949). In the Lotus Case the Court referred to the exercise of jurisdiction, however the concept might have application to "any" use of sovereign power extending beyond territorial limits. (P.C.I.J. Ser. A, No. 10, p. 18 (1929)).

213 For a discussion of the application of the concept of unjust enrichment in international law, see The Status of Permanent Sovereignty Over Natural Wealth and Resources: Study by the Secretariat, supra, n. 140, at pp. 95-6.

214 "United Nations Commends Outer Space Liability Convention", U.S. Department of State Bulletin, Vol. LXVI, No. 1698, p. 35 at 37 (January 10, 1972).

215 "Satellite Camera Set To Monitor Earth", The Montreal Star, p. A-11, col. 1 (July 24, 1972). A reproduction of this report is included in the Appendix.

216 "Satellite Photos 'Great'",The Gazette, p. 15, col. 4 (Montreal, July 27, 1972). A reproduction of this report is included in the Appendix. "Satellite Photos of Canada Described as 'Fantastic'", The Montreal Star, p. A-4, col. 3 (July 28, 1972).

217 J.N. Behrman, "The Multinational Enterprise: Its Initiatives and Government Reactions", The Journal of International Law and Economics, Vol. 6, No. 2 p. 215 at 223-4 (January 1972).

218 Quoted in U.S. Department of State Bulletin, p. 142 (July 26, 1965).

APPENDICES

APPENDIX A

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

The State 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 (II) 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 international 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 such 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

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 or 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 astonauts 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 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 State 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 State concerned. 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 States 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 in outer space, including the moon, and other celestial bodies, and each State Party from whose territory or facility an object is launched, is internation-

ally 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 thereforo, 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 the 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, 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 extraterrestial 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. A State Party to the Treaty which has reason to believe than an 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 request 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 inter-governmental organizations.

Any practical questions arising in connexion with activities carried on by international inter-governmental

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 organization 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 Depositary Governments.

3. This Treaty shall enter into force upon the deposit of instruments of ratification by five Governments including the Governments designated as Depositary 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 instruments of ratification or accession.

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

6. This Treaty shall be registered by the Depositary 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 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 Depositary 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 Depositary Governments. Duly certified copies of this Treaty shall be transmitted by the Depositary Governments to the Governments of the signatory and acceding States.

IN WITNESS WHEREOF the undersigned, duly authorized, have signed this Treaty.

*****

The text of the Space Treaty was approved by the United Nations General Assembly annexed to its Resolution 2222 (XXI), adopted 19 December 1966. The Treaty was signed 27 January 1967.

APPENDIX B

UNITED NATIONS GENERAL ASSEMBLY RESOLUTION

2600 (XXIV). International co-operation in the peaceful uses of outer space.

The General Assembly,

Recalling its resolution 2453 (XXIII) of 20 December 1968,

Bearing in mind the report of the Committee on the Peaceful Uses of Outer Space, especially the recommendations of the Scientific and Technical Sub-Committee at its sixth session with respect to the promotion of the applications of space technology,

Recalling Economic and Social Council resolution 1426 (XLVI) of 6 June 1969, in which the Council, inter alia, expressed its convictions that international co-operation through the United Nations should continue to play an important role in assisting the efforts of Governments in the fields of investigation and utilization of non-agricultural natural resources,

Aware of the urgent need for a more complete understanding of man's environment,

Recognizing that space technology may make a significant contribution to this understanding,

Expressing the desire that earth resources survey satellite programmes be available to produce information for the world community as a whole,

Wishing to encourage the study of earth resources survey programmes, including those related to remote-sensing techniques, and participation to the extent feasible and practicable in their development,

1. Invites Member States with experience in the field of remote earth resources surveying to make such experience available to other Member States which do not have such experience and encourage them to become familiar with this field;

2. Invites Member States to join in exploring the various aspects involved in the analysis of data obtained through earth resources surveying techniques, their dissemination and application, so as to maximise the benefits to be obtained therefrom,

taking into account the particular interests and needs of developing countries;

3. Invites the Secretary-General to bring the present resolution to the attention of all organizations within the United Nations system whose objectives or programmes might be furthered by this developing technology;

4. Requests the Committee on the Peaceful Uses of Outer Space to continue its studies with regard to the possibilities of further international co-operation, in particular in the framework of the United Nations system, in connection with the development and use of remote earth resources surveying techniques so as to assure that as the practical benefits of this new technology are achieved, they are made available to both developed and developing countries.

1836th plenary meeting,
16 December 1969.

APPENDIX C

UNITED NATIONS GENERAL ASSEMBLY RESOLUTION

2733C(XXV). International co-operation in the peaceful uses of outer space.

The General Assembly,

Recalling its resolutions 2600 (XXIV) and 2601 (XXIV) of 16 December 1969,

Having considered the report of the Committee on the Peaceful Uses of Outer Space,

Reaffirming the common interest of mankind in furthering the exploration and use of outer space for peaceful purposes,

Recognizing the importance of international co-operation in developing the rule of law in the exploration and peaceful uses of outer space,

Convinced of the need for increased efforts to promote applications of space technology for the benefit of all countries, particularly the developing countries,

Believing that the benefits of space exploration can be extended to States at all stages of economic and scientific development if Member States conduct their space programmes in a manner designed to promote the maximum international co-operation, including the widest possible exchange and practical application of information in this field,

1. Endorses the recommendations and decisions contained in the report of the Committee on the Peaceful Uses of Outer Space;

2. Requests the Committee on the Peaceful Uses of Outer Space to continue to study questions relative to the definition of outer space and the utilization of outer space and celestial bodies, including various implications of space communications, as well as those comments which may be brought to the attention of the Committee by specialized agencies and the International Atomic Energy Agency as a result of their examination of problems that have arisen or that may arise from the use of outer space in the fields within their competence;

3. Invites those States which have not yet become parties to 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 Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objets Launched into Outer Space to give consideration to ratifying or acceding to those agreements so that they may have the broadest possible effect;

4. Reaffirms its belief, as expressed in its resolution 1721 D (XVI) of 20 December 1961, that communication by means of satellites should be available to the nations of the world as soon as practicable on a global and non-discriminatory basis, and recommends that States parties to negotiations regarding international arrangements in the field of satellite communication should constantly bear this principle in mind so that its ultimate realization may be achieved;

5. Welcomes the intensified efforts of the Committee on the Peaceful Uses of Outer Space to encourage international programmes to promote such practical applications of space technology as earth resources surveying, for the benefit of both developed and developing countries, and commends to the attention of Member States, specialized agencies and interested United Nations bodies the new programmes and proposals to promote international benefits from space applications noted by the Committee in its report, such as the organization of technical panels, the utilization of internationally sponsored education and training opportunities in the practical applications of space technology and the conduct of experiments in the transfer of space-generated technology to non-space applications;

6. Takes note of the recommendation of the Scientific and Technical Sub-Committee of the Committee on the Peaceful Uses of Outer Space that the travel and subsistence of participants in the technical panels mentioned in paragraph 5 above should be funded by their own Governments, but that the United Nations may give timely assistance in exceptional cases within the existing programmes of the United Nations where this appears necessary both to defray costs and to stimulate interest in special areas;

7. Welcomes the efforts of Member States to share with other interested Member States the practical benefits which may be derived from their programmes in space technology, including earth resources surveying;

8. Requests the Scientific and Technical Sub-Committee, as authorized by the Committee on the Peaceful Uses of Outer Space, to determine at its next session whether, at what time and in what specific frame of reference to convene a working group on earth resources surveying, with special reference to satellites, and in so doing to take into account the importance of appropriate co-ordination with the Committee on Natural Resources, established under Economic and Social Council resolution 1535 (XLIX) of 27 July 1970;

9. Welcomes the efforts of Member States to keep the Committee on the Peaceful Uses of Outer Space fully informed of their activities and invites all Member States to do so;

10. Notes with appreciation the report of the Expert on Applications of Space Technology concerning the promotion of space applications.

11. Recalls the recommendation that Member States give consideration to designating specific offices or individuals, within their Governments, as a point of contact for communications regarding the promotion of the application of space technology and thereafter inform the Secretary-General of such designations, and urges those Member States which have not yet designated a point of contact to do so;

12. Takes note of the report provided by the Secretary-General to the Committee on the Peaceful Uses of Outer Space concerning improved co-ordination of Secretariat activities in the field of outer space.

13. Endorses the suggestion of the Scientific and Technical Sub-Committee that the Secretary-General should bring to the attention of Member States all relevant documents relating to applications of space technology submitted to the Sub-Committee by Member States, the United Nations, the specialized agencies and other bodies;

14. Approves the continuing sponsorship by the United Nations of the Thumba Equatorial Rocket Launching Station and the CELPA Mar del Plata Station and recommends that Member States should give consideration to the use of these facilities for appropriate space research activities;

15. Notes that, in accordance with General Assembly resolution 1721 B (XVI) of 20 December 1961, the Secretary-General continues to maintain a public registry of objects launched into orbit or beyond on the basis of information furnished by Member States;

16. Endorses the recommendation of the Committee on the Peaceful Uses of Outer Space that the Secretary-General be requested to issue an index of existing international instruments - conventions, treaties and agreements - relating to or bearing upon broadcasting satellite services;

17. Requests the specialized agencies and the International Atomic Energy Agency to furnish the Committee on the Peaceful Uses of Outer Space with progress reports on their work in the field of the peaceful uses of outer space, and to examine and report to the Committee on the particular problems which arise or may arise from the use of outer space in the fields within their competence and which should in their opinion be brought to the attention of the Committee;

18. Requests the Committee on the Peaceful Uses of Outer Space to continue its work as set out in the present resolution and in previous resolutions of the General Assembly, and to report to the Assembly at its twenty-sixth session.

1932nd plenary meeting,
16 December 1970.

APPENDIX D

UNITED NATIONS GENERAL ASSEMBLY RESOLUTION

2778 (XXVI). Convening of the Working Group on Remote Sensing of the Earth by Satellites

The General Assembly,

Recalling its resolution 2733 C (XXV) of 16 December 1970 in which it requested the Scientific and Technical Sub-Committee of the Committee on the Peaceful Uses of Outer Space, as authorized by the Committee, to determine at what time and in what specific frame of reference a working group on earth resources surveying, with special reference to satellites, should be convened,

Welcoming the decision of the Sub-Committee at its eighth session to establish and convene a Working Group on Remote Sensing of the Earth by Satellites,

Sharing the view expressed by the Committee on the Peaceful Uses of Outer Space in the report on its fourteenth session that the potential benefits from technological developments in remote sensing of the earth from space platforms could be extremely meaningful for the economic development of all countries, especially the developing countries, and for the preservation of the global environment,

Noting that the Working Group on Remote Sensing of the Earth by Satellites had a first organizational meeting in connexion with the fourteenth session of the Committee on the Peaceful Uses of Outer Space,

Looking forward to the early initiation of the substantive work of the Working Group, keeping in mind that experiments to test the feasibility of remote sensing of the earth from space platforms are scheduled to begin early in 1972,

Expressing confidence that in discharging its responsibility the Working Group would seek to promote the optimum utilization of this space application for the benefit of individual States and of the international community,

1. Requests Member States to submit information on their national and co-operative activities in this field, as well as comments and working papers, through the Secretary-General to the Working Group on Remote Sensing of the Earth by Satellites;

2. Endorses the request of the Scientific and Technical Sub-Committee that the Working Group solicit the views of appropriate United Nations bodies and specialized agencies, and other relevant international organizations;

3. Requests the Secretary-General to provide the Working Group with his comments on this subject and to submit working papers on matters falling within the terms of reference of the Group;

4. Requests the Committee on the Peaceful Uses of Outer Space and its Scientific and Technical Sub-Committee to bring about the early initiation of the Working Group's substantive work and to keep the General Assembly informed in a comprehensive fashion on the progress of its work.

1998th plenary meeting,
29 November 1971.

APPENDIX E
(Selected Articles from)

ARGENTINA: DRAFT INTERNATIONAL AGREEMENT ON ACTIVITIES CARRIED OUT THROUGH REMOTE-SENSING SATELLITE SURVEYS OF EARTH RESOURCES (A/AC.105/C.2/L.73)*

The State Parties to the present Agreement:

Considering that there is an urgent need for overall surveys of earth resources by means of remote sensors installed in satellites and that the expected benefits will only be obtained through a general international convention and agreements on collaboration,

Further considering that the principal economic assets of any country are human and natural resources, provided that these are identified and used,

Convinced that the promise of such benefits raises legal problems which must be solved without delay,

Reaffirming that these new techniques will act as an effective stimulus to economic and social development, and materially 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 co-operation,

Bearing in mind United Nations General Assembly resolution 2600 (XXIV) of 16 December 1969, which is concerned, in particular, with the techniques of remote earth resources surveying, and requests greater international co-operation with a view to reaping practical benefits from the new technology,

Believing that the rights of the States to which the resources belong should be established at the international level in relation to collective consumption requirements,

Recalling United Nations General Assembly resolutions 18803 (XVII) of 14 December 1962 and 2158 (XXI) of 25 November 1966 on permanent sovereignty over natural resources,

Bearing in mind United Nations General Assembly resolution 11314 (XIII) of 12 December 1958, which declares that the permanent sovereignty of peoples and nations over their natural wealth and resources is a basic constituent of the right to self-determination,

* Submitted 26 June 1970. Reproduced from the text published in UN Doc. A/AC.105/85, Annex II, p. 2.

Inspired by the Treaty on the Principles Governing the Activities of States in the Exploration and Use of Outer Space including the Moon and Other Celestial Bodies, of 27 January 1967,

Have agreed on the following:

Article 1

The techniques of remote-sensing satellite inventory and study of earth resources shall be used in close international co-operation for the benefit of all mankind.

Article 2

Until such time as some other appropriate body is available, the United Nations Secretariat shall be responsible for the functions of planning, consultation, information, inventorying and co-ordination of such activities in the initial stage to meet immediate needs, with a view of internationalizing overall surveys of resources,

Article 3

A data bank shall be established for that purpose, to which all States shall have access. When appropriate, the data bank shall disseminate on a worldwide basis the findings and practical results in respect of the use of such techniques to inventory and survey earth resources, with special reference to the interests and needs of the developing countries.

Article 4

The programmes for worldwide remote sensing will prevent the exploitation of natural resources from causing the spoliation or destruction of the environment, and will make for the preservation of a satisfactory balance through the increase of renewable resources in those areas which are best able to help maintain it.

Article 5

Until remote-sensing satellite surveys of earth resources have been placed on an international footing, the activities of the States which undertake such surveys must be based on the principle of equality between States and of the honourable fulfilment of international commitments, as well as the other principles of international law regarding friendly relations and co-operation between States.

Article 6

Surveys of natural resources and their findings with respect to the sea beyond State jurisdiction or of the ocean floor and subsoil beyond the limits of national jurisdiction shall be transmitted to the data bank. If the surveys involve the national territory and jurisdictional waters of one or more States, the facts and findings shall be promptly communicated to the State or States concerned and transmitted to the data bank.

Article 7

The principle of equality of rights and the self-determination of peoples embraces not only the right to internal sovereignty and independence, but also the economic aspect of the freedom to use and distribute their wealth, whereby the peoples may exercise their legitimate and exclusive rights over their natural resources. By virtue of this principle, the States shall exchange information among themselves on the discovery of new areas or of improved methods of exploiting natural resources, and shall transmit such information to the data bank.

Article 8

The exploitation of the natural resources of each State in its territory and in its jurisdictional waters shall be governed by national laws and regulations. Efforts shall be made by means of international agreements to improve the distribution of the resources and to plan concerted action to meet collective consumption requirements, with respect to the basic elements for subsistence essential raw materials and natural processes the knowledge of which, would raise mankind's level of living. (The final articles follow.)

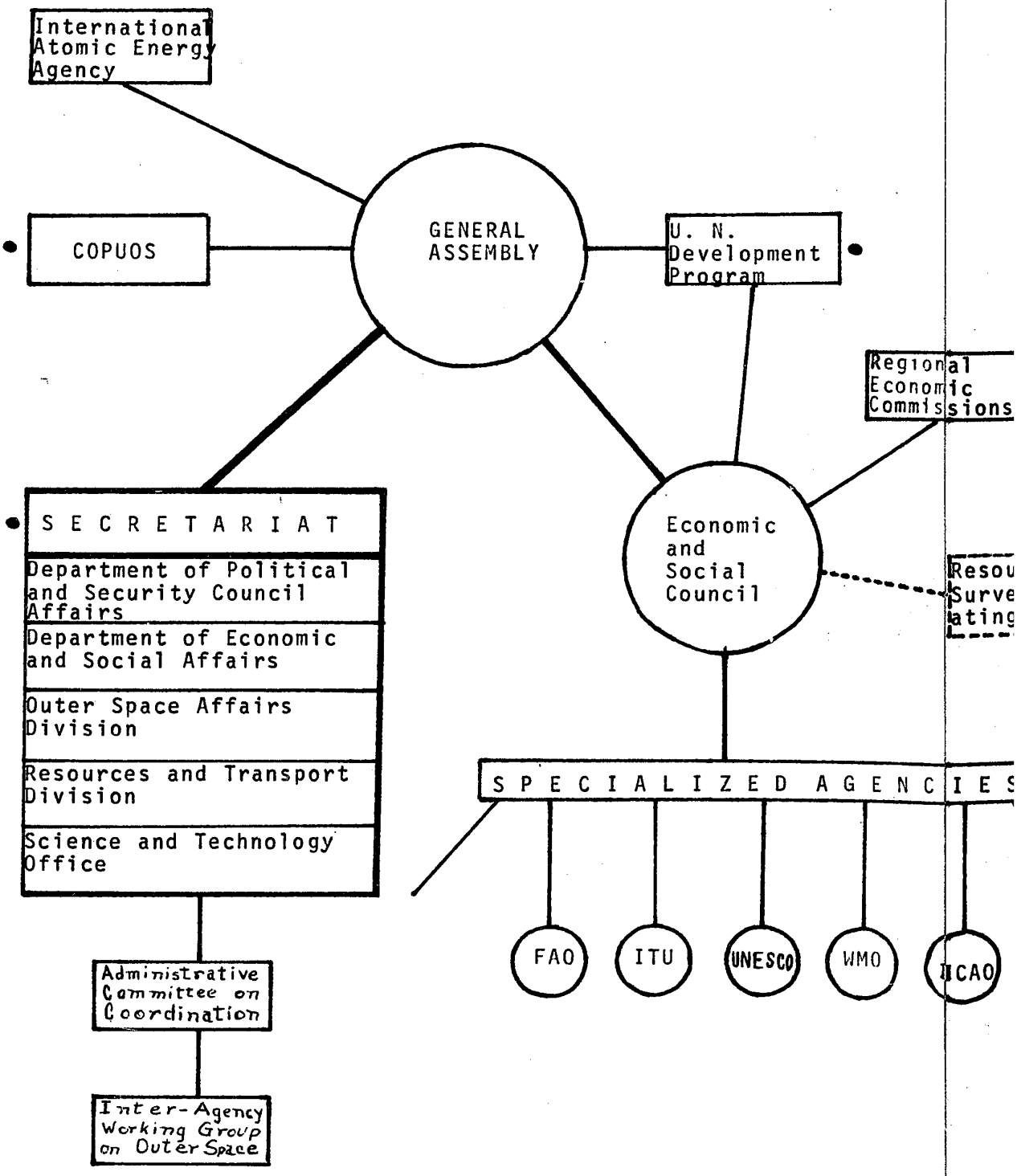
APPENDIX F

Schematic Representation of the
Organizational Structure for an

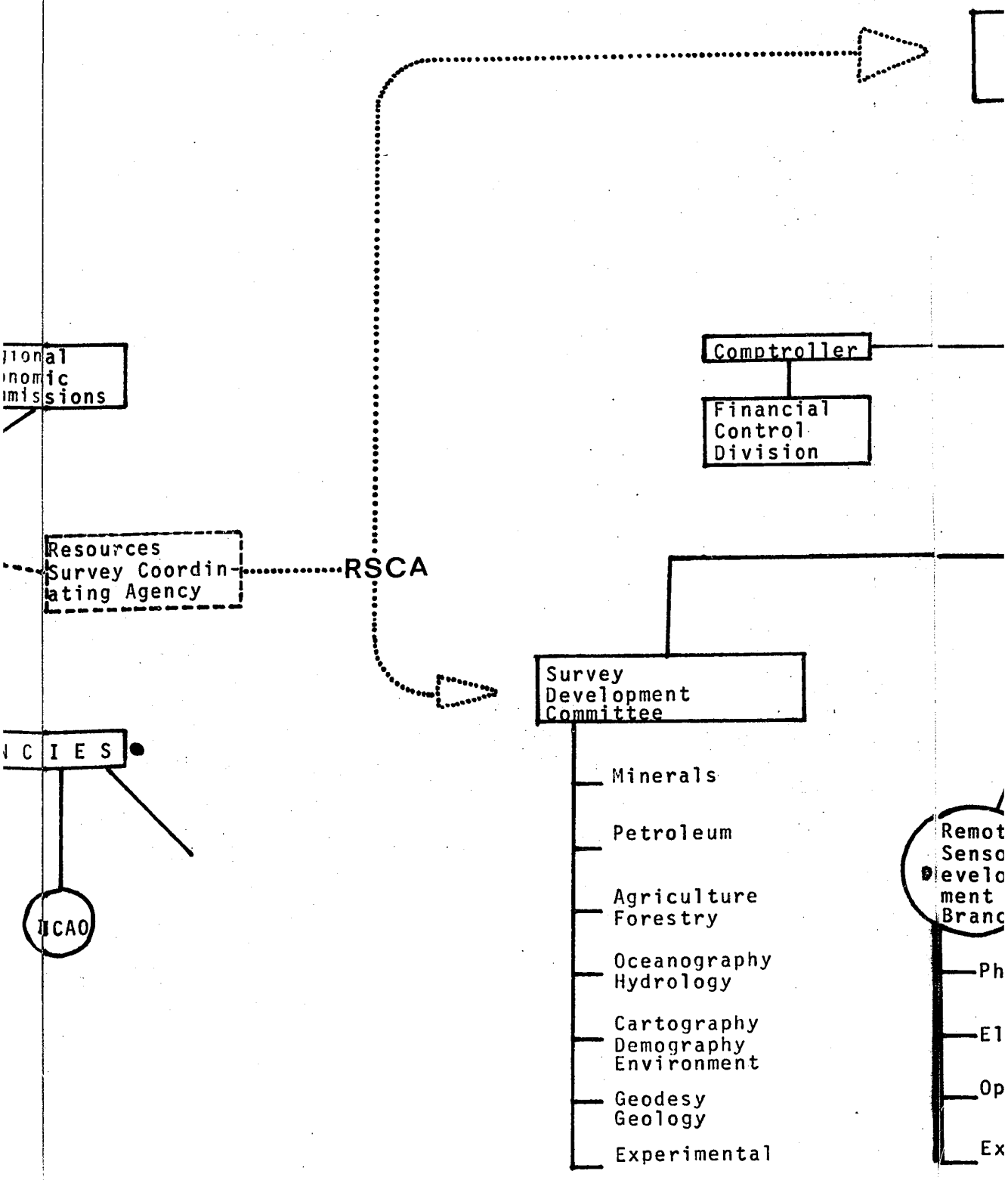
INTERNATIONAL RESOURCE SURVEYING
SATELLITE ORGANIZATION

Partial Schematic Representation of the

UNITED NATIONS ORGANIZATION

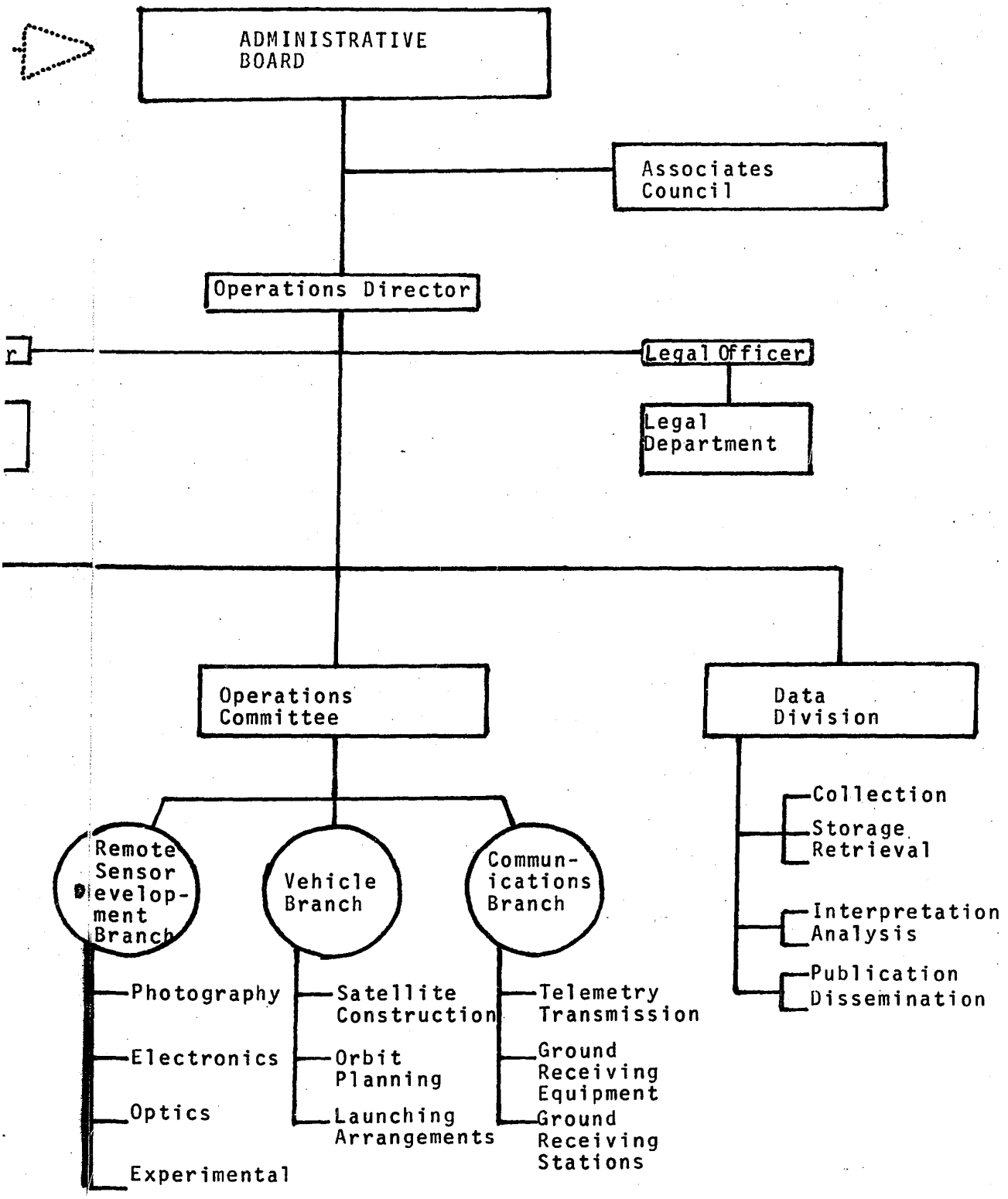


● indicates direct working relationship with RSCA


INT
Comptroller
Financial Control Division
Resources Survey Coordinating Agency
RSCA
Survey Development Committee
Minerals
Petroleum
Agriculture
Forestry
Oceanography
Hydrology
Cartography
Demography
Environment
Geodesy
Geology
Experimental
ICAO

Schematic Representation of the
Organizational Structure for an

INTERNATIONAL RESOURCE SURVEYING SATELLITE ORGANIZATION

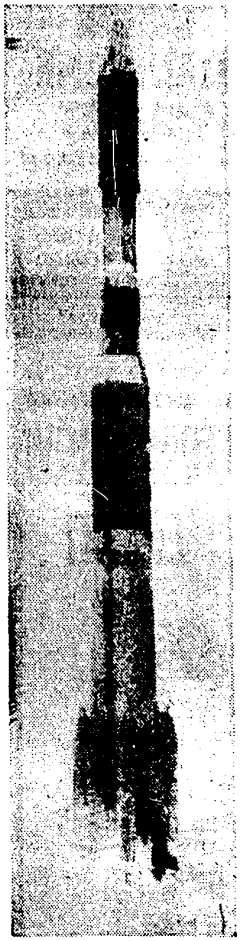


APPENDIX G

Page A-11

Successful launching

Satellite camera set to monitor earth



The satellite blasts off.

Associated Press

LOMPOC, Calif. — Their long-awaited satellite tucked in a perfect orbit over the North and South Poles, scientists are checking out systems aboard the ERTS spacecraft in preparation for receiving first pictures of the earth tomorrow.

The first pictures will be made as the butterfly-shaped spacecraft sweeps southward across the Maritime provinces.

The $176 million spacecraft was launched yesterday from Vandenberg Air Force Base here to begin a year of global environmental measurements that scientists hope will usher in a new era of using space technology to monitor earth's natural resources.

Canada, one of several countries to receive data from the satellite under an agreement with the United States, is spending $4.5 million for equipment to process the information.

A radar station in Prince Albert, Sask., will receive information from the satellite and relay it to the Canada Centre for Remote Sensing headquarters in a renovated Ottawa factory.

Under the international agreement, Canada receives information from the satellite while it is over Canadian territory.

ERTS, which is short for Earth Resources Technology Satellite, thundered aloft atop a white Delta launch rocket that flawlessly boosted the 1,900-pound spacecraft 500 miles above the South Pole and into a circular orbit.

"Everything looks fine — in fact it looks excellent," said Dr. John Clark, director of the National Aeronautics and Space Administration's Goddard Spaceflight Centre at Greenbelt, Md. The centre will control ERTS during the year in which the 10-foot-long satellite will circle the earth every 103 minutes.

Equipped with three television cameras and a special radiation-sensing device, the spacecraft will photograph the entire globe every 18 days.

Scientists hope to use the pictures to monitor natural resources such as crops, forests, schools of fish, water supplies and grasslands.

They believe the pictures, taken through filters that measure radiation reflected from the planet, can help in mapping, spotting earthquake fault systems and locating mineral and oil deposits.

"This is probably the most important launch of an unmanned satellite NASA has ever made," Clark said after ERTS was separated from the Delta rocket's second stage over the coast of East Africa.

"This mission has more potential to bring direct benefits to the average man than perhaps anything we've done so far in the unmanned space program."

The GAZETTE, Montreal, Thurs., July 27, 1972 PAGE 15 col. 4

Satellite photos 'great'

WASHINGTON — (UPI) — Space officials yesterday released some of the first pictures taken by the new earth-exploration satellite and described them as "outstanding".

The Earth Resources Technology Satellite was launched by the National Aeronautics and Space Administration from its western test range July 23. It is the first spacecraft designed solely to study the planet and its mineral, plant, and water resources.

The pictures were taken from an altitude of 560 miles around 12.30 p.m. EDT Tuesday. They show wide expanses of the Austin, Tex., area, the Lake Texhoma-Red River region on the Texas-Oklahoma border, and the Dallas-Fort Worth cities and landscape in Texas.

Also clearly visible are geological formations of the Ouachitas mountains. A band of densely cultivated land also is shown.

Officials said they are "very pleased" with ERTS' performance. They said all photographing and sensing equipment is working as planned.

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