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Satellite Power System (SPS) International Agreements

October 1978

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Office of Energy Research
Satellite Power System Project Office
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DOE/NASA
SATELLITE POWER SYSTEM
Concept Development
and
Evaluation Program

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EXECUTIVE SUMMARY

This White Paper examines present and future plans for a SPS in a political-legal context. Since a SPS will have international ramifications, the analysis focuses on international political and legal matters.

A number of existing international organizations, having both scientific and technical competence and a political-legal orientation, are involved in the governance of space objects orbiting at geostationary heights. The public international institutions include the United Nations, and in particular, the Committee on the Peaceful Uses of Outer Space, and the International Telecommunication Union. A private international institution with a scientific focus is the Committee on Space Research (COSPAR) of the International Council of Scientific Unions (ICSU).

The United Nations has been instrumental in the preparation of two international agreements that bear directly on the uses of outer space, the Moon and celestial bodies (the space environment) by a SPS. These are the 1967 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 1972 Convention on International Liability for Damage Caused by Space Objects. The United States is a party to both agreements, and they have entered into force. As a chief proponent of these two major international legal instruments, the United States has sought to assure the full and free use of the space environment for all peaceful purposes. These agreements have been premised on the res communis international legal principle. Thus, the space environment is open for the use of all who are able to use it. It cannot become an area subject to the sovereignty of a nation-state. The Liability Convention is intended to prevent against misuse of the space environment. It provides that monetary damages will compensate for misuse.

Since the 1967 Treaty preserves the right to the free use of the space environment, States and others having the capacity to do so are entitled to make use of geostationary orbital positions. However, a formal definition/delimitation of sovereign airspace and non-sovereign space environment does not exist. Consequently, in 1976 eight equatorial States issued the Bogotá Declaration. In this they asserted that the spatial area superjacent to their territorial areas was airspace and subject to their sovereignty. The space-resource States and others have rejected this claim.

The ITU, pursuant to the 1973 Telecommunication Convention and Final Protocol, continues to make allocations of radio frequencies. There has been a trend at the ITU to link the radio spectrum with the geostationary orbital position. There is no question that the ITU is charged with making microwave frequency allocations. However, such allocations depend upon the national assignments of such frequencies which are recorded with the ITU. The ITU continues to be responsible for preventing harmful interferences by competing broadcasts. It remains to be seen whether the UN, the ITU, or a new international entity will be given the principal responsibility for protecting national and international wants and needs for the efficient, economic, and equitable use of a SPS.

International law has not established international microwave exposure standards. Nonetheless, the Liability Convention has established international tort law rules. If microwave transmissions of energy from geostationary levels were to cause harm to plants, animals, and tangible items, the Convention would cover the subject.

Suggestions have been made for a new International Conference on Space Law. If and when such a conference is held, it is probable that scientific, technological, political, and legal aspects of a SPS will be considered.

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Chapter One

INTRODUCTION

1.1 International Agreements and a SPS

The needs of an energy-hungry world have suggested the use of a Satellite Power System (SPS) to bring supplies of energy from outer space to Earth-based consumers.[1] Since solar energy at the distance from the Earth at which geostationary space objects can conveniently orbit is regarded as a world natural resource, it is to be expected that the gathering, transmission, and utilization of the resource will require international agreement.

The present inquiry will focus on the possibility of obtaining international agreements having legal significance relating to:

(1) the availability to a nation-state of geostationary orbital positions (slots) for its space objects;

(2) allocations and effective use of microwave frequencies;

(3) microwave exposure standards.

1.2 Role of Law and International Organizations

My assessment will take into account the current state of international law on the foregoing matters. Of necessity it will have to examine the political context in which this law has developed. This will require an analysis of the role of the international organizations that

[1] It has been estimated that by 2000 the demand for electricity in the United States will be almost three times higher than it is now.

have been engaged in the development of legal principles, rules, and standards for these subjects. It will also require an assessment of the possible future roles of such institutions.

Such institutions will continue to be international in scope. Further, they will continue to be influenced by the lively forces of science and technology and by the human values that constantly give direction to political-legal judgments.

Pragmatic considerations will play a substantial role in what appears below. International organizations will be treated as having the principal responsibility for obtaining viable legal principles, rules, and standards. It will be their function, taking into account the needs and wants of sovereign nation-states, to obtain common denominators. Different techniques are available to obtain such common agreement. For example, with the United Nations General Assembly Committee on the Peaceful Uses of Outer Space (COPUOS) operating on the basis of consensus, its final agreements will have to command themselves to the strong support of the States composing the world community. Having arrived at their agreements these States will then be critically charged with securing the day-to-day implementation of the agreements. Such national implementation will not be possible unless all affected States, presumably a very large number of the community, are persuaded that the international agreement will serve and satisfy their respective mutual interests. The keystone to the implementation and enforcement of international legal and political promises is simply the realization that an orderly and harmonious implementation of agreed commitments will serve the general needs of all.

This time-tested prescription works best when it is acknowledged that over time States perceive that their needs and wants do change. As science and technology open new vistas the appetites of beneficiaries or potential beneficiaries take on new dimensions. Thus, the product of international law and of international organizations, in order to meet existing and future world-community expectations, must rely upon the firm facts of science and technology.

1.3 National Perspectives in International Organizations

As noted, the present world-community expectation is that the outer space environment (outer space, the Moon, and celestial bodies) is a world resource. Following World War II a very large number of new States entered the world community. Many of them are identified as less-developed-countries (LDCs), and their assertiveness has been noticed in many of the world's international organizations. Like all States they possess the condition of sovereignty, i.e., legal equality.

The newer States have been identified with efforts to improve their economic well-being. They have urged the need to establish a New International Economic Order. They have sought preferential benefits in ocean areas and have helped to evolve the concepts of the Common Heritage of Mankind and the Province of Mankind. The newer States have mobilized voting and consultative blocs in international organizations in order to overcome their separate political weaknesses. Although their preponderant voting power in the United Nations has resulted in the expression "paper majorities," nonetheless, it cannot be denied that in their consolidated positions they are influencing the substance of international agreements.

In the context of the present analysis a small bloc of States situated at the Equator has put forward claims to special rights in the area of the space environment in which geostationary space objects can conveniently orbit.

1.4 Composition of the Committee on the Peaceful Uses of Outer Space

In the past the major space States, particularly the United States and the Soviet Union, have very substantially influenced--either by their action or their inaction--the development of international space law at the United Nations. In 1958 the General Assembly established an Ad Hoc Committee on the Peaceful Uses of Outer Space consisting of 18 members of which three were within the Soviet bloc, namely, the Soviet Union, Czechoslovakia, and Poland. The other members of the committee were Argentina, Australia, Belgium, Brazil, Canada, France, India, Iran, Italy, Japan, Mexico, Poland, Sweden, the United Arab Republic, the United Kingdom, and the United States. The Soviets considered the committee to be "one-sided and heavily weighted in favor of the Western powers."[2] Consequently, the three socialist States refused to participate in the meetings of the committee. Joining the boycott were India and the UAR who considered that the committee could not usefully serve its purposes in the absence of the Soviet Union.

Through General Assembly Resolution 1472 (XIV) of December 12, 1959 COPUOS was established. To the Ad Hoc committee members were added Albania, Bulgaria, Hungary, and Romania of the socialist bloc and also Austria and Lebanon. In this manner the 18-member Ad Hoc committee was

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[2]"Unanimity on Outer Space," 6 United Nations Review 18 (February 1960).

enlarged in COPUOS to 24 members. The socialist bloc obtained 7 out of the 24 members.

The committee was again enlarged in 1961 by adding Chad, Mongolia, Morocco, and Sierra Leone.[3] The 28 became 37 on December 18, 1973 with the adoption of General Assembly Resolution 3182 (XXVIII). Added as new members by appointment of the President of the General Assembly were Chile, the German Democratic Republic, the Federal Republic of Germany, Indonesia, Kenya, Nigeria, Pakistan, Sudan, and Venezuela. Then, on December 20, 1977 the 37 became 47 with the adoption of General Assembly Resolution 32/196B. New members were Benin, Colombia, Ecuador, Iraq, Netherlands, Niger, Philippines, Turkey, United Republic of Cameroon, and Yugoslavia. Two facts stand out in the augmentations of membership. First, the space resource States were joined by representatives of the LDCs. Second, the equatorial States received strong representation. With the admission of Nauru to the United Nations in 1976 there were 9 equatorial States as members. Of these five, namely Brazil, Colombia, Ecuador, Indonesia, and Kenya are committee members. Congo, Nauru, Uganda, and Zaire have not been appointed to the committee. Since geostationary space objects find an orbital position above the Equator to be congenial the named States have a particular interest in this subject.

1.5 Additional International Forums

While it may not be possible to forecast with finality the respective roles of States having the capacity to embark on major space programs (space-resource States) and all the others, yet it is feasible to predict

[3]General Assembly Resolution 1721 E (XVI), 20 December 1961.

that they will interact on behalf of their interests in all available international institutions. If the SPS is to emerge as a reality at the end of the present century or in the next, States will have an extended period in which to work out their legal and institutional needs. This is not to say, however, that the legal and institutional issues that are under investigation in this study will be put off to future dates. In fact, positions by States have already been identified on subjects within the scope of this present analysis. Thus, at both the United Nations with its original concern for the definition and/or the delimitation of outer space, with the emphasis on the fixing of a boundary between airspace and outer space,[4] and at the International Telecommunication Union (ITU) with its initial function of allocating radio frequencies so that broadcasters might avoid harmful interferences and its more recent involvement in the allocation of geostationary orbital positions for space objects, there have been contributions to the development of legal regimes. It is even possible that there will be conflicting claims on the part of these two institutions as to the extent of their respective interests and jurisdictions.

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[4]The question of determining where outer space begins was considered by the Ad Hoc Committee on the Peaceful Uses of Outer Space in 1959. It was not until 1967 that this subject was placed on the agenda of the legal subcommittee of COPUOS. Owing to lack of time and more pressing matters it was not considered in any detail until 1977. At the April 1977 session of the subcommittee its chairman redesigned the Committee's focus by entitling the agenda item "Matters relating to the definition and/or delimitation of outer space and outer space activities," U.N. Doc. A/AC.105/196, pp. 1 and 9 (11 April 1977). At the April 1978 meeting of the legal subcommittee the agenda item was again modified. This time it was "Questions relating to the definition and/or delimitation of outer space and outer space activities, also bearing in mind questions relating to the geostationary orbit," U.N. Doc. A/AC.105/218, pp. 3, 9-10 (13 April 1978). The changes in the agenda item designations suggest an enlarged interest within the UN in new space activities, including presumably those associated with the Space Shuttle, and on geostationary orbits, including presumably their use in space telecommunications.

1.6 The Possibility of Unilateral SPS Activity

As States contemplate, both at the present, near future, and more distant future, their respective needs and wants in the solar energy field, they may have to identify the forum or forums in which decisions are to be taken. A continuing assessment might take into account not only the references of SPS issues to international institutions. It is also possible to contemplate that one or more of the space resource States would wish to embark on an essentially unilateral SPS undertaking. While such a position would be unpopular internationally, it might--at least at the outset--produce a position that would be advantageous later in political bargaining. Or, rather than arriving at SPS policies through a universal international body, such as the UN or the ITU, it would be possible for like-minded and essentially equal space resource States to form agreements serving their own narrowly defined international interests. Within this last mentioned classification, it would be possible to consider regional bodies insofar as radio frequencies and orbital positions for geostationary space objects do possess important geographical characteristics.

Against these short-term considerations are provisions contained in the "Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies."[5] Thus, Article 1, paragraph 1, provides "The exploration and use of outer space, including the Moon and other celestial bodies, shall

[5] 18 UST 2410, TIAS 6347. It will be referred to hereafter as "Principles Treaty." The agreement entered into force for the United States on October 10, 1967. See Appendix A.

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." When this paragraph was analyzed by the U.S. Senate Committee on Foreign Relations as it engaged in its constitutional function of giving its advice and consent to the President, the Committee formally stated that "nothing in Article 1, paragraph 1, of the Treaty diminishes or alters the right of the United States to determine how it shares the benefits and results of its space activities."[6]

1.7 Policy as the Product of Legal and Scientific Forces

Admittedly, the science and technology of the radio spectrum and of the effectively operating geostationary orbit are complex. Undoubtedly, many of the aspects of an operating SPS will present challenges of enormous magnitude. The processes of international law and its institutions have a complexity of their own, admittedly different from the complexity of the scientific and technological world, but nonetheless in their way such legal and political processes are complex. The purpose here is to effect a meaningful joinder of these two processes so that the SPS and its solar energy will serve the needs of mankind.

As stated, solar energy is a natural resource. The radio spectrum is a natural resource. The slot occupied by a geostationary satellite in orbit is a natural resource. As natural resources of the space environment pursuant to the Principles Treaty they are to be treated as the province of all mankind. And, as provided in Article 33 of the 1973 ITU Convention the parties are obliged to bear in mind in the employment of

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[6]"Treaty on Outer Space, Report," 90th Cong. 1st Sess., Executive Rept. No. 8, p. 4 (April 18, 1967).

frequency bands for space radio services that "radio frequencies and the geostationary satellite orbit are limited natural resources, that they must be used efficiently and economically so that countries or groups of countries may have equitable access to both in conformity with the provisions of the Radio Regulations according to their needs and the technical facilities at their disposal."[7] Thus, to the province of mankind concept has been added the further requirement that this resource must be used equitably, efficiently, and economically.

From the perspective of international law and organization the question must be asked and answered: Who may use such resources? Under what conditions may such resources be used? The answers will be found in existing legal and political constraints. And, as the law is a living institution in a living society, the answers will also be found in future developments.

The following constitutes an early effort to provide some of the answers. Throughout the methodology will be to examine relevant facts, often in a most detailed and precise fashion. Conclusions drawn from such facts will then be put forward.

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[7] TIAS 8572. This agreement entered into force for the United States on April 7, 1976.

Chapter Two

THE ITU AND THE ALLOCATION OF THE RADIO FREQUENCY SPECTRUM

2.1 Essential Powers of the ITU

The several International Telecommunication Conventions have given to the ITU powers relating to the allocation of radio frequencies. Thus, the International Telecommunication Convention signed at Montreux on November 12, 1965 provided in Article 4.2. that a purpose of the International Telecommunication Union (ITU) would be to:

> (a) effect allocation of the radio frequency spectrum and registration of radio frequency assignments in order to avoid harmful interference between radio stations of different countries; and,
>
> (b) coordinate efforts to eliminate harmful interference between radio stations of different countries and to improve the use made of the radio frequency spectrum . . .

The ITU is now governed by the new Telecommunication Convention and Final Protocol signed at Malaga-Torremolinos on October 25, 1973. Pursuant to the 1973 convention the ITU became critically involved in the use of the geostationary orbit by space objects.[1] Article 4 identified in language identical to that appearing above a major purpose of the Union.

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[1] TIAS 8572. It entered into force for the United States on April 7, 1976. Both conventions must be taken into account in an analysis of telecommunications law and practice. Although the United States is bound by the 1973 Convention to the extent that other States have not accepted it, but are parties to the 1965 Convention, they remain bound under its terms in their relations with the United States.

The 1965 and the 1973 Conventions in identical language made provision for the use of Administrative Conferences by the ITU. The World Administrative Radio Conference is one of such bodies. The agenda of such a conference may allow for the partial revision of preexisting Administrative Regulations, the complete revision of one or more of those Regulations, and "any other question of a worldwide character within the competence of the conference."[2] Following agreement on the management of radio activities the terms in the form of "Radio Regulations" are submitted to participating States for ratification. Upon ratification the agreement has the force of law.

The International Frequency Registration Board (IFRB) of the ITU performs important functions. Pursuant to Article 13 of the 1965 Convention and Article 10 of the 1973 Convention the five independent members of the IFRB are to be elected in such a way as to ensure equitable distribution among the regions of the world. Moreover, they are expected to exercise their functions "not as representing their respective countries, or of a region, but as custodians of an international public trust."[3]

Since the precise duties of the members of the IFRB are not always accurately presented, it will be helpful to quote the language of the Conventions. Both conventions recite that the "essential duties" of the IFRB shall be:

> (a) to effect an orderly recording of frequency assignments made by the different countries so as to establish, in accordance with the procedure provided for in the Radio

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[2]Article 7 of the respective Conventions.

[3]Article 13, 1965 Convention; Article 10, 1973 Convention.

> Regulations and in accordance with any decision which may be taken by competent conferences of the Union, the date, purpose and technical characteristics of each of these assignments, with a view to ensuring formal international recognition thereof;[4]

2.2 Association by ITU of Radio Frequencies and Orbital Positions

The duties of the IFRB were enormously enlarged in 1973. Thus, in Article 10.3. it is provided that the Board is:

> (b) to effect, in the same conditions and for the same purpose, an orderly recording of the positions assigned by countries to geostationary satellites.

In establishing this new function for the ITU a direct association was made between frequency assignments and the orbital position or "slot" occupied by a space object having the capacity to make use of radio frequencies or channels. Since 1973, pursuant to Article 33 of the 1973 Convention, the ITU has moved from the essentially ministerial function of registering national assignments of space orbits to the furnishing of advice to members and to the formulation of policy relating "to the equitable, effective and economical use of the geostationary satellite orbit."[5]

Despite the making of the above association in the quoted language, the question of whether from an analytical point of view there is a need to join the "recording of frequency assignments" to "positions assigned by countries to geostationary satellites" deserves critical assessment. In referring to the radio spectrum and orbits it has been suggested that the preferred designation is "the nominal orbit/spectrum

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[4]Article 13.1. of the 1965 Convention; Article 10.3. of the 1973 Convention.

[5]Infra, p. 15.

because it is impossible to consider separately these two concepts. . . ."[6] This analysis appears below.[7]

In both Conventions the IFRB is obliged

> (c) to furnish advice to Members with a view to the operation of the maximum practicable number of radio channels in those portions of the spectrum where harmful interference may occur.

In paragraph 3.d) of the 1973 Convention the IFRB, as in the 1965 Convention, paragraph 3.c), is obliged, in addition to performing essential duties, also to "perform any additional duties, concerned with the assignment and utilization of frequencies." To authorize the IFRB a new involvement in geostationary satellite orbits, the following language has been added to the quoted phrase from Article 10, namely, "and with the utilization of the geostationary satellite orbit, in accordance with the procedures provided for in the Radio Regulations." However, such additional duties of the IFRB, both under the 1965 and the 1973 Convention, are to be undertaken only "as prescribed by a competent conference of the Union, or by the Administrative Council with the consent of a majority of the Members of the Union, in preparation for or in pursuance of the decisions of such a conference."

Finally, both Conventions in Articles 13 and 10 prescribe that the IFRB is to "maintain such essential records as may be related to the performance of its duties." Numerous provisions of an administrative nature set out in the 1965 Convention are not repeated in Article 10 of

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[6]Richard E. Butler, "World Administrative Radio Conference for Planning Broadcasting Satellite Service," 5 Journal of Space Law 93 (1977). Mr. Butler is the Deputy Secretary-General of the International Telecommunication Union.

[7]Infra, pp. 29, 49, 55-59.

the 1973 Convention.

2.3 Harmful Interference with Natural Resources: Spectrum and Orbit

Both as a practical and as a legal matter the radio frequency is treated as a natural resource. So that this natural resource may be employed beneficially and in an orderly manner the members of the ITU have accepted the concept of "Harmful Interference." This concept is set forth in identical language in the 1965 Convention Article 48 and in the 1973 Convention Article 35. Thus, it is provided that:

> 1. All stations, whatever their purpose, must be established and operated in such a manner as not to cause harmful interference to the radio services or communications of other Members or of recognized private operating agencies, or of other duly authorized operating agencies which carry on radio service, and which operate in accordance with the provisions of the Radio Regulations.
>
> 2. Each Member undertakes to require the private operating agencies which it recognizes and the other operating agencies duly authorized for this purpose, to observe the provisions of [paragraph 1].
>
> 3. Further, the Members recognize the desirability of taking all practicable steps to prevent the operation of electrical apparatus and installations of all kinds from causing harmful interference to the radio services or communications mentioned in [paragraph 1].

The two Conventions carry with them a definition of the expression "Harmful Interference." Thus, in the respective Annexes 2, entitled "Definition of Certain Terms used in the Convention and in the Regulations of the International Telecommunication Union," the expression is defined as "Any emission, radiation or induction which endangers the functioning of a radionavigation service or of other safety services (e.g., 'Any radiocommunication service used permanently or temporarily for the safeguarding of human life and property') or seriously degrades, obstructs

or repeatedly interrupts a radiocommunication service operating in accordance with the Radio Regulations."

The ITU has consistently sought to encourage a rational use of the radio frequency spectrum. Thus, Article 46 of the 1965 Convention states that:

> Members and Associate Members recognize that it is desirable to limit the number of frequencies and the spectrum space used to the minimum essential to provide in a satisfactory manner the necessary services. To that end it is desirable that the latest technical advances be applied as soon as possible.

The 1973 Convention made special provisions for radio. It particularly focused on the rational use of the radio frequency spectrum and connected this subject with the geostationary satellite orbit. Following the lead contained in Article 46 of the 1965 Convention and Article 10.3.b) of the 1973 Convention the parties agreed in Article 33 to the following:

> 1. Members shall endeavor to limit the number of frequencies and the spectrum space used to the minimum essential to provide in a satisfactory manner the necessary services. To that end they shall endeavor to apply the latest technical advances as soon as possible.
>
> 2. In using frequency bands for space radio services Members shall bear in mind that radio frequencies and the geostationary satellite orbit are limited natural resources, that they must be used efficiently and economically so that countries or groups of countries may have equitable access to both in conformity with the provisions of the Radio Regulations according to their needs and the technical facilities at their disposal.

Aside from the fact that the 1973 Convention places a somewhat greater duty on ITU members to limit frequencies and spectrum space than in the 1965 Convention, the 1973 addition of paragraph 2 is of substantial importance. This paragraph reflects a direct and greater concern for "limited natural resources" consisting of radio frequencies <u>and</u> the

geostationary satellite orbit.

Although the 1973 Convention focused on the need for radio frequencies for satellites, this subject was also considered in 1965. Resolution 24 of the 1965 Montreux Conference is entitled "Telecommunication and the Peaceful Uses of Outer Space." Resolution 24 called attention to United Nations General Assembly Resolutions 1721 (XVI) and 1962 (XVII) which had stated that satellite telecommunication should be available to all nations on a global and non-discriminatory basis and had identified important legal principles relating to the conduct of States in the exploration and use of the space environment. The concept that the space environment constituted a global natural resource available on a widely distributed basis was reflected in a call upon the members of the ITU to promote the principle that "all countries should have equal opportunity to use space telecommunication facilities."[8]

2.4 The Governmental Process of the ITU

To facilitate the implementation of the purposes of the Conventions each made reference to the use of and the binding force of ITU Regulations,[9] and Administrative Regulations.[10] Both Conventions provided that ratification or accession "involves acceptance of the Administrative Regulations in force at the time of ratification or accession." Article 42 of the 1973 Convention identifies the force of such regulations, namely, "The

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[8]International Telecommunication Conference (Montreux, 1965) Resolution No. 24, at p. 204.

[9]Article 15 of the 1965 Convention.

[10]Articles 42 and 43 of the 1973 Convention.

provisions of the Convention are completely by the Administrative Regulations which regulate the use of telecommunication and shall be binding on all Members." In the event of inconsistent provisions in the Convention and Administrative Regulations the Convention prevails.

The ITU has complemented each of the Conventions with sets of Administrative Regulations dealing with Telegraph, Telephone, Radio, and Additional Radio.[11] The United States in accepting both conventions has attached a protocol on behalf of the territories of the United States whereby the United States does not accept "any obligations in respect to the Telephone Regulations or the Additional Radio Regulations referred to in Article 15 of the International Telecommunication Convention (Montreux, 1965)." This is set forth in Article 59 of the Final Protocol of the 1965 Convention.[12] The same statement relating to Article 42 and Article 82 of the 1973 Convention is to be found in Article XXXVIII of the Final Protocol of that Convention. Thus, the United States, while bound by the 1973 Convention, has consistently accepted as applicable to it only the historic telegraph and radio regulations and has rejected the telephone and special radio regulations.

Before proceeding to an assessment of the critically important substantive provisions of the 1959 ITU Radio Regulations, the 1963 Partial Revision of the 1959 Radio Regulations, the 1971 Final Acts of the World Administrative Radio Conference for Space Telecommunications (WARC ST), and the 1977 World Administrative Radio Conference for the Planning of the Broadcasting-Satellite Service in Frequency Bands 11.7 - 12.2 GHz

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[11] Article 15 of the 1965 Convention and Articles 42 and 82 of the 1973 Convention.

[12] 18 UST 575, TIAS 6267.

(in Regions 2 and 3) and 11.7 - 12.5 GHz (in Region 1) (WARC BS), it is necessary to identify with particularity some additional basic features of the ITU governmental process.

As noted above, the regulatory regime of the ITU focuses in large part on the performance of the International Frequency Registration Board and on the Administrative Regulations of identified functional units. For radio communications the critical points in the governmental process relate to harmful interference and to the need for the rational use of the radio frequency spectrum and of the geostationary satellite orbit.

International organizations typically endeavor to establish international standards. Since sovereign nation-states compose such organizations the international standards are those acceptable to such members. Once such international standards have been agreed to it then becomes the duty of such members to secure their implementation by all available national processes. The ITU operates on the premise that national self-interest will be served through the harmonious acceptance of international standards and by an orderly and consistent implementation of such standards by its membership. With respect to radio frequencies the ITU agreements consistently refer to their equitable, effective, and economical use. The agreements also provide that such frequencies should be used efficiently and economically. Over time these standards have been transposed by the ITU to the presence of space objects in geostationary orbit, particularly for the broadcasting satellite service in frequency bands 11.7 - 12.2 GHz (in Regions 2 and 3), and 11.7 - 12.5 GHz (in Region 1). However, it must be recognized that both in the formulation

and in the implementation of such international standards that national interest is a dominant consideration. Thus, in some circumstances it ay be anticipated that world community interests best served through an orderly and consistent implementation of agreed to standards may be disregarded. Further, until nation-states are entirely clear as to the benefits to them of a community as opposed to a strictly national approach, there is a normal reluctance to accept international standards.

In the interaction between the ITU as an international organization and its members it is of critical importance to understand the meanings given to two words, namely, "allocate" and "assign." These terms relate to access to and the use of radio frequencies, including the use of such frequencies by space objects. The position of the ITU on this was reflected by a statement of Secretary-General Mili of the ITU in 1968 when he stated "it is certain that all telecommunications problems are the sole competence of the ITU, including problems relating to telecommunication by satellite."[13]

Radio broadcasters and listeners benefit when emissions and receptions are not marred by harmful interference. Thus, national governments either monopolize broadcasting or issue licenses to broadcasters to use specific and limited frequencies at given times. National authority is required prior to the use of the natural resource of radio wavelengths. National governments would not serve useful purposes if they were to allow use of a given spectrum in such a manner that their nationals would not be able to have the effective use of the granted privilege. Obviously,

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[13] 35 Telecommunication Journal 240 (1968), cited by D. D. Smith, International Telecommunication Control 160 (1969).

there is a need to plan at a world level for the most equitable, effective and economical access to and use of radio frequencies.

The ITU's international radio conferences allocate usable portions of the spectrum to different communications services, including such competitive needs as fixed, mobile, broadcast, aeronautical, maritime, and space. Thus, ITU allocations to services insures against frequency interference among such competing services, as well as among the services of competing nations. Allocations also are made to three geographical regions of the world. Very roughly, Region 1 refers to Europe (including Asiatic Russia), Africa and the Middle East, Region 2 to the Western Hemisphere, and Region 3 to the Pacific Area and the Far East. When the allocations have been formally adopted by the radio conference they are published in Article 5 of the Radio Regulations in the form of a "Table of Frequency Allocations." This process has been identified as the legislative process of the ITU's radio conferences.[14] This legislative process forms the basis for the international standards mentioned above. Neither the ITU nor the radio conferences possess the means to force compliance even though the parties have entered into international agreements having the force of law. At this stage "the frequency spectrum is distributed among different services but not directly among different countries."[15] Country distributions are effected by regional conferences.

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[14]David M. Leive, International Telecommunications and International Law: The Regulation of the Radio Spectrum 19 (1970).

[15]Ibid., p. 20.

States, as opposed to the ITU, designate or assign particular frequencies to their own national applicants.[16] Such assignments are a function of the sovereignty of such States. Theoretically, such assignments could be made by States as they might see fit. However, membership in the ITU obliges them to participate in the above mentioned legislative process. Assuming a willingness on the part of the signatories to the ITU conventions a State will notify the IFRB of the frequency assignment that has been made. The Board possesses authority to examine the national notice, correspond with the State, issue findings with respect to conformity to existing laws, identify the possibility that the noticed frequency would constitute harmful interference with previously recorded assignments, and record the national assignment in the Master International Frequency Register. This phase of the ITU's activities has been described as regulatory with the functions of the Board being "quasi-judicial."[17] This conclusion is supported by the fact that the legal status of a national assignment depends in part on the findings of the Board.

Thus, it will be seen that the ITU acts in two stages. In the legislative stage it is engaged in the allocation of radio frequencies to communications services at the world level. In the regulatory stage the ITU makes assessments of the assignment of frequencies by member States to specific stations to determine if such assignments are consistent with the ITU Convention, with the Radio Regulations, and with other

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[16] Assignments of frequencies by the United States are "effected by the Federal Communications Commission (FCC) and the Office of Telecommunications Policy (OTP), acting in concert." Office of Telecommunications Policy, Executive Office of the President, "The Radio Frequency Spectrum, United States Use and Management," p. B-5 (1975). When the frequencies are published they constitute the National Table of Frequency Allocations.

[17] Leive, op. cit., p. 20.

relevant ITU determinations. Leive has identified these stages:

> The first stage is similar to a domestic legislature's passage of a law dividing a natural resource into different categories and providing that potential users file their claims within the proper categories; the second stage is comparable to the filing of claims (frequency assignments) by individual users (countries) with a domestic administrative agency (the Board). Unlike such agencies, however, the Board possesses only limited powers to review claims or to ensure compliance with the law.[18]

For the ITU to be useful in dealing with radio frequencies two things are required. First, it is necessary to be clear as to the aggregate of its powers and functions. Second, it must serve as a catalyst to bring out the clearest possible recognition on the part of its members that their well-being in the world of communications depends on community-oriented perspectives. This is because the Board does not have the authority to distribute or to withhold frequencies. Each member is allowed to make its own frequency assignments. The member can also insist that its unilaterally identified assignment be recorded in the Master Register. Thus, the ITU serves as an agent-like broker or negotiator on behalf of its client members. It is able to record the assignments made by States. On behalf of its members it can make allocations and seek to secure conformity therein. But, in the absence of good will and a sense of community on the part of its members, the effective mandate of the ITU is quite limited.

2.5 The Issue of Priority of Rights to Radio Frequencies

All of the foregoing has direct relevance to space telecommunications. Among the functions given to the ITU in the 1973 Convention is the

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[18] *Ibid.*, p. 20.

following:

> Coordinate efforts with a view to harmonizing the development of telecommunications facilities, notably those using space techniques, with a view to full advantage being taken of their possibilities.[19]

This brief review of the relevant, and on the whole, consistent provisions of the 1965 and 1973 conventions has indicated that a fairly limited international regime exists concerning radio communications. The governing power of the ITU and its components requires further identification. This is needed particularly insofar as nation-states assert priority of rights to use radio frequencies with the corollary that rightful uses of the radio spectrum not be subjected to harmful interference.

Such an assessment requires a more detailed examination of the role and function of the IFRB, and this in turn necessitates a further examination of the legal principles and rules developed by the ITU's Administrative Radio Conferences and their formal regulations. These include the 1959 World Administrative Radio Conference which produced "Radio Regulations, with Appendices, and Additional Protocol,"[20] the 1963 World Extraordinary Administrative Radio Conference to Allocate Frequency Bands for Space Radiocommunication Purposes which produced the "Partial Revision of Radio Regulations, Geneva, 1959, and Additional Protocol,"[21] the 1971 World Administrative Radio Conference for Space Telecommunications which

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[19] 1973 Convention, Article 4.2.c).

[20] 12 UST 2377, TIAS 4893. This entered into force for the United States on October 23, 1961.

[21] 15 UST 887, TIAS 5603. This entered into force for the United States on January 1, 1965.

produced the "Final Acts of the World Administrative Radio Conference for Space Telecommunications,"[22] and the 1977 World Administrative Radio Conference for the Planning of the Broadcasting-Satellite Service which produced the "Final Acts of the World Administrative Radio Conference for the Broadcasting-Satellite Service in Frequency Bands 11.7 - 12.2 GHz (in Regions 2 and 3) and 11.7 - 12.5 GHz (in Region 1)."[23] All dealt with varying aspects of radio by space object or satellite services. While the 1971 agreement made the most substantial changes relating to satellites, it will be helpful to examine all of the agreements in order to be aware of the general pattern as well as the important changes.

This examination will focus on two concerns. First, there is the issue of the legal right of a nation-state to use a radio frequency or geostationary orbital position that it has assigned to a national user following national registration with the ITU pursuant to its allocation procedures. Second, there is the issue of the permanency of the national right. The first issue will test the validity of the claim of "first-come is first-served." The second will test the durability of such a claim, if in fact the nation-state has acquired something of value as a result of its involvement in the assignment-allocation process. Impacting on

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[22] 23 UST 1527, TIAS 7435. This entered into force for the United States on January 1, 1973.

[23] International Telecommunication Union, Geneva, 1977. This agreement had not entered into force on October 1, 1978. There is also the 1974 World Maritime Administrative Radio Conference which produced a "Partial Revision of the Radio Regulations (Geneva, 1959) with Final Protocol," U.S. Senate, Executive G, 94th Cong., 1st Sess., 1975. This was signed by the United States on June 8, 1974 with a reservation. It was intended to come into force on January 1, 1976 for governments which, by that date, had notified the ITU of their approval. This agreement is not considered here, since it relates more to maritime communications than to space communications, although the two services must accommodate to each other.

each of these considerations is the fact that the radio spectrum is a natural resource, and, pursuant to the ITU is a "limited natural resource." In this connection it should also be kept in mind that the ITU has linked this characterization of the radio frequency with the "limited natural resource" of the geostationary orbit. These positions are specifically asserted in Article 33 of the 1973 ITU Convention.

After examining the not entirely unanimous views of respected United States commentators on these matters, who, on the whole have focused more on the radio spectrum than on orbital positions, the relevant language of the several agreements will be examined. Thereafter suitable conclusions will be drawn.

The absence of agreement on the part of commentators may be explained in part by the fact that the "legal significance of the elaborate notification and registration procedure is nowhere clearly defined."[24] This is admitted by the ITU. In referring to the findings of the IFRB the ITU has stated that the Board's findings do:

> confer certain rights on Administrations [nation-states], the right to international protection, or at least the right to official international recognition, and place certain obligations on them, the obligation to respect the rights conferred on others. These rights and obligations are invoked by Administrations when they discuss cases of harmful international interference that have actually occurred in practice.
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> The nature of this task can be compared to traffic control on the radio roads in which the Board, before giving an indication with a green, yellow, or red light, has to take careful stock of the existing traffic situation.[25]

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[24] Leive, op. cit., p. 22.

[25] From Semaphore to Satellite, International Telecommunication Union, p. 253.

To this last statement Leive has observed "If the Board can be compared to a traffic officer, it is an officer unable to adequately measure the traffic, whose 'tickets' for violations are often ignored, and who lacks not only a jail but also a court for the offenders."[26] Nonetheless, he has written that two principles govern the rights and obligations of States that have registered national assignments with the IFRB. These are applicable international law consisting of the relevant conventions and ITU Radio Regulations and a State's earlier use of a frequency and due notification of this fact to the Board. He has observed:

> While the significance of the first principle has not been adequately recognized, the importance of the second principle has been generally overemphasized. It has been widely assumed that harmful interference disputes between two countries generally are resolved strictly on the basis of a "first-come first-served" principle. This is not true. In many disputes first use of a frequency is a controlling factor, and often is not even relevant to a determination of the respective rights of the parties concerned.[27]

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[26] Leive, op. cit., p. 22, fn. 8.

[27] Ibid., p. 23. Italics added. For Leive's further assessment of this issue see Chapter 4 "Rights and Obligations," pp. 144 ff. In his final assessment of the importance of priority of notification to the IFRB and use on the right of space telecommunications to immunity from harmful interference by other services he stated that the Radio Regulations in force in 1970 "do not explicitly establish the respective rights and obligations of the parties to a harmful interference dispute (e.g., an earth station and a terrestrial station) both of which are in conformity with the Convention and Regulations. In view of the enormous investment in space and earth stations and the likelihood that the probability may increase as space communications services expand, it would appear prudent to attempt to clarify the state of the law applicable in such cases." Ibid., p. 240. Despite this fact as of 1970 the IFRB's powers to examine national notices of frequency assignments to space objects was "substantially narrower than its examination of terrestrial and earth station notices." Ibid., p. 235. Further, the Board's coordination procedures for space stations was considered "weaker" than those available for "terrestrial and earth stations." Ibid., p. 234.

Writing prior to the convening in 1971 of WARC ST, Smith has also called attention to the role of prior claims for radio frequencies. In the context of the practice of some countries of not following the findings of the IFRB he states: "One reason for this non-adherence is that frequencies are . . . [allocated] on a time priority basis rather than on equitable principles. In the early days of regulation this caused nations to hoard frequency assignments that they would never use, and today it creates difficulties in the determination of which frequency use should predominate."[28]

Writing in 1970 at a time when the 1963 revised Radio Regulations were in force, another commentator has observed that these Regulations did not introduce a new approach to the traditional system of unilateral national assignment of radio frequencies to national entities. He stated: "The conference proceeded on the assumption that space communications were merely an extension of terrestrial communications which fell within the sovereign prerogative of individual states. Accordingly, the traditional principle of 'first use, first served' has been extended to the new field of space communications and applies both to the use of frequencies and to the occupation of orbital 'parking slots' by communication satellites."[29] This outcome served the interests of the

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[28] D. D. Smith, International Telecommunication Control 30 (1969).

[29] Eric N. Valters, "Perspectives in the Emerging Law of Satellite Communications," 5 Stanford Journal of International Studies 76-77 (June 1970). He also observed that "This principle reflects an approach that values the freedom of national action more highly than international decisionmaking concerning the utilization of a scarce international resource. It favors the economically and technologically advanced states and, in principle, protects their communications satellites against interference from subsequently launched communications satellites of other states, regardless of the comparative merits of such satellites." Ibid.

technologically advanced States.

Writing in 1973, following the 1971 World Administrative Radio Conference, Chayes has summarized pre-1971 practices and has offered conclusions relating to radio frequency priorities for the post-1971 era. His comment takes into account the fact that the ITU even prior to 1971 had associated the recordation by the IFRB of radio frequency national assignments with the orbital positions of the satellites that employed such radio frequencies.[30]

Chayes writes:

> Until the WARC of 1971, registration, in the case of satellite-communications systems, required notice of the frequencies to be used, the proposed orbital position and certain other characteristics, notably the effective power at which the satellites would operate, antenna directionality, and other matters relevant to compliance with the criteria established for use of frequencies already in use by terrestrial services in the area of coverage. If these characteristics were in conformity with ITU Regulations, and if there were no likelihood of interference with stations already registered, the applicant would be entitled to have the frequencies registered in the Master Register with a favorable finding. That meant, in effect, that the system was entitled to priority over any later systems that caused interference with it, even though the registered system was not designed so as to economize spectrum use and did not take account of prospective needs of other users in planning.[31]

The 1971 WARC ST modified this framework by requiring users of radio frequencies in satellite systems to coordinate their respective uses of the radio spectrum. While the change allows prospective users of the spectrum to object to existing uses, and while it obliges existing users

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[30] See p. 6 infra for the treaty basis for the linking of radio frequencies with the orbital slots of space objects.

[31] A. Chayes and others, Satellite Broadcasting 18 (1973).

to consult with those who have objections, the 1971 rules do not oblige existing users to make substantive adjustments. Thus, Chayes concludes that "Overall, the coordinating process remains one for a series of bilateral adjustments of national policies rather than an integrated spectrum-management function. The regime of first-come-first-served is hardly altered."[32]

Two options were available to the 1971 WARC ST respecting use of the geostationary orbit. First, the ITU could have been authorized to allocate an orbit upon application, even though the State might not have the capacity to use it. Secondly, and in the view of States that considered the first option to be wasteful, there was the possibility that a State might make use of the orbital position, subject to the duty to relocate the space object as required. The second option was accepted as a voluntary procedure, pursuant to paragraph 639 AF of Spa 2. Thus, pursuant to paragraph (b) if difficulties were to arise because of over use of the orbit consultation could be used to "explore all possible means of meeting the requirements of the requesting administration, for example, by relocating one or more of its own geostationary space stations involved, or by changing the emissions, frequency usage (including

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[32] Ibid. The requirement of coordination is set out in Annex 8 of the Final Acts of the 1971 WARC ST. This is a revision of Article 9A of the 1963 Radio Regulations. The revised paragraph 639AJ provides in part: "Before an administration notifies the Board or brings into use any frequency assignment to a space station on a geostationary satellite or to an earth station that is to communicate with a space station on a geostationary satellite, it shall effect co-ordination of the assignment with any other administration whose assignment in the same band for a space station on a geostationary satellite or for an earth station that communicates with a space station on a geostationary satellite is recorded in the Master Register, or has been co-ordinated or is being co-ordinated under the provisions of this paragraph. For this purpose, the administration requesting co-ordination shall send to any other such administration the information listed in Appendix 1A." 23 UST 1527, 1687, TIAS 7435.

changes in frequency bands) or other technical or operational characteristics."[33] Pursuant to paragraph (c), if the foregoing procedures failed to resolve difficulties among potential users, the concerned States were to "together make every possible effort to resolve these difficulties by means of mutually acceptable adjustments, for example, to geostationary space station locations and to other characteristics of the systems involved in order to provide for the normal operation of both the planned and existing systems."[34]

The 1971 WARC ST in Resolution No. Spa2-1,[35] however, did accept the view that the registration with the IFRB of a national assignment of a radio frequency would not establish any permanent priority for the registrant over a particular frequency. The resolution, entitled "Relating to the Use by all Countries, with Equal Rights, of Frequency Bands for Space Radiocommunication Services," linked the subjects of radio frequencies with satellite orbital slots.

In the preambulatory provisions of the Resolution it was noted that "all countries have equal rights in the use of both the radio frequencies allocated to various space radiocommunication services and the geostationary satellite orbit for these services." The preamble also referred to the view that "the use of the allocated frequency bands and fixed positions in the geostationary satellite orbit by individual countries or groups of countries can start at various dates depending on requirements and readiness of technical facilities of countries."

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[33] 23 UST 1527, 1686, TIAS 7435.

[34] Ibid.

[35] 23 UST 1527, 1820, TIAS 7435.

The States then resolved:

1. that the registration with the ITU of frequency assignments for space radiocommunication services and their use should not provide any permanent priority for any individual country or groups of countries and should not create an obstacle to the establishment of space systems by other countries;

2. that, accordingly, a country or group of countries having registered with the ITU frequencies for their space radiocommunication services should take all practicable measures to realize the possibility of the use of new space systems by other countries or groups of countries so desiring. . . .[36]

This Resolution was designed to promote the "coordinated use of the special frequencies available for satellite systems."[37] The foregoing Resolution has been construed to mean that registration of national assignments with the IFRB does not accord to the registrant a permanent priority concerning the registered frequencies. Thus, Rankin has concluded that "registration of a space services frequency assignment with the ITU does not provide the individual registrant with any permanent priority claim over that particular frequency, and that it is not to be viewed as a barrier to the establishment of space systems by other countries."[38]

Support for this viewpoint is also found in recommendations of the 1971 Conference. Thus, Recommendation No. Spa2-1 entitled "Relating to the Examination by World Administrative Radio Conferences of the Situation with Regard to Occupation of the Frequency Spectrum in Space

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[36] 23 UST 1527, 1820-1, TIAS 7435.

[37] Clyde E. Rankin, III, "Utilization of the Geostationary Orbit--A Need for Orbital Allocation?" 13 Columbia Journal of Transnational Law 107 (1974).

[38] Ibid., pp. 106-107.

Radiocommunications"[39] accepts the proposition that nation-states should be enabled to establish the telecommunication links which they deem necessary. This view is based on the conclusion that "technology is steadily and rapidly evolving and that the best possible use should be made of resources in space radiocommunications."[40] The rule of priority rights to frequencies is conditioned by the judgment that such frequencies must be used in the "most efficient manner possible consistent with developing technology and that such assignments are relinquished when no longer in use."[41] The focus of this Recommendation was clearly on the efficient and economic use of radio frequencies. Thus, the ITU Administrative Council was invited to seek consideration by the next World Administrative Radio Conference of "all aspects of the use of the frequency band(s) concerned including, interalia, the relevant frequency assignments recorded in the Master International Frequency Register and to find a solution to the problem."[42]

However, the past practices of the IFRB have been such that the first national claim for the registration in the Board's Master Register of its assignment has established preferences if not rights within the context of the ITU governing process. When the Board receives a frequency assignment for registration that conforms to the frequency allotment plans of the ITU, such assignments are accorded "the highest level status

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[39] 23 UST 1527, 1839, TIAS 7435.

[40] Ibid.

[41] Ibid.

[42] Ibid., p. 1840. Italics added.

of any category of user."[43] Such assignments are listed with the date of registration in Column 2a of the Master Register. Pursuant to the Radio Regulations such assignments are entitled to ". . . the right to international protection from harmful interference."[44] But, if a registrant does not conform to the ITU registration plan, it is nonetheless listed in Column 2b of the Master Register. This does not accord to the registrant the international protection assured to situations in "full conformity with the allotment plan of the Union."[45] Such a registration is effected so that other parties will know that the frequency is in use as a result of the nation's assignment. Even so, such a registrant does have identifiable rights. Thus, the Regulations "require that the IFRB give an unfavorable ruling to a new user which would interfere with a station already listed in Column 2b so long as that station is operating in conformity with the Convention and Regulations and has not caused interference to a station in full conformity with the ITU frequency plan."[46]

Column 2d of the Master Register is used for assignments presented to the Board but not ruled on by it. Listed there are the broadcasting services operating in crowded high-frequency ranges. Also listed are

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[43] Allan H. Ickowitz, "The Role of the International Telecommunication Union in the Settlement of Harmful Interference Disputes," 13 Columbia Journal of Transnational Law 86 (1974).

[44] ITU Regulations of December 21, 1959, Paragraph 607, 12 UST 2377, 2507 TIAS 4893. This international agreement entered into force for the United States on October 23, 1961.

[45] Ickowitz, op. cit., p. 86, citing Paragraph 608.

[46] Ibid., citing Paragraph 608.

radio operators that have been identified as engaging in harmful interferences by the Board. Even so, such a Column 2d listing is of some value. Such a registration will offer "security against future stations listed in Column 2d interfering with their operations--provided that they are operating in accordance with the ITU Convention and Radio Regulations."[47]

The foregoing assessment does offer support for the proposition that the first to list an assignment with the Board will derive an advantage therefrom. This conclusion was captured by Ickowitz in his summary:

> Only those stations which function in the planned portion of the spectrum in accordance with ITU . . . [allocations] are entitled to an absolute right to international protection from interfering users. Assignments operating in accordance with the Convention and Radio Regulations receive limited protection against future newcomers. The Board can refuse to protect a station which has interfered with these users when subsequently registered stations interfere with it in the future. Finally, the doctrine of prior notification is applied by the Board when both parties are in conformity with the Convention and Radio Regulations, or when two . . . [registrants] listed in Column 2d of the Register interfere with each other.[48]

He concluded that the concept of "priority" needs clarification in an operational context. Since the Regulations do not provide for exceptions to its applicability, much has been left to the undirected judgment of the IFRB. Consequently, a "principle like that of the 'first-come, first-served' rule must be limited in some way before it can become a workable doctrine in a variety of situations. As it is applied now, the

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[47] Ibid., citing Paragraph 501.

[48] Ibid., p. 87.

rule is too rigid to be very useful in different cases."[49]

The ITU remains steadfast to its principle, as set out in Paragraph 607 of the 1959 Regulations, that assignments set out in Column 2a of the Master Register are entitled to "the right to international protection from harmful interference." This has not been touched in either the 1963 or the 1971 Regulations. Thus, in the 1971 revised Article 9A, entitled "Co-ordination, Notification and Recording in the Master International Frequency Register of Frequency Assignments to Radio Astronomy and Space Radiocommunication States except Stations in the Broadcasting-Satellite Service,"[50] the IFRB is to be notified by an ITU member of any frequency assignment to an earth or space station if "the use of the frequency concerned is capable of causing harmful interference to any service of another administration; or if the frequency is to be used for international radiocommunications; or if it is desired to obtain international recognition of the use of the frequency."[51] Section IV. of revised Article 9A is entitled "Procedure for the Examination of Notices and the Recording of Frequency Assignments in the Master Register." Pursuant to Paragraph 639BP of this section the Board is empowered, when it receives a notice from a member State concerning a frequency assignment, to examine the "probability of harmful interference to the service rendered by a space radiocommunication station for which a frequency assignment already has been recorded in the Master Register. . . ."[52]

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[49] Ibid., p. 95.

[50] 23 UST 1684, TIAS 7435. This is Annex 8 to the 1971 Convention.

[51] Ibid., Paragraph 639BA, p. 1695.

[52] Ibid., p. 1698.

The Board's role in the combined areas of frequency allocation, harmful intereference, and priority of use by the State that has given notice to the Board of a frequency assignment is illustrated in Paragraph 639BS of revised Article 9A. It reads:

> When, following an examination of a notice with respect to No. 639BP, the Board reaches an unfavorable finding based upon the probability of harmful interference to a recorded assignment for a space station which the Board has reason to believe may not be in regular use, the Board shall forthwith consult the administration responsible for the registered assignment.[53]

If it is determined by the Board that the assignment has not been used for two years the Board is authorized to engage in coordination with IRU members likely to be adversely affected by harmful interference and to engage in further examination of the situation as appropriate. Such coordination and examination are to take place before the assignment "is brought back into use . . . [and] the date on which the assignment is brought back into use shall then be entered in the Master Register."[54] While this language allows for the protection of a priority, even though the frequency has not been in use, it also suggests that the Board can exercise an ongoing influence over the equitable, effective, and economical utilization of the spectrum.

Section VIII. of revised Article 9A is entitled "Modification, Cancellation and Review of Entries in the Master Register." This section deals with situations where the use of a recorded assignment to a space station is suspended for a period of 18 months. The registering State is obliged to notify the Board of the date when use was suspended and when

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[53] Ibid., p. 1699.

[54] Ibid.

the assignment is to be brought back to regular use. If the registering State does not notify the Board, it is authorized to inquire of the affected State when the assignment is to be brought back into regular use. If the State does not respond within six months, the Board is to treat the assignment "as one which has been established as having been out of regular use for two years."[55]

This section allows a State to relinquish the use of a recorded frequency assignment. Thus, in the case of a permanent discontinuance of the use of any recorded frequency assignment, the notifying administration shall inform the Board within ninety days of such discontinuance, whereupon the entry shall be removed from the Master Register."[56] Further, the Board has the authority to either cancel or suitably modify the registration of a member State. Thus:

> Whenever it appears to the Board from the information available that a recorded assignment has not been brought into regular operation in accordance with the notified basic characteristics, or is not being used in accordance with those basic characteristics, the Board shall consult the notifying administration and, subject to its agreement, shall either cancel or suitably modify the entry.[57]

The 1971 Radio Regulations also require that member States submit to the Board well in advance of the putting into use of a given frequency a notice concerning such prospective use. For a frequency assignment made by a member to either an earth or a space station, such notice must reach the IFRM "not earlier than three years before the date on which the assignment is to be brought into use . . ." and not later than 90 days

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[55] Ibid., Paragraph 639DM, p. 1709.

[56] Ibid., Paragraph 639DN, p. 1709.

[57] Ibid., Paragraph 639DO, p. 1709.

before the date of use.[58] Further, the 1971 revised Article 9A established in Section 1 a "Procedure for the Advance Publication of Information on Planned Satellite Systems." Thus, a member State "which intends to establish a satellite system shall, prior to the coordination procedure in accordance with No. 639AJ where applicable, send to the International Frequency Registration Board not earlier than five years before the date of bringing into service each satellite network of the planned system, the information listed in Appendix 1B."[59] According to Mr. Richard E. Butler, Deputy Secretary-General of the ITU, this rule requires that member States intending to introduce direct satellite broadcasting systems must "provide advance notification at least five years before the establishment of such systems."[60]

The foregoing Appendix 1B is set out in Annex 15 to the 1971 Regulations. It is entitled "Advance Publication Information to be furnished for a Satellite Network."[61] Member States, pursuant to the 1971 Regulations, are obliged to supply the IFRB with orbital information relating to space stations. Where the space station is situated aboard a geostationary satellite, such information is to include the "planned nominal geographical longitude on the geostationary satellite orbit and the planned longitudinal and inclination tolerances."[62] Also to be indicated is the arc of the geostationary satellite orbit "over which

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[58] Ibid., Paragraph 639BF, p. 1696.

[59] Ibid., Paragraph 639AA, p. 1684. Paragraph 639AJ appears in footnote 32, supra.

[60] U.N. Doc. A/AC.105/C.2/SR.258, p. 6, May 20, 1976.

[61] 23 UST 1527, 1739, TIAS 7435.

[62] Ibid., 1740.

the space station is visible, at a minimum angle of elevation of 10° at the Earth's surface, from its associated earth stations or service areas . . . [and] within which the space station could provide the required service to its associated earth stations or service areas. . . ."[63] Further, the arcs are to be "indicated by the geographical longitude of the extremes of these arcs on the geostationary satellite orbit."[64]

Revised Article 9A of the 1971 Regulations also identified the need for member States to engage in coordination respecting proposed frequency assignments. The Article made specific reference to the use of the frequency spectrum above 1 GHz. Pursuant to Section II., "Co-ordinating Procedures to be applied in appropriate Cases" before a member State gives notice to the Board or brings into use any frequency assignment to an earth station, whether for transmitting or receiving, in a particular band "allocated with equal rights to space and terrestrial radiocommunication services in the frequency spectrum above 1 GHz, it shall effect co-ordination of the assignment with any other administration whose territory lies wholly or partly within the co-ordination area of the planned earth station."[65]

Aside from the issue of priority and notice, there is also the companion problem of registered assignments that are not in active use. This has been referred to as "deadwood." If first registration with the IFRB establishes a preferred right, if not a permanent priority, to the use of a frequency, then the non-use could be considered to be a matter

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[63] Ibid.

[64] Ibid.

[65] Ibid., Paragraph 639AN, p. 1689.

wholly at the discretion of the registrant. The registrant would be able to assert that a future use was contemplated. But, if first registration, or use, provides no basis for a claim of preference, priority, or exclusivity, then the "deadwood" situation could allow the Board to register the frequency for use by a different State. To encourage the equitable and efficient use of radio frequencies the 1971 WARC ST fixed means to penalize "deadwood" stations no longer in use.[66]

However, the holder of the "deadwood" registration would have to be amenable to the imposition of the restraints. It has been noted that "such 'deadwood' cannot be removed from the Master Register without the consent of the government concerned."[67] To reduce the possibility of harmful interference the IFRB would need to possess the power to remove "deadwood" frequencies from the Master Register when such frequencies were not used. Pending such a development when an interference dispute arises involving such registrations "the new users are often preempted by priority given to the earlier user."[68]

Following the 1971 WARC ST and Resolution No. Spa2-1 representatives of the ITU have called attention to paragraph one which provides that "the registration with the ITU of frequency assignments for space radiocommunication services and their use should not provide any permanent

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[66]David M. Leive, The Future of the International Telecommunication Union, A Report for the 1973 Plenipotentiary Conference 45 (1972). This conclusion is based on Recommendation No. Spa2-1, "Relating to the Examination by World Administrative Radio Conferences of the Situation with Regard to Occupation of the Frequency Spectrum in Space Radiocommunications." 23 UST 1527, 1839, TIAS 7435.

[67]Ickowitz, op. cit., 85, citing E. Pepin, "General Legal Problems in Space Telecommunications," 38 Telecommunication Journal 387 (1971).

[68]Ickowitz, op. cit., 93.

priority for any individual country or groups of countries and should not create an obstacle to the establishment of space systems by other countries."[69] Thus, Mr. Richard E. Butler of the ITU advised the Legal Subcommittee of the Committee on the Peaceful Uses of Outer Space of the UN on May 20, 1976 that "The Convention also provided for equal rights in the frequency bands for space radio communication services and ensured that international registration of frequency assignments did not give permanent priority to any country or group of countries."[70] In addressing the same group in March 1977, Mr. Butler in referring to the 1971 WARC ST Conference indicated that it had "laid down the principle of equal rights in the frequency bands for space radio communication services and stated that the international registration of frequency assignments did not provide any permanent priority for any individual country or groups of countries."[71]

The radio spectrum resource is both a natural and an international resource. The function of the ITU, as reflected in the observations of Mr. Butler, are to insure the most equitable, efficient, and economical use of the resource. Yet, it is important to bear in mind the following assessment:

> While the use of this resource by one country will often affect the extent to which other countries can use the resource, there are parts of the spectrum in which one country's use will not affect others. In addition, it should be stressed that in general the communications needs of any particular country are not guaranteed under the ITU regulatory

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[69] 23 UST 1527, 1820, TIAS 7435. Italics added.

[70] U.N. Doc. A/AC.105/C.2/SR.258, p. 6, May 20, 1976.

[71] U.N. Doc. A/AC.105/C.2/SR.273, March 28, 1977.

> regime. While the spectrum is "owned" by no one nation, a variety of factors--political, economic, entrenched rights--suggests that in practice the spectrum may not be equally available to all countries.[72]

2.6 The 1959 ITU Radio Regulations and Space Activities

In analyzing the present and future regulatory role of the ITU in the area of radio communications between Earth and space it is necessary to consider the relevant international agreements from 1959 to the present. While the most current carry with them more of the substance of existing legal requirements, nonetheless the evidence of the transition from the past to the present offers an understanding of trends. Further, this review will allow for conclusions to be drawn concerning the validity of the positions taken by the commentators that have been referred to above.

Although the 1959 International Telecommunication Convention[73] made no specific mention of radio for space communications, the subject was barely treated in the Radio Regulations, with Appendices, and Additional Protocol which were signed on the same day as the Convention.[74] Partial revisions were effected in 1963,[75] and in 1971.[76] Major changes were proposed in 1977. Since the agreements subsequent to the 1959 Radio Regulations were revisions, those portions of the respective agreements

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[72] Leive, International Telecommunications and International Law: The Regulation of the Radio Spectrum 17 (1970).

[73] 12 UST 1761, TIAS 4892, December 21, 1959. This was the predecessor to the 1965 Convention, 18 UST 575, TIAS 6267, and the current 1973 Convention, TIAS 8572.

[74] 12 UST 2377; TIAS 4893.

[75] 15 UST 887; TIAS 5603.

[76] 23 UST 1527; TIAS 7435.

that did not undergo modifications remained in full force for the affected States.

The 1959 Radio Regulations gave very little attention to the space radio frequencies that might be registered with the IFRB. It did begin the process of identifying systems in which space objects could participate, and it did begin to define a variety of space-connected subjects. Thus, in 1959 a definition was established for a "Space Service," for an "Earth-Space Service," and for a "Space Station." In 1959 the first allocation of frequencies for space use was made to Region 2. The allocation was made for "research purposes"[77] under the classifications of "space" and "earth-space."[78]

By 1971 the definition of a "space service" had been deleted[79] and a new definition had been given to "space station," namely, "A station located on an object which is beyond, is intended to go beyond, or has been beyond, the major portion of the Earth's atmosphere."[80] In 1971 a "Space System" was defined as "Any group of co-operating earth and/or space stations employing space radiocommunication for specific purposes."[81] The identification of services has been expanded with the "Meteorological-Satellite Service" emerging from the 1963 conference.[82] In 1971, the

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[77] 12 UST 2377, 2450, TIAS 4893.

[78] Ibid., p. 2449. Allocations were made in the ranges of 108-144 Mc/s, 235-401 Mc/s, 1,350-1,535 Mc/s, 1,700-1,710 Mc/s, 2,290-2,300 Mc/s, 5,250-5,255 Mc/s, 15.15-15.25 Gc/s, and 24.25-40 Gc/s. Ibid., pp. 2449-2478. The foregoing frequencies were variously allocated in all three regions. None were allocated at the GHz level.

[79] 23 UST 1527, 1571, TIAS 7435.

[80] 23 UST 1527, 1569, TIAS 7435.

[81] Ibid., p. 1571.

[82] 15 UST 918, TIAS 5603.

following new services were defined: Amateur-Satellite, Standard Frequency-Satellite, Time-Signal Satellite, Space Research, Space Operation, and Inter-Satellite.[83] Additionally, the ITU has defined or redefined services dealing with Fixed-Satellite, Mobile-Satellite, Aeronautical Mobile-Satellite, Maritime Mobile-Satellite, Land Mobile-Satellite, Broadcasting-Satellite, Radiodetermination-Satellite, Radionavigation, Aeronautical Radionavigation-Satellite, Maritime Radionavigation-Satellite, Earth Exploration-Satellite, and Meteorological-Satellite.[84]

2.7 The 1963 ITU Radio Regulations and Space Activities

The 1963 Regulations made a connection between the radio spectrum and "Space, Orbits and Types of Objects in Space." Thus, definitions of eight related objects or events were made, including a definition of deep space, orbit, stationary satellite, and spacecraft.[85] This same approach was pursued in the 1971 Regulations to include definitions of deep space, spacecraft, satellite, active satellite, passive satellite, orbit, inclination of an orbit, period of a satellite, altitude of the apogee (perigee), geosynchronous satellite, and geostationary satellite. In all instances the 1959 definitions were altered. Important additions were also made. Among the definitions made were: spacecraft "a man-made vehicle which is intended to go beyond the major portion of the Earth's atmosphere," satellite "a body which revolves around another body of

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[83] 23 UST 1576-1577, TIAS 7435.

[84] Ibid., pp. 1570-1576.

[85] 15 UST 887, 919-920, TIAS 5603.

preponderant mass and which has a motion primarily and permanently determined by the force of attraction of that other body." The term "body" was also defined as to mean "a body so defined which revolves around the Sun is a planet or planetoid." "Active satellite" means an "earth satellite carrying a station intended to transmit or retransmit radiocommunication signals." "Passive satellite" means an "earth satellite intended to transmit radiocommunication signals by reflection." Orbit by 1971 was defined as:

> 1. the path, relative to a specified frame of reference, described by the center of mass of a satellite or other object in space, subjected solely to natural forces, mainly the force of gravity.
>
> 2. by extension, the path described by the center of mass of an object in space subjected to natural forces and occasional low-energy corrective forces exerted by a propulsive device in order to achieve and maintain a desired path.

A geosynchronous satellite is an "earth satellite whose period of revolution is equal to the period of rotation of the Earth about its axis." A geostationary satellite is a "satellite, the circular orbit of which lies in the plane of the Earth's equator and which turns about the polar axis of the Earth in the same direction and with the same period as those of the Earth's rotation. The orbit on which a satellite should be placed to be a geostationary satellite is called the 'geostationary satellite orbit.'"[86]

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[86] 23 UST 1578-1579, TIAS 7435. The foregoing definitions are set out in Annex I of the agreement and constitute revisions of Article 1 of the 1963 Radio Regulations. For a critical appraisal of the validity of these definitions, see James J. Gehrig, "Geostationary Orbit--Technology and Law," Proceedings of the 19th Colloquium on the Law of Outer Space 267 (1977).

2.8 The 1971 ITU Radio Regulations and Space Activities, WARC ST

The 1971 Regulations contain detailed provisions relating to the use by satellites of the radio spectrum. Allocations were made ranging from 7,000-7,100 KHz to 275 GHz, with the highest MHz being 8,500 and the lowest GHz being in the 10.95-11.2 range.[87] The 1971 Regulations identify a total of 104 allocations for different space services.[88] These allocations to space services unquestionably contributed to the expansion of radio services and radio spectrum allocations between 1959 and 1971. The table[89] illustrates this fact:

Year International Radio Conference	Number of Radio Services	Spectrum Allocated (KHz)
1959 Geneva	23	10 to 40,000,000
1963 Geneva (Space)	26	10 to 40,000,000
1967 Geneva (Maritime)	26	10 to 40,000,000
1971 Geneva (Space)	41	10 to 275,000,000

The 1971 Regulations did not make allocations in the GHz range below 10.55 and at the 71-84, 152-170, 200-220, 240-250, and above the 275 frequencies.[90] By 1977 the ITU was able to report the rapidly expanding use of frequencies above 10 GHz.[91]

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[87] 23 UST 1527, 1587-1645, TIAS 7435.

[88] Ibid., pp. 1587-1645.

[89] Office of Telecommunications Policy, Executive Office of The President, "The Radio Frequency Spectrum: United States Use and Management," p. A-5 (1975). The 1971 figure, as indicated, reflects a large number of new satellite services.

[90] 23 UST 1527, pp. 1633-1645, TIAS 7435.

[91] U.N. Doc. A/AC.105/213, p. 26, Dec. 22, 1977.

2.9 The 1977 ITU Radio Regulations and Space Activities, WARC BS

In 1971, the WARC ST invited the Administrative Council of the ITU to include on the agenda of the next conference an examination of relevant frequency assignments recorded in the Master International Frequency Register. Concern existed that member States would experience difficulty in frequency bands in meeting requirements for space radiocommunication as the use of frequencies and orbital positions increased.[92] The Administrative Council initiated activity which led to the convening in Geneva on January 10, 1977 of "The World Administrative Radio Conference for the Planning of the Broadcasting-Satellite Service in Frequency Bands 11.7 - 12.2 GHz (in Regions 2 and 3) and 11.7 - 12.5 GHz (in Region 1)," WARC BS. On February 13, 1977 the Final Acts of the WARC BS were signed by representatives of 111 countries. The extreme complexity of the subject matter had posed substantial problems for the ITU. These had only been resolved through the use of computers.

It should be emphasized that although the Final Acts have the appearance of an international agreements ready for approval as an operating commitment the Acts at this stage are merely a "Plan." Their present status has been described: "The Final Acts are destined to be incorporated as an integral part of the Radio Regulations by the general

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[92] Recommendation No. Spa2-1, 23 UST 1527, 1839-1840, TIAS 7435. Resolution No. Spa2-2, entitled "Relating to the Establishment of Agreement and Associated Plans for the Broadcasting-Satellite Service," also called for the convening of appropriate conferences. 23 UST 1527, 1821, TIAS 7435. Further authorization was contained in Article 54 of the 1973 ITU Convention and in Resolution No. 27 of the 1973 ITU Conference.

World Administrative Radio Conference in 1979. . . ."[93] The negotiators identified their work as "planification."[94]

The 1977 WARC BS in formulating its "Plan" for the use of the identified frequencies in the several regions took into account "All the technical parameters necessary for the purpose of ensuring the optimum use of available resources. Among these parameters we can quote the frequency, the position, the power, the direction of the antenna beam and the beam width, etc. The position is always indicated in the Plan, whether it is on the earth or orbital. In the case of the geostationary orbit the term 'nominal orbital position' is used. The indication of this nominal position means that the use of this part of an orbit for a transmitter is compatible with an operation of the system free of interference to or from other users."[95] Butler also indicated that "The mention of this position does not, from the ITU point of view, constitute an appropriation." The "Plan" takes into account country symbol and IFRB Serial Number, nominal orbital position in degrees, channel number, boresight geographical coordinates in degrees and tenths of a degree, antenna beamwidth, orientation of the ellipse, polarization, "E.i.r.p. in the direction of maximum radiation in dW," and remarks. Considerations relating to antenna beamwidth and orientation of the ellipse are specified

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[93]Richard E. Butler, "World Administrative Radio Conference for Planning Broadcasting Satellite Service," 5 Journal of Space Law 94 (1977). He also stated that "thus, it can be said that the outcome of the conference is binding on all members." Ibid.

[94]Seventeenth Report by the International Telecommunication Union on Telecommunication and the Peaceful Uses of Outer Space, submitted to the Committee on Peaceful Uses of Outer Space (COPUOS), U.N. Doc. A/AC.105/213, p. 27, 22 December 1977.

[95]Butler, op. cit., p. 98.

in further detail.[96]

The Conference was able to plan frequency assignments for the broadcasting-satellite service for Regions 1 and 3, but was not able to arrive at a plan for Region 2 consisting of the Americas. For Region 2 it was considered that the technical bases for sharing conditions between the broadcasting satellite service and the fixed-satellite service, e.g., telecommunication satellites, were in need of further delineations. It was determined for both of these services that planning could best be accomplished through the convening of a Regional Conference to meet no later than 1982. According to Butler "The results of that proposed Regional Conference will necessarily conform to the principles of the 1977 Conference and the Radio Regulations."[97] The preparatory work for the Conference, the negotiations, and the "Plan" put forward in the Final Acts were heavily influenced by the terms of Article 33 of the 1973 ITU Convention.[98]

The 1977 Conference was convened to plan the equitable, effective, and economical use of the broadcasting-satellite service in frequency bands 11.7 - 12.2 GHz (in Regions 2 and 3) and 11.7 - 12.5 GHz (in Region 1). Its charge was to establish the sharing criteria for the identified bands between the broadcasting-satellite service and the other services to which these bands are allocated, to plan for the

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[96] U.N. Doc. A/AC.105/213, pp. 27-28. "E.i.r.p." is equivalent isotropically radiated power. It is the product of the power of an emission as supplied to an antenna gain in a given direction relative to an isotropic antenna.

[97] Butler, op. cit., p. 95.

[98] Supra, p. 6.

broadcasting-satellite satellite service in the indicated bands; to establish procedures to govern the use of these bands by the broadcasting-satellite service and by the other services to which the bands have been allocated, and to consider expert studies relating to the possible re-arrangement of the existing Radio Regulations and the Additional Radio Regulations.[99]

Although the 1977 Conference has been characterized by "planification" for the sharing of radio frequencies in an essentially limited frequency area, nonetheless the ITU engaged in procedures to "govern the use" of the identified bands.[100] It bears repeating that the Conference considered that the 1979 WARC "should be asked to incorporate these Final Acts as an integral part of the Radio Regulations."[101] Moreover, "when the final Acts are incorporated in the Radio Regulations, they will be binding on all Members, on the same footing as the Telecommunication Convention to which the Radio Regulations are annexed."[102]

The 1977 Conference accepted as principles a number of propositions that have been previously identified with ITU Conventions and prior Radio Regulations. Among these are: the equitable, effective, and economical use of the linked orbit-spectrum, the equal rights of all countries, the view that the geostationary satellite orbit and the radio frequency spectrum are limited natural resources, no permanent priority for a nation-state to be obtained by the registration with the ITU of

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[99] Final Acts, Preamble, p. 1

[100] U.N. Doc. A/AC.105/213, p. 5.

[101] *Ibid.*

[102] *Ibid.*

frequency assignments for space radiocommunication services and their use, such registration not to constitute an obstacle to the establishment of space systems by other States, and registration of frequency assignments for space radiocommunication services by one country should allow for sharing in a practical way with new space systems of other countries who wished to engage in such a sharing. The Conference also was guided by the terms of Paragraph 428A of the 1971 Radio Regulations dealing with "spillover" of broadcasts into a member State other than the country of dissemination.[103]

A technically complex and critically important problem that was finally overcome at the Conference related to the avoidance of interterence between regions. Necessitated was a sharing between regions of given frequencies. Protection was required for Region 2, where the planned fixed service will operate with low power flux densities, from interference by broadcasting satellites serving Regions 1 and 3. In its 17th Report to COPUOS the ITU indicated:

> The problem was especially critical for satellites situated on the orbital axis above the Atlantic, since broadcasting-satellites are situated further to the west than the region to be served (owing to lack of illumination of solar cells during equinoctial eclipses) and in the case of the Atlantic can cause problems in the Americas, particularly Brazil.
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> After a long discussion, it was decided that Regions 1 and 3 should use the orbital positions between 37°W and 146°E. In addition, supplementary attention was provided for the transmitting antenna

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[103] Ibid., pp. 5-6. Paragraph 428A provides that "in devising the characteristics of a space station in the Broadcasting-Satellite Service, all technical means available shall be used to reduce, to the maximum extent practicable, the radiation over the territory of other countries unless an agreement has been previously reached with such countries." 23 UST 1527, 1648, TIAS 7435.

> of broadcasting-satellites (5 dB for the sidebands). Furthermore, assignments to the satellites most likely to cause interference were made for preference in the band between 12.2 and 12.5 GHz, which is not allocated to the fixed-satellite service in Region 2. Annex 11 to the Final Acts gives the limits of power flux density produced in Region 2 and a check point situated in Brazil.[104]

The 1977 WARC BS produced an agreement consisting of 16 articles in the Final Acts, 11 annexes, a Final Protocol, 9 Resolutions, and 8 Recommendations.[105]

Article 1 consists of general definitions. It uses the expression "Frequency assignment in accordance with the Plan," and this is defined as "Any frequency assignment which appears in the Plan for which the procedure of Article 4 of the Final Acts has been successfully applied."[106]

Article 2 refers to the frequency bands dealt with at the Conference, as well as "to the other services to which these bands are allocated, so far as their relationship to the broadcasting-satellite service in these bands is concerned."

Article 3 imposes on States situated in Regions 1 and 3 the duty to operate their broadcasting-satellite space stations on radio frequencies specified in the "Plan." States in Region 2 are to apply interim provisions contained in Article 11 of the Final Acts. Further the members agreed not to "change the characteristics specified in the Plan, or establish new broadcasting-satellite space stations or stations in the other services to which these frequency bands are allocated, except

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[104] U.N. Doc. A/AC.105/213, p. 7.

[105] Final Acts, Intertelecommunication Union, Geneva, 1977.

[106] Italics added. Attention is called to this terminology, since the IFRB has been charged with making allocations of frequencies.

as provided in the Radio Regulations and the appropriate Articles and Annexes of these Final Acts."

Article 4 is entitled "Procedure for modifications to the Plan." Noteworthy in this complex article is the fact that the term "modification" covers the inclusion or cancellation of a frequency assignment.

Annex 10, entitled "Orbital Position Limitations," provides detail for the application of Article 4 in achieving modifications of the "Plan." Member States are to observe the following criteria in respect to limitations on orbital positions:

1. No broadcasting-satellite serving an area in Region 1 and using a frequency in the band 11.7 - 12.2 GHz shall occupy a nominal orbital position further West than 37°W or further East than 146°E.

2. Any new nominal orbital position in the Plan in the range of orbital arc between 37°W and 10°E associated with a new assignment, or resulting from a modification of an assignment in the Plan, shall be coincident with, or within 1° to the East of, a nominal orbital position in the Plan at the date of entry into force of the Final Acts.

Annex 10 also takes into account the use of a new nominal orbital position not coincident with any nominal orbital position in the "Plan" at the date of entry into force of the Final Acts. Such a use would be associated with a reduction in orbital activity on the part of the space resource State.

Article 5 deals with giving notice to the IFRB of frequency assignments for recordation in the Master Register for Broadcasting-Satellite Service in Regions 1 and 3. The notice must reach the IFRB not earlier than three years before the date on which the assignment is to be brought into use and not later than 90 days before that date. The Article also makes provision for the cancellation of entries in the Master Register.

Article 6 sets out procedures relating to frequency assignments to terrestrial stations affecting the frequencies dealt with at the Conference. The technical complexity of the problem is indicated by the fact that 56 paragraphs are required to deal with the subject.

Article 7 deals with procedures leading to the recording in the IFRB's Master International Frequency Register of frequency assignments to stations in the Fixed-Satellite Service in the 11.7 - 12.2 GHz frequency band for Region 2 when such assignments are to broadcasting-satellite stations in accordance with the "Plan." Over 30 paragraphs in the Final Acts focus on coordination to be effected by ITU members on this subject.

Article 8 contains miscellaneous provisions relating to IFRB procedures. Article 9 contains procedures to protect terrestrial services in Regions 1 and 3 from interference from broadcasting-satellite space stations in Region 2. Article 10 is designed to protect space services in Region 2 from interference by broadcasting-satellite space stations of Regions 1 and 3. Article 11 identifies the nine items appearing in the column headings of the "Plan."[107]

Article 12 is of particular interest to the United States since it relates to Region 2. The article purports to deal with the broadcasting-satellite service pending the establishment of the detailed "Plan" for this region at the Regional Conference to be convened no later than 1982. The article constitutes interim provisions. Continuing the ITU's association of frequencies and orbits it is provided that "Space stations in the broadcasting-satellite service shall be located in the following

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[107]See footnote 94 supra.

portions of the orbit":

> 75°W to 100°W longitude (however, for service to Canada the USA and Mexico, the elevated portion shall be only between 75°W and 95°W longitude);
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> 140°W to 170°W longitude.

The article also provides that space stations in both the broadcasting-satellite service and in the fixed-satellite service may be located in specified orbital areas. Such space systems in the 11.7 - 12.2 GHz frequency band are to use "to the maximum extent technically and economically practicable, available techniques in order to make the most efficient use of the geostationary orbit and the frequency spectrum." Article 13 deals with the approval of the Final Acts. Article 14 contains a promise of the ITU membership to "endeavor to agree on the action required to reduce harmful interference which might be caused by the application of these provisions and the associated plan." Article 15 states that the Final Acts are to enter into force on January 1, 1979. This date has to be weighed against the fact that the WARC to be held in 1979 is to be asked to incorporate the Final Acts into the Radio Regulations as an integral part of them.

Article 16 asserts that the provisions and the associated "Plan" have been designed for the future and that the agreement should be binding for a period of 15 years or until revised by a duly constituted Administrative Radio Conference.

Annex 1 to the Final Acts of the 1977 Conference sets criteria to be used in determining whether a service is considered to be affected by a proposed modification of the "Plan." Annex 2 specifies the basic characteristics to be furnished in notices relating to space stations in

the broadcasting-satellite service.[108] Annex 3 deals with a method for determining the limiting interfering power flux density in specific situations. Annex 4 identifies the need for coordination of a fixed-satellite space station or a broadcasting-satellite space station in Region 2 with respect to Article 7 of the "Plan." Annex 5 also deals with power flux density as related to Article 9.

Annex 6 is entitled "Planning principles in Region 2." In this Annex the members of the ITU provide instructions for States located in Region 2 and to the regional conference to be convened to deal with the 11.7 - 12.2 GHz band. In keeping with the ITU's association of radio frequencies with orbital positions reference was made to "equitable rights of access to the geostationary orbit spectrum resource." Although the Final Acts do not provide a definition for the expression "Geostationary orbit spectrum resource," paragraph 4 of this Annex states:

> Subject to the provisions of the Convention, the Radio Regulations and the Resolutions in force, it is recognized that all administrations have the right of access to the geostationary orbit spectrum resource in order to fulfill their requirements.[109]

Undoubtedly, the quoted language is consistent with the ITU position that both the position in space occupied by a space object and the radio frequency employed in broadcasting from such a space object are natural resources legally available for the use of all States.

Annex 6 also advises Region 2 States that the forthcoming regional plan is to make provisions for the efficient use of the geostationary orbit

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[108] Because of the relevance of the identified criteria to possible future allocations of frequencies at the lower GHz range, the criteria are included in Annex 1 to this Chapter.

[109] The term is not defined in the 1971 WARC ST.

and the spectrum. Thus:

> The plan for Region 2 shall use, to the maximum extent technically and economically practicable, the techniques available so as to make the most efficient use of the geostationary orbit and the frequency spectrum to fulfill the requirements both of the Region as a whole and of the individual administrations.

Annex 7 acknowledges that the shared "use of the spectrum/orbit resources" in Region 2 poses problems for two services, namely, the broadcasting-satellite and the fixed-satellite. This annex identifies ten techniques suited to the efficient exploitation of the "spectrum/orbit resource."[110]

The 16 pages of Annex 8, entitled "Technical Data Used in Establishing the Provisions and Associated Plan and which should be Used for Their Application," attest to its complexity. This Annex identified disagreement among member States on the subject of polarization. Thus, the United States expressed concern over the acceptance of circular polarization for the broadcasting-satellite service. The United States "indicated that the very probable adoption of linear polarization by the fixed-satellite service would preclude the use of cross-polarization to facilitate sharing between the two space services and would affect orbit and spectrum utilization within the Region."[111] Iran "expressed a reservation regarding the adoption of circular polarization for planning the broadcasting-satellite service in Region 3 and states its intention to use linear polarization."[112]

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[110] These techniques are set out in Annex 2 to this Chapter.

[111] Final Acts, Annex 8, p. 5.

[112] Ibid.

This Annex provided an additional set of definitions, one being "nominal orbital position." This is identified as "the longitude of a position in the geostationary satellite orbit associated with a frequency assignment to a space station in a space radiocommunication service. The position is given in degrees from the Greenwich meridian."[113]

This Annex also deals with orbital spacing and with satellite station keeping. The Annex refers only to the "Plan" for Regions 1 and 3, and indicates general acceptance of "nominal orbital positions spaced uniformly at intervals of 6°."[114] As to station keeping it is stated that "space stations in the broadcasting-satellite service must be maintained in position with an accuracy of better than ± 0.1° in both the N-S and E-W direction. (These tolerances lead to a maximum excursion of ± 0.14° from the nominal satellite position.)"[115]

Annex 11 sets out technical methods for the calculation of power flux density produced in the territories of Region 2 by space stations in the broadcasting-satellite service in Regions 1 and 3. This Annex contains a table identifying 88 orbital positions assigned in the "Plan" which orbital positions occupy the area from 37°W to 5°E and channels 1 to 25. These assigned orbital positions pertain to broadcasting space stations of Regions 1 and 3.[116]

Resolutions A through I deal generally with the acceptance of the work of the 1977 Conference by the 1979 WARC and with the expectation

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[113] Ibid., p. 2.

[114] Ibid., p. 14.

[115] Ibid.

[116] Ibid., Annex 11, pp. 2-6.

that the Final Acts of WARC BS would enhance the beneficial uses of the radio spectrum. Several deserve mention. Thus, Resolution A resolved that "the 1979 World Administrative Radio Conference be requested to annex the provisions and associated Plan to the Radio Regulations as an integral part thereof, in the form and to the extent it deems most appropriate without thereby affecting their content or integrity." Resolution B has express legal significance. The 1977 Conference resolved that "both during this interim period and after the date on which they have been annexed to the Radio Regulations, the provisions and the associated Plan shall retain their integrity as a legal instrument; that during this period the IFRB and the other appropriate organs of the Union shall be guided by the provisions of these Final Acts and the Radio Regulations."

Resolution C dealt with the updating of the Master International Frequency Register for Regions 1 and 3. Resolution D was concerned with the Register in Region 2. Resolution E dealt with the same subject. Resolution F connected frequencies with the geostationary orbit. This resolution took note of the fact that WARC BS had established a "Plan" designating frequency bands and positions in the geostationary orbit for Regions 1 and 3. It stated that the Conference expected that the Region 2 Conference would design a similar "Plan." It took note of the fact that the operation of space radiocommunication services in the indicated frequency bands in orbits other than the geostationary orbit would be incompatible with the efforts of the Conference. The conclusion was that member States "shall ensure that their space stations in these frequency bands are operated in the geostationary orbit and no other."

Resolution G called upon the International Radio Consultative Committee (CCIR), a technical body of the ITU, to assist in the planning of the Region 2 Conference. Resolution H reidentified the goals of the Region 2 Conference, e.g., that it is to "draw up a detailed plan for the orbit spectrum resource," and that "the plan is to provide for the detailed assignment of the orbital positions and frequency channels available, ensuring that the broadcasting-satellite service requirements of the various administrations are met in an equitable manner satisfactory to all the countries concerned." The IFRB was invited to request the States participating in the Region 2 Conference to submit their requirements at least one year prior to the convening of the Conference. Resolution I dealt with the collection of data on the functioning of the "Plan" for Regions 1 and 3.

The Recommendations were directed in large part to the 1979 WARC. Recommendation AA invited the CCIR to study spurious emissions in the broadcasting-satellite service. Recommendation BB asked the CCIR to submit information relating to transmitting antennae for the same service. Recommendation CC asked the CCIR to submit information on propaganda at 12 GHz for the same service. Recommendation DD invited the CCIR to study polarization characteristics of receiving antennae of space stations with the view of obtaining protection for the up-links of systems for satellites occupying a given position in the geostationary orbit. Recommendation EE asked member States to estimate the future technical requirements for up-links. Recommendation FF asked the CCIR to study the interdependence of receiver design, channel grouping, and sharing criteria. Recommendation GG took into account that frequency band

23.6 - 24 GHz had been allocated to the radio astronomy service on a primary basis. The Conference recommended that space stations be designed in such a manner as to reduce the radiation level of the second harmonic so that observations by radio astronomers would not be seriously disturbed. Recommendation HH recommended that the forthcoming Region 2 Conference "draw up a detailed plan for the orbit/spectrum resource available for the broadcasting-satellite services in the 11.7 - 12.2 GHz band." The recommendation is notable for its specificity:

> The plan shall provide for the detailed assignment of the orbital positions and frequency channels available, ensuring that the broadcasting-satellite service requirements submitted by the various administrations are met in an equitable manner satisfactory to all the countries concerned. It should be laid down as a matter of principle that each administration in the Region should be guaranteed a minimum number of channels (4) for the operation of the broadcasting-satellite service. Above this minimum, the special characteristics of the countries (size, time zones, language differences, etc.) shall be taken into account.

2.10 Assessment of Role of ITU in SPS Activities

Several broad conclusions can be derived from what has been written above. The ITU, despite some assessments that would constrict it to fairly narrow influences and powers, has staked out for itself a wide-ranging function regarding what has come to be identified as the "geostationary orbit spectrum resource." The ITU's involvement stems from Article 33 of the 1973 Convention, and in particular, relies on the provision that "In using frequency bands for space radio services Members shall bear in mind that radio frequencies and the geostationary satellite orbit are limited natural resources, that they must be used efficiently

and economically so that countries or groups of countries may have equitable access to both in conformity with the provisions of the Radio Regulations according to their needs and the technical facilities at their disposal."[117] The World Administrative Radio Conferences, and in particular WARC BS of 1977, confirm the ITU's efforts to realize the foregoing commitment. It is to be expected that the 1979 WARC and the proposed Region 2 Conference prior to 1982 will arrive at important decisions as they seek to put into operation the foregoing concepts.

In the mass of complex and technical documentation produced by the ITU and its radio conferences the theme is constantly repeated that all nation-states have a right of access to the geostationary orbit spectrum resource. Hence, the ITU is engaged in implementing the guarantee set forth in the 1967 "Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and other Celestial Bodies."[118] Article 1, paragraph 2 provides:

> 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.

Since the ITU has expressed a concern for the equitable access to the space resource by countries, including the needs of the less-developed countries, Article 1, paragraph 1 of the Principles Treaty is also relevant. It provides:

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[117] TIAS 8572, pp. 35-36.

[118] 18 UST 2410, TIAS 6347. The treaty entered into force for the United States on October 10, 1967. It will be referred to hereafter as "Principles Treaty." See Appendix A.

> 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.

Operating on the premise that the frequency/orbit resource is both international, natural, and limited the ITU has endeavored to effect an orderly disposition of the linked resource. This has taken the form of seeking to avoid harmful interferences. This has involved a vast amount of coordination by the IFRB as it has engaged in its function of receiving national assignments of frequencies, in according registration and notice, and in making service allocations. The ITU has focused on the duty of its member States to use the allocations that have been made. Failure to use can result in possible loss of registration. This has rendered somewhat less meaningful than prior to 1973 the claim that priorities could be established through the "first come - first served" concept. In this situation the earlier rather abstract discussions are giving way to practical considerations in which the technical needs of States and the special competence of the IFRB play a role. Whenever there is competition for a given resource, and advantages are to be derived from its use, there emerges a need for some kind of administrative process and entity. For the time being the ITU has accepted the role of such a central and community-oriented intergovernmental institution.

The ITU is not the only world organization that is involved in the management of the space resource. In comparison with the UN, the ITU has been identified as a primarily technical body with the UN being a primarily political body.[119] Nonetheless, there have been points of

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[119] David M. Leive, The Future of the International Telecommunication Union, op. cit., p. 42.

competition. It has been suggested that the ITU possesses special competence in "the regulation of the technical and operating aspects . . ." of space activities.[120] While the UN is seen as the institution for debating and reaching a consensus on international legal aspects of space activities, it is considered that in working together they "have shown a realistic appreciation for the interdependence of technology, institutional requirements, and the legal implications of space programs."[121]

In the ITU's report to the legal sub-committee of COPUOS in 1977 relating to the work of the 1977 WARC BS it was noted that "no doubt the member countries concerned will ask for the appropriate consideration when the definition of outer space is taken up by the Sub-Committee."[122] The foregoing has been interpreted to mean that "the subject of sovereign claims over portions of the geostationary orbit was related to the definition of outer space . . . and that the question was properly one for consideration by the Legal Sub-committee rather than the International Telecommunication Union."[123]

In fact, the UN has long been involved in seeking to obtain a clarification of the relationship between the legal regimes applicable

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[120] A. L. Moore, "Direct Broadcast Satellites by Treaty or Regulation: The Committee on Peaceful Uses of Outer Space v. the ITU," Proceedings of the 19th Colloquium on the Law of Outer Space 349 (1977).

[121] Ibid.

[122] Butler, "World Administrative Radio Conference for Planning Broadcasting Satellite Service," op. cit., p. 98. This statement follows Mr. Butler's observation that "The indication of this nominal position means the use of this part of an orbit for a transmitter is compatible with an operation of the system free of interference to or from other users. The mention of this position does not, from the ITU point of view, constitute an appropriation."

[123] Eilene Galloway, "Present Status in the United Nations of Direct Television Broadcast Satellites," 2 Annals of Air and Space Law 275 (1977).

to the sovereign area of airspace[124] and the non-sovereign areas of outer space, the Moon, and other celestial bodies.[125] As noted in the Introduction, the United Nations through its Ad Hoc Committee on the Peaceful Uses of Outer Space began in 1959 to consider the boundary between space and airspace. Although the subject received occasional reference at the UN prior to 1967 it was not until that year that the issue became an agenda item for the legal subcommittee of COPUOS. Even then the problem was not given careful scrutiny until 1977. The focus of the subcommittee on this subject is illustrated in the successive agenda titles. In 1970 the subcommittee received a background paper from the UN Secretariat entitled "The Question of the Definition and/or the Delimitation of Outer Space," which in large part dealt with the spatial approach to the subject.[126] In 1977 the chairman of the subcommittee assigned the following title to the agenda: "Matters relating to the definition and/or delimitation of outer space and outer space activities."[127] This was changed in 1978 by the legal subcommittee to "Questions relating to the definition and/or delimitation of outer space and outer space activities, also bearing in mind questions relating to the geostationary orbit."[128]

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[124]Convention on International Civil Aviation of December 7, 1944. 3 Bevans 944, TIAS 1591. This agreement entered into force for the United States on April 4, 1947.

[125]"Principles Treaty," Article 2.

[126]U.N. Doc. A/AC.105/C.2/7, 7 May 1970.

[127]U.N. Doc. A/AC.105/196, 11 April 1977.

[128]U.N. Doc. A/AC.105/218, 13 April 1978.

The styles and decisional processes of the ITU and the UN are different. As a specialized agency of the UN the ITU has for many years developed procedures and processes to deal with radio frequencies. The ITU uses a Plenipotentiary Conference scheduled to meet at regular intervals and normally every five years. It conducts periodic administrative conferences to issue specific regulations. It has an administrative council of 36 members and an experienced general secretariat. Its IFRB and the International Radio Consultative Committee (CCIR) are staffed by experts.[129]

The ITU's decisional process is manned by technicians representing member States who work with the specialists of the ITU. Presumably the national technicians interrelate with politically oriented decision makers in their home States before they engage the procedures and processes of the ITU. The impression exists that the ITU in the totality of its operations is weighted more in the direction of technical feasibility than in the direction of a balancing of competing political interests. The ITU, although certainly not immune from the pressures of competing ideologies and the differing interests of the new and the old States, is separated from the great concerns for the maintenance of international peace and security that reside in the UN.

Outer space decisions at the UN are focused in COPUOS. It has two subcommittees, namely, legal and scientific and technical. Each establishes working groups to assist in the preparation of draft

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[129] For an assessment of ways to strengthen the ITU see "The Future of Satellite Communications, Resource Management and the Needs of Nations, Second Report of the Twentieth Century Fund Task Force on International Satellite Communications," pp. 21-27 (1970).

international agreements. Reports are received by COPUOS from the ITU, other specialized agencies, and from a variety of non-governmental organizations, such as the Committee on Space Research (COSPAR) of the International Council of Scientific Unions (ICSU). It also receives statements from the International Astronautical Federation (IAF) and works with the UN Secretariat. When COPUOS agrees on a draft treaty the matter is referred to the First Committee of the General Assembly. If the First Committee supports the draft it is submitted to the General Assembly for its approval. Obtaining the latter's approval the agreement is submitted to member States for their approval. Thus, for such an agreement to enter into force it has been necessary for a very considerable consultation to have been effected between decision makers having both legal-political perspectives and also scientific and technological outlooks. However, in contrast with the ITU, it is clear that there is a heavier weighting of legal-political outlooks at the UN. Because legal-political considerations must always press heavily on scientific and technological facts and interests, it is possible that the larger involvement at this time by the ITU in the matter of the orbital patterns of geostationary space objects will not preclude the UN from claiming a dominant involvement. It is doubtful that the ITU has preempted the subject of orbital slots. Of necessity both of these international organizations will have to consult and cooperate with each other in arriving at international agreements on this subject.

The utilization of the geostationary orbit will depend on the characteristics of this world natural resource. Since 1973 the position of the ITU has consistently been that the resource is a <u>limited</u> resource.

The ITU operates on the basis that the radio frequency spectrum is a limited world resource, places the radio broadcast facility on the space object in geostationary orbit, and links the limitedness of the radio spectrum to the asserted limitedness of parking slots for geostationary space objects. Attention will next be given to the issue whether the orbital slot suited to radio broadcasts is in fact a limited natural resource, in the sense of imposing large constraints upon the effective use of radio broadcasts emanating from space objects in geostationary orbit, and, if so, the nature or extent of such limitations. Political and legal considerations will affect the use of any resource whether plentiful or limited.

ANNEX 1

BASIC CHARACTERISTICS TO BE FURNISHED IN NOTICES RELATING TO SPACE STATIONS IN THE BROADCASTING-SATELLITE SERVICE

1. Country and IFRB number
2. Nominal orbital position (in degrees from the Greenwich meridian)
3. Assigned frequency or channel number
4. Date of bringing into use
5. Identity of the space station
6. Service area (if necessary, the service area may be defined by a number of "test points")
7. Geographical coordinates of the intersection of the antenna beam axis with the Earth
8. Rain-climate zone
9. Class of station
10. Class of emission and necessary bandwidth
11. Power supplied to the antenna (Watts)
12. Antenna characteristics
    - gain of the antenna referred to an isotropic radiator
    - shape of the beam (elliptical or circular)
        - major axis (degrees) at -3 dB points
        - minor axis (degrees) at -3 dB points
    - orientation of the ellipse
    - ΔG (difference between the maximum gain and the gain in the direction of the point in the service area at which the power flux density is at a minimum)
    - pointing accuracy
    - type of polarization
    - sense of polarization
    - radiation pattern and cross-polar characteristics

ANNEX 2

Use of the Spectrum/Orbit Resource

Since the equal sharing of the spectrum/orbit resource between the broadcasting-satellite service and the fixed-satellite service in Region 2 is inherently difficult and may impose some restrictions on both services, it is important that the technical parameters be chosen, and the techniques for efficient use of the spectrum/orbit resource be applied in such a way that both space services will benefit as much as possible.

The following techniques are among those identified as leading to a more efficient use of the spectrum/orbit resource and should therefore be applied to the maximum extent technically and economically practicable consistent with the capability of systems to fulfill the requirements for which they were designed.

1. Clustering
2. Cross-polarization
3. Crossed-beam geometry
4. Paired service areas
5. Frequency interleaving
6. Minimum space station spacings
7. Space station antenna discrimination
8. Earth station antenna discrimination
9. Minimizing e.i.r.p. differences*
10. Realistic quality and reliability objectives

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*See footnote 96 for definition.

Chapter Three

INTERNATIONAL SPACE LAW AND THE USE OF NATURAL RESOURCES: ORBITAL POSITIONS

3.1 The Orbital Position as a World Natural Resource

International space law deals with man's activities in the space environment, including the use of the natural resources of the space environment. Focus will be given here to the geostationary orbital position as a world natural resource. Attention will be given later to the use and exploitation of solar energy at geostationary orbital heights. Both subjects have a similar characteristic. In effect, each resource is consumed but renews itself so that its use does not deplete it. Resources of this kind traditionally have been open to common use and constitute a *res communis*. Thus, they are not open to ownership in the sense of exclusivity of use by a claimant, but rather are available for the use of all. The traditional international law of the sea is based on the foregoing principle. This concept was captured in Article 2 of the Principles Treaty, which provides that "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."

3.2 The Debate over the Number of Orbital Positions

In a mechanical sense it might be supposed that the space available for space objects in geostationary orbit would be a limited natural resource.

Thus, if such space objects were to be obliged to maintain a distance of 2° from each other while in orbit above the equator, then no more than 180 such space objects would ever have safe access to or a presence at geostationary level.[1] However, such a simplistic approach must give way to the practical prospect of using one space object in one orbital slot for a multiplicity of functions thereby extending its performance. It has been suggested that 1,800 space objects could function simultaneously at the geostationary height.[2] The antennas on communications satellites have been small. That of Intelsat IVA was 1.27x1.27 m. That of Intelsat V was 2.44 m. That of the ATS-6 was 9 m.[3] It has been proposed that the microwave antenna for a geostationary space object broadcasting on a 2.45 GHz frequency would be 1 km in diameter.[4] However, much larger solar panels are needed on a SPS to capture solar energy for conveyance to the microwave antenna and ultimately to Earth. Both types

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[1]The figure of 180 satellites placed along the equator was mentioned by the Colombian delegate to the Legal Sub-committee of COPUOS on March 31, 1977. U.N. Doc. 105/C.2/SR.277, p. 3, April 5, 1977.

[2]This is based on the following proposition: "The circumference of the geostationary orbit is approximately 165,000 miles. A one-degree segment of this orbit is about 460 miles. If satellite station-keeping were good to about ± 0.1 degree (actually it can be maintained more precisely), then one degree of orbit space could hold five satellites with virtually no danger of collision, and the full 360° could accommodate 1,800 satellites. Actually, since the geostationary orbit has considerable depth and width and present satellites range between ten and twenty feet in diameter, the orbit could physically accommodate a much greater number without collision. The question of orbital slot scarcity thus has little to do with purely physical limitations." Walter R. Hinchman, "Issues in Spectrum Resource Management," in The Future of Satellite Communications, Resource Management and the Needs of Nations, The Twentieth Century Fund, p. 52 (1970).

[3]Burton I. Edelson and Walter L. Morgan, "Orbital Antenna Farms," 15 Astronautics & Aeronautics, No. 9, p. 22 (September 1977).

[4]MSFC-JSC, "Solar Power Satellite Baseline Review, (Preliminary)," p. 16, NASA, Washington, D.C. (July 13, 1978).

of panels would considerably reduce the amount of collision-free space for geostationary orbits. Thus, the gallium arsenide array could measure 4800 m x 9600 m, with a blanket area of 44.31 km^2 and a planform area of 45.08 km^2. A silicon array could measure 5200 m x 10400 m, with a blanket area of 52.34 km^2 and with a planform area of 54.08 km^2.[5] Another estimate of the size of the collecting area of a photovoltaic system on a geostationary space object is between 100 and 200 km^2.[6] The silicon solar cells consist of "two extremely large arrays."[7] Following the photovoltaic concept the usual design of this panel "consists of rectangular arrays about 2.7 mi x 3.2 mi (4.3 km x 5.2 km) separated by a microwave transmitter."[8] Glaser suggests different dimensions for the photovoltaic solar cell where 5,000 MW are to be produced. This would require a space object measuring "about 4 kilometers by 11 kolometers with a transmitting antenna 1 kilometer in diameter."[9] One hundred units were not considered to be burdensome on the geostationary orbital area.[10] It has been estimated that over 100 space objects employing photovoltaic cells with dimensions of between 100 and 200 km^2 would be required to meet only one-half of the new energy needs of the United States by the year

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[5] Ibid., p. 28 at PD646-78C.

[6] Physical Nature and Technical Attributes of the Geostationary Orbit, U.N. Doc. A/AC.105/203, p. 17, August 29, 1977.

[7] Charles E. Bloomquist, A Survey of Satellite Power Stations, PRC R-1844, PRC Systems Sciences Co., p. 6 (September 1976).

[8] Ibid.

[9] Peter E. Glaser, "Solar Power from Satellites," Hearings before the Subcommittee on Aerospace Technology and National Needs of the Committee on Aeronautical and Space Sciences, U.S. Senate, 94th Cong., 2nd Sess., p. 4 (1976). Cited hereafter as Hearings.

[10] Ibid., pp. 7, 33.

2025.[11] However, only one satellite would suffice to "generate very substantial power for use on Earth."[12] Structures as large as those identified above will be subjected to "orbital perturbations."[13] Stationkeeping and attitude control will be obliged to meet clearly identified legal standards. The distance between such space objects will depend on their size and the methods available to manage their positions.

Viewed in this light, and depending on the scientific and technological capabilities brought to bear on the subject, the contention that the orbital position is a limited natural resource becomes somewhat less meaningful. The issue then turns to the effective management of spectrum and orbit resources.[14]

A principal goal in the management of spectrum resources is to avoid radio interference. Techniques have been devised so that "radio systems can employ the same operating frequencies without mutual interference provided their radio signals are adequately distinguished by location, orientation and breadth of transmission paths, polarization of radiated energy or type of modulation . . . [as well as by] operating at different times."[15]

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[11] U.N. Doc. A/AC.105/203, p. 17, August 29, 1977.

[12] Hearings, op. cit., p. 3.

[13] Ibid., p. 17.

[14] For a basic assessment of spectrum management, see The Radio Frequency Spectrum, United States Use and Management, Office of Telecommunications Policy, Executive Office of the President (1975). The study notes constraints on spectrum management including the fact that the spectrum is limited, it is not elastic, it is not flexible, and it does not follow national boundaries, pp. A-4-6.

[15] Walter R. Hinchman, "Issues in Spectrum Resource Management," in The Future of Satellite Communications, Resource Management and the Needs of Nations, The Twentieth Century Fund, p. 34 (1970).

Hinchman has given careful attention to the view that the spectrum/orbit resource is a limited one. He states that "the so-called scarcity of spectrum/orbit resources is emerging as more myth than fact."[16] The geostationary orbit "may be considered as a thick, broad band of space lying roughly 22,300 miles above the earth's surface, directly above and concentric with the equator."[17] The 1971 WARC ST definition is: "A satellite, the circular orbit of which lies in the plane of the Earth's equator and which turns about the polar axis of the Earth in the same direction and with the same period as those of the Earth's rotation." Further, "the orbit on which a satellite should be placed to be a geostationary satellite is called the 'geostationary satellite orbit.'"[18]

Such space objects are not all in the same circular orbit in the plane of the Earth's equator. Their pattern in space "is an annulus-like three-dimensional corridor in which satellites travel at different speeds, altitudes and inclinations to the plane of the Earth's equator."[19] Thus, while geostationary space objects "tend to group into segments along the geostationary orbit, these enormous volumes [of space occupied per satellite] reduce the possibility of collision to a negligible level. Generally, the availability of physical space is not a matter of concern. Orbit limitation is a problem of electromagnetic interference between

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[16] Ibid., p. 51.

[17] Ibid., p. 52.

[18] Paragraph 84BG, Annex 1, Revision of Article 1 of the Radio Regulations, 23 UST 1527, 1579, TIAS 7435.

[19] James J. Gehrig, "Geostationary Orbit--Technology and Law," Proceedings of the 19th Colloquium on the Law of Outer Space 268 (1977).

satellites using the same frequency band of the radio spectrum."[20]

The size of the space object will, however, affect the possibility of collision. One estimate has been based on a satellite possessing a radius of 25 m. Two space objects having this dimension will have to pass each other by more than double that distance in order to avoid a collision or other possible interference.[21] With 100 satellites of this size in geostationary orbit it is estimated that the collision cross-section would be 0.8 km^2 and with a "total of 200 passages through the equatorial plane per day, there will be less than one collision per 500 years."[22] Thus, for both active and passive satellites of this size the danger of collision is negligible. However, "a totally different picture emerges if large space structures are considered such as those envisaged for collection and transmission of solar energy. Assuming that such a space structure would have an area of 100 km^2, it would suffer one collision on the average of every five years from the hypothetical 100 small inactive satellites, which is signficant because its planned life-time would be about 30 years."[23] Since such collisions would not necessarily result in the destruction of, or even change the motion of the large SPS, it might need only repairs and station-keeping. However, the impact could place the inactive satellites on a new orbit in which it would continue to cut through the geostationary orbit causing more than the first collision.

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[20] Ibid., pp. 268-269.

[21] Physical Nature and Technical Attributes of the Geostationary Orbit, U.N. Doc. A/AC.105/203, p. 7, August 29, 1977.

[22] Ibid.

[23] Ibid.

To optimize the use of the radio spectrum a number of technical procedures may be employed. These have been identified by Hinchman under the heading "design variables," namely:

1. The degree of common frequency usage;
2. The degree to which both satellites illuminate the same area of the earth's surface;
3. Earth station antenna size and design;
4. Antenna polarization;
5. Reversal of frequency assignments;
6. Modulation type and degree; and
7. Interference allowance.[24]

In his view all of the foregoing variables "in all their combinations and variations must be considered in examining the concept of discrete orbital 'slots' and the danger of spectrum/orbit 'scarcity.'"[25] Thus, the availability of radio frequencies must be established. If such frequencies can operate without interference, the space object can be accommodated in orbit.

Gehrig lists ten of the more important technical considerations which allow for an increased use of the geostationary orbit and an enlargement of the number of satellites using the same frequency assignment in an effective way.[26]

The relevance of these technical considerations was accepted by the 1977 WARC BS. It also identified ten processes which would allow

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[24]Hinchman, op. cit., pp. 52-55.

[25]Ibid., p. 55.

[26]Gehrig, op. cit., p. 269.

for an efficient use of the spectrum/orbit resource. Pursuant to Annex 7 "Use of the Spectrum/Orbit Resource," the Conference prescribed that the following techniques should be applied "to the maximum extent technically and economically practicable consistent with the capability of systems to fulfill the requirements for which they were designed":

1. Clustering
2. Cross-polarization
3. Crossed-beam geometry
4. Paired service areas
5. Frequency interleaving
6. Minimum space station spacings
7. Space station antenna discrimination
8. Earth station antenna discrimination
9. Minimizing e.i.r.p. differences
10. Realistic quality and reliability objectives.[27]

With a suitable use of the foregoing elements in the management of the radio frequency spectrum it can be concluded that radio frequencies emanating from space objects located in geostationary orbit need not be

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[27] Final Acts, WARC BS, Annex 7, pp. 1-2. Equivalent Isotropically Radiated Power (e.i.r.p.) is defined as "the product of the power of an emission as supplied to an antenna and the antenna gain in a given direction relative to an isotropic antenna." Final Acts, WARC ST, 23 UST 1527, 1579, TIAS 7435. The 1977 WARC BS Conference agreed to Annex 8 entitled "Technical Data Used in Establishing the Provisions and Associated Plan and Which Should be Used for Their Application." The Conference under the heading of basic technical characteristics, in paragraph 3.10 referred to the "Plan" for orbital spacing for Regions 1 and 3. This was "based generally on nominal orbital positions spaced uniformly at intervals of 6°." Reference was also made to satellite station-keeping, as follows: "Space stations in the broadcasting-satellite service must be maintained in position with an accuracy of better than ± 0.1° in both the N-S and E-W direction. (These tolerances lead to a maximum excursion of ± 0.14° from the nominal satellite position.)." Final Acts, WARC BS, Annex 8.

a limited natural resource. Experiments have been conducted for many years to determine how best to use the radio spectrum, including a determination of "the minimum angle of separation possible."[28] Smith has observed that "as with other problems of this type, the technical solution to the problem of over-crowding of orbital positions will only prove effective to the extent that a political accord has been reached."[29]

In analyzing the assessments that have been made as to the number of orbital positions, it should be kept in mind that the effective use of such positions is more important than the specific number of positions. Such positions can be extended in a practical sense through allocating additional frequencies and installing more broadcast capabilities on each space object. Each broadcast can be focused on a relatively limited area so as to avoid harmful interference. With the installation of a second satellite system frequencies could be reversed so that a higher frequency band could be employed for up-links and a lower frequency for down-links. Present technology allows for enlargement of broadcast capabilities through antenna polarization, variable types and degrees of modulation, and establishing lower standards for noise without violating harmful interference expectations. While, from the scientific and technological perspective, it "seems likely that the spectrum/orbit resources are potentially adequate to meet almost any demand at present conceivable,"[30] this position has not obtained universal international acceptance. Evidence of the unresolved issue of the number of effective

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[28] D. D. Smith, International Telecommunications Control 161 (1969).

[29] Ibid.

[30] A. Chayes and Others, Satellite Broadcasting 17 (1973).

orbital slots available at geostationary level is a statement of the head of the Outer Space Division of the United Nations in October 1978. He indicated that despite a careful review of all present factual information that it was wholly impossible to place a number on the useful geostationary orbital positions.

3.3 The Application of International Space Law to Orbital Use

From the political-legal point of view some States have taken the position that the mere use of an orbital slot by a space object may constitute an appropriation of this portion of the space environment in violation of Article 2 of the Principles Treaty. To this concern that nation-states would preempt a common world resource some of the non-space resource States have advanced the view that the ITU should have the authority to register allocations of orbital slots. This last position seeks to link the powers of the ITU in the area of allocating and registering radio frequencies with the associated subject of orbital slots. To complicate matters on December 3, 1976, eight equatorial States put forward their views relating to special national rights at geostationary levels. All of these three situations, namely, national claims relating to the use of the radio spectrum, to the use of orbital slots, and to special rights at geostationary levels, have enlarged the role of law and politics relating to the spectrum/orbit resource.

The 1967 Principles Treaty was designed to facilitate the exploration and use of the space environment "on a basis of equality and in accordance with international law."[31] In encouraging States to engage

[31]Article 1, paragraph 2. See also Article 3.

in space activities the treaty also sought to provide for the orderly use of the resources of the space environment. Thus, resource States that have placed geostationary space objects into orbit have taken the position that this activity is a use foreseen by the Treaty. Since the Treaty prohibits an appropriation of the space environment, or parts thereof, States operating geostationary space objects in orbit have maintained that they are engaged in a use and not a permanent appropriation. This position is buttressed by the fact that a space object cannot be absolutely maintained at a given orbital position, although a proximate position can be maintained with the aid of station-keeping procedures. Also, orbital positions cannot be maintained permanently by a space object, since the object or its component parts wear out. While Intelsat IV has a projected lifespan of 10 years, a lifetime of up to 30 years would be preferred for the SPS. When the satellite becomes unproductive it is transferred out of the geostationary orbital position and becomes unoperational. Further, for an "appropriation" to take place there must be such an intent by the launching State. Absent such an intent under present international law the space environment is being treated as a res communis. Therefore, at the present time the proposition is tenable that it is possible to use the orbital resource without owning it, e.g., without either having or obtaining a vested property right in such a resource.

It has been suggested, especially by equatorial States, that the presence of a nation's space object in geostationary orbit constitutes a de facto occupation of the orbital slot. Additionally, in 1969 in commenting on the provisions of Article 2 of the Principles Treaty,

which denies to States the right to appropriate the space environment, a representative of France at COPUOS urged that this provision implied a limitation on the complete freedom of States in space. He stated:

> In fact, the very use of geostationary satellites can be regarded as an "appropriation" of the equatorial orbit, which is a privileged portion of space. In return for such a de facto occupation, the State responsible for the satellite should agree to submit to certain rules. The same applies to the use of a frequency band for broadcasting. . . .[32]

In reply to this position the representative of the United States said:

> . . . the use of space or a celestial body for activities that are peaceful in character and compatible with the provisions of the Outer Space Treaty is, by definition, entirely legitimate. Using a favorable orbit for a legitimate activity cannot reasonably be classified as a prohibited national appropriation in the sense of Article II.
>
> The point I wish to make is that using a favorable geostationary orbit is no more an "appropriation" or "de facto occupation" than using a particularly favorable area of the lunar surface . . . for a manned landing.[33]

If, as suggested, a primary purpose of the Principles Treaty was to allow States to enjoy the peaceful use of the space environment, then the intent of a using State becomes important. If the intent is not an intent to assert an exclusive right to a given use, and if that use is designed to and is carried out, as provided in Article 1 of the Principles Treaty, "for the benefit and in the interests of all countries . . ."

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[32] U.N. Doc. A/AC.105/62, pp. 3-4 (June 1969).

[33] United States Delegation to the Second Session of the Working Group on Direct Broadcast Satellites, Statement made by United States representative Herbert Reis at the Working Group Meeting, July 31, 1969 (mimeo.).

then such conduct would not consist in an appropriation by the using State. A using State can support such conduct by reference to the first three articles of the 1967 Treaty.[34]

It has been suggested that the underlying basis for the French position was that "a geostationary satellite occupies a definite orbital position in space and this, by any practical measure, amounts to de facto appropriation."[35]

The United States position hinges on its commitment not to appropriate orbital space. The United States distinguishes between the encouragement in the Treaty to use the space environment pursuant to Article 1, to engage in activities pursuant to Article 3, and the terms of Article 2 interdicting "appropriation by means of use." On this position Glazer has observed that "if this line of reasoning is followed, then the use of orbital space without submission to an enlarged regulatory regime is permitted provided that there is no 'intent' to appropriate the orbital space involved and the use thereof is otherwise consistent with Article 3 of the Treaty."[36] He stated: "The French position on de facto appropriation of the geostationary orbit at least raises a real conflict since states with advanced technology do have the capability of preempting

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[34]See Appendix A.

[35]Clyde E. Rankin, III, "Utilization of the Geostationary Orbit--A Need for Orbital Allocation?" 13 Columbia Journal of Transnational Law 101 (1974). Compare J. Henry Glazer, "Domicile and Industry in Outer Space," 17 Columbia Journal of Transnational Law 81 (1978).

[36]Ibid., p. 81. Article 3 provides "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."

the use of that orbit to the exclusion of other states."[37]

The French position, if it were to be accepted, would require the establishment of an international body authorized to make allocations of geostationary orbital positions. This would appear to be contrary to the prohibition against national appropriations in Article 2 of the Principles Treaty insofar as such an allocation could be treated as an approval of a national claim or appropriation of a segment of the space environment. On this point Rankin has observed that "assignment of orbital slots by an international body would not be a violation of Article 2 since the article speaks in terms of '. . . national appropriation by claim of sovereignty.'"[38] Two objections can be voiced concerning this outlook. First, no international institution exists having allocative powers with respect to orbital slots, and it is unlikely that such an institution will be formed in the near future. Second, the granting of such authority to an international body would require changes in the 1967 Treaty, which, as has been emphasized, seeks to free the space environment for peaceful and beneficial uses for States generally. The Treaty does not impose special constraints in this respect on States having an advanced scientific and technological base. Moreover, if such orbital allocations were to be forthcoming from such an international organization, although not according the claimant State a sovereign right to a given orbital area, such allocations would undoubtedly confer so much exclusivity of use that the benefiting State would be able to assert a kind of quasi-sovereignty or preferred status over the orbital slot. A priority

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[37] Ibid., p. 82.

[38] Rankin, op. cit., p. 101.

of use, even though not permanent and not exclusive, could, with the approval of such an institution, ripen into more than a right to engage either exclusively or with other States in activities and to use. It could provide a basis for a claim of quasi-sovereign rights or preferred status which might then possibly be extended or converted to claims of sovereignty. Such an outcome would be diametrically opposed to the letter and spirit of the Principles Treaty.

One analysis of the Principles Treaty, as it relates to the use of the geostationary orbit, bears out the foregoing assessment.[39] Attention was given to Articles 1, 2, and 9 of the Treaty. Thus, it is noted that while the "common interests" provision of Article 1, paragraph 1, might be considered to be "vague," nonetheless it could not be construed to prevent national use of a "segment of the geostationary orbit for the purpose of satellite power generation."[40]

As previously stated, the "free use" clause of Article 1, paragragh 2, is interpreted as designed to promote space activity, even though such free use is not unlimited. Such limitations are set forth in Article 1, paragraph 1, and Articles 2, 4, and 9.[41] Free use imposes a duty on such a user to provide benefits to the general community, but the entitlement of the general community under the language of "for the benefit and in the interests of all countries" of Article 1, paragraph 1, cannot be used to

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[39] Political and Legal Implications of Developing and Operating a Satellite Power System, Final Report, Econ, Inc., Princeton, N.J., 77-195-1 (August 15, 1977).

[40] Ibid., p. 54.

[41] Article 4 imposes restrictions on the use of nuclear weapons and weapons of mass destruction.

deny to the space resource State the right to "free use."[42]

The purpose of Article 2 is seen to implement the "free use" guarantees of Article 1, paragraph 2. From this the conclusion was drawn, that while a space resource State cannot "appropriate" an orbital slot, such a slot can be used. The validity of such orbital use will be governed by the intent of the using State not to have exclusive use of the slot, and intent can be measured at least in part by the permanence or relative permanence of the use.[43]

The role of Article 9 is to insure that space environment activities, especially as related to exploration and use, will be "guided by the principle of co-operation and mutual assistance." Space resource States are to conduct their activities "with due regard to the corresponding interests of all other States Parties to the Treaty." These terms are construed to be a limitation on the "free use" of the space environment assured in Article 1, paragraph 2.[44] But, since consultation among States is required by Article 9, it is clear that the drafters of the Treaty expected such consultation to ease the way for States to protect their rights to "free use" while taking into account the corresponding interests of the other signatories.[45]

The foregoing analysis accepts the position that the resource States are to have the free use of, but not a sovereign right of

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[42] Ibid., p. 54.

[43] Ibid., pp. 55-56.

[44] Ibid., p. 59.

[45] Jerzy Sztucki, "International Consultations and Space Treaties," Proceedings of the 17th Colloquium on the Law of Outer Space 147 (1975).

appropriation to, the space environment. They are to have equal rights of access and use pursuant to the res communis legal principle. Although States by reason of the stage of their development do not have equal space capabilities, nonetheless the space resource States are not to be denied by the non-space resource States the right to free use. Over time, however, as provided in Article 1, paragraph 1, the resources of the space environment are open for sharing "irrespective" of the degrees of "economic or scientific development" of the signatory States, since such space environment resources are "the province of mankind." In short, the use of an orbital slot by space resource States is not a de facto appropriation. It is merely a use for an indeterminate but temporary period. The ultimate utility and validity of such use will be subject to later community judgments and must conform to the goal of serving the general interests of mankind.

3.4 Preferential Claims to the Orbit Resource

Because of the belief on the part of some States that geostationary orbital slots constitute a limited natural resource--a belief that has been termed a myth, and in any event has not been proven to be a scientific fact despite the language of Article 33 of the 1973 ITU Convention--some States have sought to establish preferential claims to the resource. These claims have taken two directions. Some of the non-resource States, including some of the LDCs, have urged that the ITU make allocations of orbital slots. Others, namely the principal equatorial States, have asserted sovereignty over geostationary orbital positions.

Israel, supported by Algeria and Kuwait, presented a proposal to the 1973 Plenipotentiary Conference of the ITU seeking enlarged powers for the ITU relating to the allocation of orbital positions. The underscored words constitute the proposal and would allow the ITU to:

> effect allocation of the radio frequency spectrum and of the geostationary orbit and registration of radio frequency assignments and of position slots on the geostationary orbit, in order to avoid harmful interference between radio stations of different countries. . . .[46]

The acceptance of the Israeli proposal would have modified the traditional practices of States of assigning for use on a unilateral basis the orbital positions best suited to their needs. Resource States, including the United States, opposed the position of Israel, and ultimately its proposal was tabled.

Aside from the major issue as to whether such a responsibility should be assigned to a technical body such as the ITU, a number of arguments were made against the Israeli proposal. As noted above, the 1967 Principles Treaty would have to be reconsidered if an organization were to be granted authority to allocate orbital positions, and such an instrumentality would have to be equipped not only with a very high degree of technical competence but also would have to possess a considerable amount of political authority, particularly if the issue of compliance with allocations were ever raised.

Second, the United States had taken the position at WARC ST in 1971 that an orbital allocation "would inhibit the development of the geostationary orbit as a natural resource."[47]

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[46] Rankin, op. cit., p. 102, fn. 25.

[47] Rankin, ibid., p. 104. Citing, United States Department of State, Office of Telecommunications, Position Paper on the Allocation of Orbit Positions and Specific Radio Frequency Channels, WARC ST (June 1971).

Third, it was urged that an allocation plan would possibly have a "detrimental effect on the conservation of the geostationary orbit."[48] It was feared that a premature and even excessive amount of regulation could thwart innovative uses of space objects and might even impose constraints on their development.

Finally, as previously indicated, an institutional allocation of a permanent orbital position would violate the freedom of use provisions of the Principles Treaty and also its prohibition against a national appropriation by claim of sovereignty or by any other means. It has been suggested that an alternative to international allocations or to national assignments would be a "rational licensing or sharing system operated by an international agency. . . ."[49] A fully negotiated agreement following such a direction would undoubtedly advance the province of mankind prescription of the Principles Treaty. Presumably any licensing would authorize use of positions having special value to States. The portion of the geostationary orbit "of greatest interest to the United States lies between 60° and 135° West longitude. This arc covers the forty-eight contiguous mainland states; and all satellites in that sector are visible for radio transmission from any earth station within the continental United States."[50]

The Israeli initiative may have influenced the 1973 revision of Article 10 of the ITU convention dealing with the functions of the IFRB. The 1965 ITU convention, Article 13 dealing with the IFRB, did not

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[48] Ibid.

[49] Ibid., p. 105.

[50] Ibid., p. 103.

mention geostationary orbits. However, in 1973 the IFRB was empowered to effect "an orderly recording of the positions assigned by countries to geostationary satellites." It was authorized to furnish advice to members "with a view to the equitable, effective and economical use of the geostationary satellite orbit," and it was instructed to perform any additional duties "concerned with the . . . utilization of the geostationary satellite orbit. . . ."[51]

One commentator has characterized the new functions for the IFRB as expanded "recording functions to include the gathering of information on geostationary satellites, yet failed to tell it what to do with the information once it was obtained."[52] The Conference by emphasizing in Article 33 of the Convention the freedom of access by States to the space environment gave its support to Articles 1 through 3 of the 1967 Principles Treaty. The 1973 ITU Conference by according new powers to the IFRB did not impose constraints respecting the use by space objects of the geostationary orbit position. The ITU was not empowered to regulate or allocate the use of orbital slots. The ITU's most recent pronouncement on the subject relates to equitable rights of access to the geostationary orbit spectrum resource.[53] In 1977 it was agreed that members of the ITU

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[51]Article 10, paragraph 3, 1973 Telecommunication Convention and Final Protocol, TIAS 8572.

[52]Rankin, op. cit., p. 169. The tools used by the IFRB allow for the verification of coverage areas of the satellite transmitting antenna beams, verification of link parameters for individual assignments, and for the completion of incompatibility analysis for the WARC BS "Plan." International Telecommunication Union. Seventeenth Report by the International Telecommunication Union on Telecommunication and the Peaceful Uses of Outer Space. U.N. Doc. A/AC.105/213, p. 20, December 22, 1977.

[53]Annex 6 to Final Acts of the WARC BS, 1977.

"have the right of access to the geostationary orbit spectrum in order to fulfill their requirements."[54] No preferential rights can be derived from this language. If anything, it is supportive of the free use provisions of Articles 1 through 3 of the 1967 Principles Treaty. This is consistent with the ITU's position that the geostationary satellite orbit, like the radio-frequency spectrum, is a natural resource " to be exploited for the benefit of all and are not subject to appropriation."[55] In 1977 the ITU emphasized that the general principles governing its activities include "the effective use of the orbit/spectrum and the equal rights of all countries."[56] It should not be forgotten, however, that at the 1977 WARC BS Conference the ITU made plans for submissions to the 1979 Conference, which, if accepted, would allow the ITU to allocate geostationary orbital positions as well as frequencies to Region 1 and 3 States for channels in the 12 GHz band. It will also be recalled that the 1977 Conference prepared a "Plan" for the consideration of a Region 2 Conference prior to 1982 in which the Conference would be asked to allocate orbital positions at geostationary levels that would not be in conflict with others previously made.

The claims for preferential rights respecting space environment resources have taken two courses. The claims that have just been identified

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[54] Ibid., paragraph 4.

[55] International Telecommunication Union. Report on Types of Assistance Extended by the United Nations System to Developing Countries in the Field of Practical Applications of Space Technology, U.N. Doc. A/AC.105/124/Add. 1, p. 13, April 3, 1974.

[56] International Telecommunication Union. Seventeenth Report by the International Telecommunication Union on Telecommunication and the Peaceful Uses of Outer Space, U.N. Doc. A/AC.105/213, p. 5, December 22, 1977.

have been put forward especially by the LDCs. Their concern has been for a generalized equitable sharing of a resource characterized as the province of mankind. Their position is consistent with the res communis principle of international law. They accept the common ownership of the space resource. They seek to share in the resource as a result of community decisions.

3.5 Sovereign Claims to the Orbit Resource: The Bogotá Declaration of December 3, 1976

On December 3, 1976 eight equatorial States, namely, Brazil, Colombia, Congo, Ecuador, Indonesia, Kenya, Uganda, and Zaire signed in Bogotá a document, now referred to as The Bogotá Declaration, containing their conclusions relating to the use of geostationary orbits by space objects. Colombia had previously taken the initiative on this subject. In 1975 it had made a presentation to the First Committee of the General Assembly in which it claimed that since the geostationary orbital arc is a national natural resource that sovereignty could be exercised over it by subjacent States.[57] A similar statement of policy was also made in 1976.

Since the Bogotá Declaration advances positions in conflict with the 1967 Principles Treaty, the relationship of these States to the Treaty should be recorded. Brazil, Ecuador, and Uganda were bound by it on January 1, 1978.[58] Indonesia and Zaire were signatories but are not

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[57] U.N. Doc. A/C.1/PV.2049, pp. 43-46, October 13, 1975.

[58] Treaties in Force, U.S. Department of State Publication 8934 (1978). The Declaration is set out in Appendix B. Appendixes D through J provide detailed information concerning States parties to all relevant UN and ITU international agreements.

included as being bound by the 1978 listing in Treaties in Force. Congo, Colombia, and Kenya did not sign the Treaty and are not bound by it. The 1978 position of Colombia is that there is no intention to ratify the agreement "so long as its provisions had not been expanded in such a way as to permit a definition and delimitation of outer space that recognized the geostationary orbit as s limited natural resource under the sovereignty of equatorial states insofar as those segments which correspond to their national territories were concerned."[59] Further, in the absence of a clear and precise definition of "outer space" States in the exercise of their "full and sole sovereignty as a subject of international law, could enact laws defining their national space and therein exercise the rights and assume the obligations established under national law."[60]

The common interest of these eight States stemmed from the fact that the space resource States, because of the ellipticity of the equator, have found that geostationary space objects have an ideal orbital position at a height of approximately 22,300 miles above the equator.[61] With the use by such States of the geostationary orbital position, and with plans on their part for an augmented use of such slots, the equatorial States have wondered whether such use might constitute a de facto "appropriation" of such slots. In convening in Bogotá these States were unquestionably influenced by the fact that space objects of the ERTS and LANDSAT type were capable of sensing and identifying the presence of natural resources. Moreover, there had been a strong tradition on the part of the new and

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[59] U.N. Doc. 105/C.1/SR.199, p. 2, February 28, 1978.

[60] Ibid., p. 4.

[61] U.N. Doc. A/AC.105/203, p. 5, August 29, 1977.

less-developed countries at the UN to secure the adoption of resolutions dealing with permanent sovereignty over natural resources.[62]

The product of the Bogotá meeting has been described both as a "pretension" and as a "counterpoise" by the equatorial States against a "de facto appropriation by states with advanced technology . . . [they] asserted de jure 'territorial' claims to sectors of the geostationary orbit notwithstanding the prohibitions against national appropriation set forth in the space treaties."[63]

The Bogotá Declaration identified five areas of concern. First, the eight States described the geostationary orbit as a natural resource. They said:

> Equatorial countries declare that the geostationary synchronous orbit is a physical fact linked to the reality of our planet because its existence depends exclusively on its relation to gravitational phenomena generated by the earth, and that is why it must not be considered part of outer space. Therefore, the segments of geostationary synchronous orbit are part of the territory over which Equatorial states exercise their national sovereignty.[64]

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[62]A notable illustration is General Assembly Resolution 1803 (XVII) of December 13, 1962. Actually, General Assembly Resolutions dating from 1952 advance this claim. The Bogotá Declaration made reference to General Assembly Resolution 2692 (XXV) of December 11, 1970, entitled "Permanent Sovereignty over Natural Resources of Developing Countries and Expansion of Domestic Sources of Accumulation for Economic Development." This Resolution spoke of land and marine resources but not air or space resources. Also motivating the Bogotá States was a general feeling that proposals emanating from the ITU relating to orbits and frequencies were impracticable and unfair.

[63]J. Henry Glazer, op. cit., pp. 81, 114. Scholarly comment on the claims of the equatorial States has been generally negative. See the articles set forth in the Addendum to the Bibliography. These were presented at the 20th and 21st Colloquia on the Law of Outer Space of the International Astronautical Federation in 1977 and in 1978.

[64]"First Meeting of Equatorial Countries," p. 2, mimeo.

Consequently, they decided "to proclaim and defend on behalf of their peoples the existence of their sovereignty over this natural resource."[65]

Second, the Declaration refers to "Sovereignty of Equatorial States over the Corresponding Segments of the Geostationary Orbit." Here the authors mention the concept of permanent sovereignty over natural resources, and in particular, General Assembly Resolution 2692 (XXV). Reference is also made to General Assembly Resolution 3281 (XXIX) which is "The Charter of Economic Rights and Duties of States." Relying on these documents the Bogotá States conclude that "the above mentioned provisions lead the equatorial states to affirm that the synchronous geostationary orbit, being a natural resource, is under the sovereignty of the equatorial states."[66]

Third, they refer to the "Legal Status of the Geostationary Orbit." In this section the Bogotá States indicate that their move will benefit their national interests and those of the universal community instead of the most developed countries. They make no claim to segments of the orbit situated above the "open sea." This area is considered to be beyond the "national jurisdiction of states" and is to be considered as appertaining to the Common Heritage of Mankind.[67] During the discussions of the Bogotá Declaration at meetings of the Scientific and Technical Sub-committee of COPUOS, attention had been drawn to the Common Heritage of Mankind concept. Thus, Ecuador has noted that segments of the geostationary orbit "corresponding to the high seas beyond the limits of national jurisdiction

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[65] Ibid.

[66] Ibid., p. 5.

[67] Ibid., pp. 5-6.

would be considered the common heritage of mankind, and there would be safeguards for everyone, provided the international community regulated the use and exploitation of the orbit."[68]

In the following language the Bogotá States agreed to the transiting of space objects when outside the geostationary orbital positions of the signatories. Thus, "The equatorial states do not object to the free orbital transit of satellites approved and authorized by the International Telecommunication Convention, when these satellites pass through their outer space in their gravitational flight outside their geostationary orbit."[69] This statement appears to be consistent with their view that the geostationary orbit is a natural resource of the State, since in the relevant passage the geostationary orbit was identified as not being a part of outer space. The equatorial States contemplate granting permission to the space resource States to place permanently in the geostationary orbital area of the granting States the foreign space object. Such permission is to be in the form of a "previous and expressed authorization on the part of the concerned states, and the operation of the device should conform with the national law of that territorial country over which it is placed."[70] By such consent the authorizing State is allowing a foreign State to operate within the territory of the former. The Bogotá States also indicated that the presence of foreign space objects currently

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[68]U.N. Doc. A/AC.105/C.1/SR.199, p. 7, February 28, 1978. Carl Q. Christol, "The Legal Common Heritage of Mankind: Capturing an Illusive Concept and Applying it to World Needs," Proceedings of the 18th Colloquium on the Law of Outer Space 42 (1976).

[69]Declaration, op. cit., p. 6.

[70]Ibid., p. 6.

in their sovereign orbital areas is not condoned nor will these States allow such presence to constitute the basis for a claim of preemptive rights.

Fourth, they assess their relationship to the Principles Treaty. That Treaty is not to be considered a "final answer" to the exploration and use of outer space.[71] It was entered into at a time when the LDCs "could not count on adequate scientific advice and were thus not able to observe and evaluate the omissions, contradictions and consequences of the proposals which were prepared with great ability by the industrialized powers for their own benefit."[72] Here the Bogotá States refer to the absence of a final definition of outer space. A consequence of the lack of such a definition, according to the Declaration, has been to allow the resource States to engage in a national appropriation. Since the Principles Treaty is regarded as incomplete, this provides a basis for the equatorial States to claim that the geostationary orbit was intended to be excluded from its coverage. Further, the absence of a definition of outer space in the Treaty allows the equatorial States to conclude that the prohibition against appropriation has no application to the geostationary orbital area. This being the case the equatorial States that had ratified the Treaty are not inhibited from claiming the orbital slot area as a part of their sovereign areas.

Fifth, the equatorial States refer to diplomatic and political action. They acknowledge that the 1967 Treaty does not specifically exclude the geostationary orbital position from the prohibitions against appropriation

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[71] Ibid., p. 7.

[72] Ibid.

contained in Article 2. They seek to persuade countries that have not ratified the 1967 Treaty to refrain from "undertaking any procedure that allows the enforcement of provisions whose juridical omission has already been denounced."[73] Approval was given to the comparable positions previously taken by Colombia and Ecuador at the United Nations, and they promised to work together to obtain acceptance of their position that "the geostationary orbit . . .[is] an integral part of their sovereign territory. . . ."[74]

The equatorial States have advanced the foregoing claims at meetings of the ITU and the UN. At the close of the February 1977 WARC BS they submitted a formal statement which was incorporated in the Final Protocol of the conference. In this they indicated that

> they were not bound by the decisions of the Conference regarding the location of geostationary satellites on the segments of the orbit over which these States exercise sovereign rights, nor the positioning of such satellites requiring the prior authorization of the equatorial countries concerned. They would also reserve the right to take whatever steps they may deem fit to preserve and secure the observance of their rights. No claims were made on either side of the geostationary orbit or for other orbits.[75]

3.6 Consideration of the Bogotá Declaration by COPUOS

Such claims have not gone unnoticed, and they have been vigorously rejected by the space resource States and by signatories to the 1967

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[73] Ibid., p. 8.

[74] Ibid., p. 8.

[75] Richard E. Butler, "World Administrative Radio Conference for Planning Broadcasting Satellite Service," 5 Journal of Space Law 97 (1977); U.N. Doc. A/AC.105/C.2/SR 273, p. 4, March 28, 1977.

Principles Treaty. Since the Bogotá Declaration focused on political-legal considerations, it was natural that the UN was to become the principal forum for debate on this subject.

The first formal and extended rejection of the Bogotá Declaration reaching COPUOS was a working paper submitted by the Soviet Union entitled "Considerations on the Legal Status of Geostationary Orbits."[76] Relevant portions of the working paper provide:

> 1. Geostationary orbit is inseparable from outer space and all relevant provisions [of the 1967 Principles Treaty] are applicable to it. Under the Treaty, geostationary orbit, like outer space as a whole, is not subject to national appropriation by any means whatsoever.
>
> 2. The placing of satellites in geostationary orbit by States creates no right of ownership over the respective orbital positions of the satellites or over segments of the orbit.
>
> 3. All States enjoy an equal right to the utilization of geostationary orbit. The utilization of geostationary orbit by States must not be detrimental to the interests of other States.

Paragraph 4 of the working paper emphasized the need for States to cooperate in placing communications satellites in geostationary orbit, took into account the recommendations and decisions of the ITU in this area, and linked the effective use of radio frequencies with space objects.

The position of the United States was identified at a meeting of the Scientific and Technical Sub-committee of COPUOS on February 24, 1978. Basing its position on a study by the Secretariat of the UN[77] the United States indicated that it was "clear that there was no scientific or

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[76] U.N. Doc. A/AC.105/L.94, June 21, 1977; U.N. Doc. A/32/20, Annex VI, p. 29, 1977.

[77] Physical Nature and Technical Attributes of the Geostationary Orbit, U.N. Doc. A/AC.105/203, August 29, 1977.

technical basis for a claim of sovereignty over the geostationary orbit."[78] The United States "agreed with others that had come to that inescapable conclusion."[79]

Representative of the views of the equatorial States was the position of Brazil before COPUOS. Speaking of the geostationary orbit it was the Brazilian view that "the very existence of dissimilar conditions among States with regard to the exploitation of that limited resource means, in practice, that the occupation of the synchronous orbit takes place on a 'first come, first served' basis. That practice could create situations where the annexation of a particular point of that orbit by a satellite does represent an annexation of space that contravenes the terms of the Treaty of 1967."[80]

Support for the position of the United States and the Soviet Union came from Poland on March 31, 1977.[81] On the same date Colombia urged, since outer space had not been defined, that it was proper to assert that the geostationary orbit was within the sovereign area of a State. Hence, such a claim was not violative of the res communis principles of the Principles Treaty. Consequently, "the use, enjoyment, and occupation of that segment was subject to the prior authorization of the State concerned, and any attempt by third parties to place stationary satellites in it was therefore rejected. . . ."[82]

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[78] U.N. Doc. A/AC/105/C.1/SR.199, p. 9, February 28, 1978.

[79] Ibid.

[80] U.N. Doc. A/AC.105/PV.176, p. 21, July 27, 1977.

[81] U.N. Doc. A/AC.105/C.2/SR.277, p. 2, April 5, 1977.

[82] Ibid., p. 4.

Also making a presentation to the Legal Sub-committee of COPUOS was Kenya. Emphasis was placed on the need for the space resource States to obtain the prior authorization of equatorial States before stationing space objects in that orbit.[83]

In discussions at the Scientific and Technical Sub-committee on February 24, 1978, Colombia and Ecuador supported the positions advanced in the Bogotá Declaration. Ecuador specifically identified its sovereignty to include "those segments situated above its mainland territory, its continental territorial sea in the Pacific Ocean and its island territory and territorial sea in Galapagos province."[84] Japan and Australia rejected the sovereign claims of the equatorial States on the grounds that the geostationary orbit was clearly part of outer space.[85] The Soviet Union restated its position that the geostationary orbit was an inalienable part of outer space.[86] Reflecting the general views of the LDCs was the position taken by Egypt on February 24, 1978, namely, that "no country or group of countries had exclusive sovereignty over any part of outer space. Outer space did not belong to the jurisdiction of any country, and its resources were part of the common heritage of mankind."[87] Among the equatorial States there was a willingness to treat the geostationary orbit over the high seas as a common heritage of mankind.[88]

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[83] U.N. Doc. 105/C.2/SR.280, p. 2, April 7, 1977.

[84] U.N. Doc. A/AC.105/C.1/SR.199, p. 6, February 28, 1978.

[85] Ibid., pp. 7-8.

[86] Ibid., p. 8.

[87] U.N. Doc. A/AC.105/C.1/SR.200, p. 3, March 1, 1978.

[88] U.N. Doc. A/AC.105/216, p. 26, March 6, 1978.

Both the Scientific and Technical Sub-committee and the Legal Sub-committee of COPUOS gave attention in their 1978 meetings to the claims of the equatorial States relating to sovereignty over geostationary orbital positions. In each of the subcommittees there were assertions of diametrically opposing points of view. Since further debate on this subject will be based on the differing perspectives, they will be summarized. The basis for the summarization is the report of the Legal Sub-committee on the Work of its Seventeenth Session (13 March-7 April 1978).[89]

The equatorial States urge that they have sovereignty over their natural resources, and that such resources include the geographical area used by geostationary space objects while in orbit. In support of this proposition it is urged that the area is sui generis and most notably that it falls within their territory since there has not as yet been firmly established a legal boundary between sovereign airspace and the res communis of the space environment. Since the equatorial States are either clearly or essentially LDCs, they have sought to obtain the support of LDCs generally by urging that the limited natural resource of the geostationary orbit should be used in priority for the benefit of the LDCs. Presumably the use would be effected on an equitable basis with advantages going first to the equatorial States, then to the other LDCs, and lastly to the developed countries because of the general advantages already possessed by the latter.

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[89] U.N. Doc. A/AC.105/218, pp. 9-10, April 13, 1978. Compare the Report of the Scientific and Technical Sub-committee on the Work of its Fifteenth Session, U.N. Doc. 105/216, pp. 26-27, March 6, 1978.

Brazil, taking into account the possibility of making a distribution of benefits to be derived from the use of the geostationary orbit, suggested that the Principles Treaty did not preclude the establishment of a specific legal regime for the geostationary orbit. Those States, including Colombia, inclined to support the formation of such a regime mentioned the sui generis quality of the geostationary orbit as a limited natural resource.

On the other hand, the space resource States urged that the Principles Treaty fully covered the peaceful and beneficial use of the geostationary orbital area by space objects. Pursuant to the Treaty such orbits are inseparable from the space environment, and are not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means. In their view, the geostationary orbits are free for use by all States without discrimination of any kind on a basis of equality and in accordance with international law and the UN Charter. Emphasizing that geostationary space objects were engaged in a use of the space environment, these States urged that such use did not create a right of ownership over the respective orbital positions of the satellites or over segments of the orbits. They also noted that under the Principles Treaty users of the geostationary orbit were obliged to take into account the corresponding interests of other States and that they had to be guided by the principles of cooperation. The space resource States also were inclined to doubt the legal worth of the General Assembly resolutions relating to full and complete sovereignty over natural resources. They were considered to be more a statement of political and economic expectations than existing rules of international law.

Some States made mention of the scientific and legal complexities involved in the claims of the equatorial States. They suggested that further studies along such lines would be required before it would be possible to pass judgment on such claims. In assessing the nature of the debate one commentator has added another dimension to the problem. It has been suggested that "realism appears to dictate that international rule-making either for the geostationary orbit or any other orbital location in space should only be considered when there are real as opposed to fanciful conflicts between states relative to the orbital locations involved."[90]

3.7 Present Use of the Geostationary Orbital Position is Lawful

It is clear that the successful operation of a SPS will depend on the use of the geostationary orbital position. In order to be successful such use must conform to the principles, standards, and rules of international law. At the present time the space resource States are using orbital slots lawfully. The introduction of a SPS into orbit would constitute a new use and activity in the space environment. Up to the present there has been no evidence on the part of the resource States that their orbital uses and activities reflect an intention or constitute a claim to the appropriation of an orbital slot or segments of the space environment. They have been guided by the belief that the 1967 Treaty has confirmed the application of the *res communis* principle to the space environment. The same principle would apply to a SPS operating at geostationary orbital level. Thus, the mere presence of an operating

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[90] Glazer, *op. cit.*, p. 82.

SPS could not constitute evidence of the intent of a space resource State to establish either de facto or de jure rights to the orbital slot. Although the SPS would be performing a different service than the space objects providing radio or television broadcasts, the common commitments of such space objects to a use of the space environment rather than its appropriation would require the application of the same legal guidelines. Consistency would require that the right to use rather than the acquisition of property or sovereign rights be accepted. Thus, with respect to the possible future use of a SPS, an advanced State is fully entitled to urge that its prospective conduct fully conforms to existing international law.

The equatorial States, speaking for themselves and generally for as yet a highly amorphous contingency of LDCs, argue that they are now within their rights in asserting that the space environment at orbital levels is a part of their sovereign territory. The resolving of such differing views, even assuming that such views can be reconciled, will take much time. It may even lead to the formation of a new space regime in the form of a new international organization. However, pending the resolution of contending positions, it is clear that the space resource States can rely on the Principles Treaty.

Further, a formal, treaty-contained definition of the delimitation between sovereign airspace and the non-sovereign space environment is not wholly needed. The practices of the resource States since 1957 have clearly established a customary rule of international law to the effect that outer space exists at distances from the Earth where space objects successfully orbit, and this surely must include the heights at which

geostationary space objects are in orbit.

If, as is believed to be the case, the geostationary orbital level is not a wholly limited natural resource because of the elastic ways in which it can be used, then the supposed conflicts between the equatorial and space resource States may certainly be fanciful. Indeed, it may not be possible to determine this fact unless and until the space resource States put at least one SPS into operation.

Moreover, it is quite possible that the claims now being put forward by the equatorial States, apparently designed to allow them to license the use of the orbital slots to the space resource States, could be satisfied in other ways. Rather than contemplating a bilateral relationship by the users and those claiming sovereignty, it is possible that the world community will establish methods and institutions for the allocation of benefits derived from the exploration and use of the space environment. The Principles Treaty speaks of the need to consider the well-being of the entire community through the implementation of the province of mankind concept. The law of the sea negotations have confronted the need to take into account the Common Heritage of Mankind concept. By the end of this century or in the next, it may be possible to employ such concepts in such a way as to favor the national-interest contentions now being raised by the equatorial States as well as to effect an equitable distribution of outer space resources and benefits to both space resource and non-space resource States and peoples.

Chapter Four

INTERNATIONAL SPACE LAW AND THE USE OF NATURAL RESOURCES: SOLAR ENERGY

4.1 Solar Energy as a Source of Power

High altitude solar energy,[1] like the geostationary orbital position, is a world natural resource.

In this Chapter attention will be called to the natural characteristics of this resource, to the relationship of international law essentially as stated in the 1967 Principles Treaty to solar energy, and to international political-legal efforts to facilitate the acquisition and transmission to Earth of such solar-based energy.

Solar energy is considered to be a vast, unlimited, inexhaustible, and renewable source of power. It is also a very clear source of such power. It is so vast and unlimited that no one has claimed exclusive rights to it. It is even more inexhaustible and renewable than the water of the ocean, a resource that has been treated as a res communis and therefore not subject to exclusive rights but rather open to the common use of all. High altitude solar energy, like the water of the free high seas, is not subject to sovereign appropriation by States at the present stage of science and technology.

The principal focus of an energy-hungry world on solar energy has been a scientific and technological one. The main considerations have

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[1]This expression will be taken to mean that energy derived from the sun at heights where geostationary space objects are able to orbit effectively, namely, at the range of 22,300 miles above the surface of the Earth.

been the development of knowledge allowing for the conversion of the solar energy situated in the space environment into electricity. To this must be added the development of processes to beam such energy safely to Earth. Finally, there is the need to develop practical means to convert the beam to useful power on Earth.[2] Quite conceivably solar energy, especially at orbital levels, will be the most valuable and important of all of the space environment resources. This forecast is supported by a study made by the International Astronautical Federation for COPUOS (IAF). It concluded that space-based solar power plants constitute "perhaps the most imagination and potentially significant prospect for the utilization of space in the service of mankind."[3]

The IAF study identified practical advantages resulting from the use of orbiting space objects in the gathering and transmission of solar energy. Particular emphasis was placed on the future need to have "solar power plants capable of base-loaded operation, without dependence on costly energy storage, or alternative energy sources for periods of low isolation."[4] It was considered that base-loaded power in space, where there is virtually constant isolation, "is available at an average rate

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[2]Peter E. Glaser, "Testimony, Solar Power from Satellites," Hearings before the Subcommittee on Aerospace Technology and National Needs of the Committee on Aeronatuical and Space Sciences, United States Senate, 94th Cong., 2nd Sess., p. 3 (1976). These hearings contain numerous assessments of the solar energy problem by experts in the field.

See also, Peter E. Glaser, "Solar Power Satellites--A Global Power Generation Option," Presentation to Scientific and Technical Subcommittee, Committee on the Peaceful Uses of Outer Space, February 15, 1978. Cited hereafter as "Solar Power Satellites."

[3]State of the Art and Assessment of Scientific and Technological Developments in the Exploration and Practical Uses of Outer Space within an International Framework, U.N. Doc. A/AC.105/173, p. 22, May 7, 1976.

[4]Ibid., p. 23.

of the order of 10 times that at the best earth-surface-location."[5]

Further:

> Space-based power plants can be constructed without (a) the need for support against gravity (the principal mass constraint on ground-based structures), (b) design safety factors to allow for once-in-a-lifetime events such as hurricanes, typhoons, tidal waves, or earthquakes, (c) thermal-waste discharges to the terrestrial biosphere, or (d) community concerns about local power-plant siting.[6]

4.2 Legalization of Use of Moon Resources by SPS

A SPS has been suggested as a practical way to forward solar energy from geostationary orbital level to the Earth. The effectiveness of such a system may require the use of tangible resources located on the Moon or other celestial bodies. COPUOS has been discussing the terms of a proposed Moon Treaty since 1970. The exceedingly cautious negotiations have produced countless drafts, with the last being the Austrian Working Paper of April 3, 1978.[7] Article 6, paragraph 2, of the draft would allow States bound by the agreement "the right to collect on and remove from the moon samples of its mineral and other substances."[8] The Moon Treaty negotiations illustrate an unwillingness on the part of States to allow tangible and non-renewable resources to be treated as property

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[5] Ibid.

[6] Ibid. A separate study by the United Nations Secretariat contrasted the location of energy collection in space and on the ground. "The constant illumination of the array in space would make the solar cells about 10 times as efficient as an array on the ground." Solar Power Stations in Space, U.N. Doc. A/AC.105 (XIX) CRP, p. 1, June 1, 1976.

[7] U.N. Doc., A/AC.105/218, Annex 1, p. 2, April 13, 1978.

[8] Ibid. Paragraph 1 of the Article provided that "There shall be freedom of scientific investigation on the moon by States Parties without discrimination of any kind, on the basis of equality and in accordance with international law."

appertaining to either juridical or natural persons. Thus, Article 11, paragraph 3, of the proposed Austrian text provides that "neither the surface nor the subsurface of the moon, nor any part thereof or natural resources in place, shall become property of any State, international intergovernmental or non-governmental organization, national organization or non-governmental entity or of any natural person."[9] Nonetheless, the parties to the agreement are to be granted the right to explore and use the Moon without discrimination of any kind of a basis of equality pursuant to international law and the Treaty.[10] Article 1, paragraph 2, in defining the Moon includes "orbits around or other trajectories to or around it."[11]

The foregoing is relevant to the present analysis since the focus of the proposed agreement is generally on tangible resources, since it allows limited privileges for activities having a scientific or technological orientation, and because it identifies an orbit to or around the Moon as the legal equivalent of the Moon and thus subject to the non-property limitations set out in Article 11, paragraph 3. But, the Austrian draft did not propose rules of international law pertaining to those natural resources found in the spatial area adjacent to the Moon, nor to the natural resources of the high altitude, such as solar energy.

The Austrian draft, following earlier drafts, does provide in paragraph 1 of Article 11 that "the moon and its natural resources shall be considered the common heritage of mankind. . . ." This outlook or trend was seen above in the analysis of the use of geostationary orbital

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[9] Ibid., p. 6.

[10] Ibid., Article 11, paragraph 4.

[11] Ibid., p. 2.

positions. That this doctrine would not apply to the spatial area adjacent to the Moon, e.g., outer space, but would include orbits around the Moon, acknowledges the difficulty of asserting claims to the intangible, unlimited, inexhaustible, and renewable resources of outer space.

If it is accepted at the outset that the space environment, including outer space, constitutes a res communis, it is possible through international agreement to establish a law governing the use of that environment, including its resources. The proposed Moon Treaty seeks to protect community interests in tangible natural resources in place on the surface or the subsurface of the Moon. It also envisages the protection of community interests in orbits around the Moon by including such orbits as, in effect, an extension of the Moon. Thus, the proposed agreement has been able to effect a transition from a tangible resource, e.g., Moon rocks, to a less tangible but nonetheless measurable resource, e.g., the orbital pattern of a space object.

From the legal point of view it appears that the intent of the proposed agreement is to modify the res communis principle with respect to these two resources. As previously stated, Article 11, paragraph 1, provides: "For the purposes of this Agreement, the moon and its natural resources shall be considered the common heritage of mankind. . . ." This concept requires the employment of international procedures if community needs and wants are to be realized. Article 11, paragraph 5, provides: "States Parties to this Agreement hereby undertake to establish an international regime, including appropriate procedures, to govern the exploitation of the natural resources of the moon as such exploitation is about to become feasible." Nonetheless, the solar energy of the space environment appears

to be excluded from the proposed agreement. First, it is not in a physical sense an attribute of the Moon. Second, it is much less measurable than either rocks or orbital patterns because of its vast, unlimited, inexhaustible, and renewable characteristics. Thus, at the present the trends away from the res communis principle in favor of the common heritage of mankind concept have relevance only to the indicated fairly tangible resources and in specifically identifiable spatial contexts. Solar energy at geostationary orbital level must still be considered as controlled by the res communis principle. Nonetheless, the extended Moon Treaty negotiations clearly indicate an expanding consensus favoring a wide sharing of the resources of the space environment and the benefits derivable from such resources. It should nonetheless be noted that many of the provisions of the proposed Moon Treaty are restatements of principles found in the 1967 Treaty or are derivable from them.

4.3 The 1967 Principles Treaty and High Altitude Solar Energy

At the present time, to the extent that international law deals with the gathering and transmission of high altitude solar energy, the 1967 Principles Treaty applies the res communis principle to such energy. The Treaty was based on the belief that mankind should be able to derive benefits from the use of the space environment and its resources.

Although the terms of the Treaty do not in all instances contain common assurances relating to the three elements of the space environment, namely, outer space, the Moon, and other celestial bodies, nonetheless, the purpose of the Treaty is to facilitate activities by man in the

beneficial and peaceful uses of the environment. Thus, Articles 1, 3, 9, 10, and 13 make reference to the exploration and use. Article 2 refers only to use. Article 4, paragraph 2, provides that only the Moon and celestial bodies shall be used exclusively for peaceful purposes. The term "outer space" is not included in the requirement to use for peaceful purposes. The same paragraph also states that "the use of military personnel for scientific research or for any other peaceful purposes shall not be prohibited." Articles 9 and 11 refer to the peaceful exploration and use of outer space.

Another major theme of the 1967 Treaty is that of scientific investigation so that benefits might be derived from the activities and uses of the environment. Conversely, such investigations was not to result in harms to the environment. Thus, Articles 1, 4, 5, and 9 deal with the affirmative role of science and technology in the space environment. Article 1, paragraph 3, provides that there shall be freedom of scientific investigation in the space environment and that international cooperation shall be encouraged in this endeavor. Article 4 allows for scientific research on the Moon and celestial bodies. Article 4 by prohibiting the use of nuclear and mass destruction weapons in the space environment allows for effective scientific investigation and research. Article 5 facilitates use and research by requiring the reporting of phenomena, including presumably scientific information, which could constitute a danger to the life or health of astronauts.

Another major theme of the Principles Treaty relates to the avoidance of harmful contamination and the need to conduct space activities in such a manner as to give due regard to the corresponding interests of other States.

The general purport of Article 9 is twofold. First, there is the goal of facilitating scientific inquiry. Second, there is the expectation that such scientific inquiry and activities growing out of that inquiry will allow for the exploration and use of space environment resources for the benefit of human beings. The beneficial use of high altitude solar energy certainly fits into this expectation.

Critical attention must be focused on Article 2 of the Principles Treaty in assessing the lawfulness of acquiring solar energy. This Article provides that "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." An initial question relates to the scope of the Article. The critical term is "outer space." Thus, while prohibiting the nationalization of outer space, the agreement says nothing about taking possessing through use of the resources of outer space. Thus, the capture and use of solar energy is clearly outside the scope of the Article. Moreover, as previously stated, the purpose of the Treaty was to facilitate the use of the space environment. As an inexhaustible and renewable resource of the space environment it is clear that solar energy can be used for beneficial and peaceful purposes by those able to capture and transmit it to Earth.

Nonetheless, the question has been raised whether the term "national appropriation" should be interpreted so as to preclude national use of space environment resources. Even if the national appropriation limitation were relevant to a resource of outer space, as opposed to the area of outer space, which it is not, the concept of national appropriation would have to be analyzed and understood. Appropriation in the sense used in

Article 2 relates to acquisition of national sovereignty with the consequence that the sovereign would have the ultimate power to dispose of property rights in outer space. Article 2 denies such exclusive rights to a national sovereign. In rejecting such a possibility the Treaty accepted the res communis principle, thereby allowing for competing users, but not owners or potential owners of property, to exploit the available resources. Thus, the national appropriation concept has no relevance to the legal freedom of legal persons to capture and use high altitude solar energy. Article 2 does not constitute an exemption from an arguable prohibition against the use of such energy. Article 2 is irrelevant and therefore inapplicable.

Up the the present, space objects have relied upon solar energy for the power required for their functioning. To date no one has advanced the notion that the capture and use of such energy is in violation of any of the provisions of the Principles Treaty, of international law generally, or the U.N. Charter. While this specific practice need not necessarily be the basis for a customary rule of international law allowing for the wholesale capture and use of high altitude solar energy, it does reinforce the view that the permissibility of such use from a legal perspective will depend very materially on the needs, wants, and practices of the space resource States and ultimately the larger world community.

The United States has from the very beginning of the space age linked the space environment to its use exclusively for peaceful and scientific purposes.[12] The United States also has often associated the objective

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[12]Statement of Ambassador Henry Cabot Lodge to the Political Committee of the United Nations, January 14, 1957. 36 Department of State Bulletin 227 (1957). Section 102 (a) of the National Aeronautics and Space Act of 1958 states: "The Congress hereby declares that it is the policy of the United States that activities in space should be devoted to peaceful purposes for the benefit of all mankind." Public Law 85-568, 72 Stat. 426.

of beneficial uses with that of peaceful purposes.

As noted above, the concept of peaceful purposes or uses has been incorporated into the 1967 Treaty, and in a not entirely consistent way. Thus, Article 4, paragraph 1, which imposes constraints on the use of nuclear weapons and other kinds of weapons of mass destruction is limited in spatial area to Earth orbits, and to outer space and celestial bodies. However, the United States regards celestial bodies to include the Moon for the purposes of Article 4, paragraph 1.[13]

However, paragraph 2 of Article 4 merely provides that only the Moon and other celestial bodies, presumably excluding both Earth orbits and outer space per se, are to be used exclusively for peaceful purposes. On the other hand, Article 9 applies the peaceful exploration and use concept both to outer space and to the Moon and other celestial bodies. Article 11 dealing with the promotion of international cooperation also applies the peaceful exploration and use concept to outer space and to the Moon and other celestial bodies.

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[13]In the opinion of Ambassador Arthur J. Goldberg, Article 4 "contains an undertaking not to place in orbit around the earth, install on the moon or any other celestial body, or otherwise station in outer space, nuclear or any other weapons of mass destruction." "Statement to Committee One of the General Assembly, December 17, 1966, Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies," Staff Report, United States Senate, Committee on Aeronautical and Space Sciences, 90th Cong., 1st Sess., p. 16 (March 1967). Italics added. To the same effect was Ambassador Goldberg's testimony before the Senate Committee on Foreign Relations on March 7, 1967. He stated with regard to paragraph 1 of Article 4 that it "relates to outer space generally and provides that any party shall not place in orbit any object, which means satellites, carrying nuclear weapons or any other kind of weapons of mass destruction, install such weapons on celestial bodies, which would include the moon. . . ." "Treaty on Outer Space," United States Senate, Committee on Foreign Relations, Executive D, 90th Cong., 1st Sess., p. 22 (1967). Italics added.

Efforts to extend via interpretation the coverage of the "exclusively for peaceful purposes" concept contained in Article 4 to outer space per se, thereby imposing duties beyond the terms of the Article, which limits the peaceful purposes requirement to the Moon and other celestial bodies, have urged the relevance of Articles 9 and 11. It has also been argued that Article 4, paragraph 2, should be read in conjunction with the provisions of Article 1, paragraph 1, which requires that the exploration and use of the totality of the space environment "shall be carried out for the benefit and in the interests of all countries."[14] While it is possible to be sympathetic to the efforts to extend the spatial coverage of the exclusively peaceful purposes concept to an area more extensive than the Moon and other celestial bodies, the words of the agreement and the negotiations of the agreement seem to preclude such a conclusion.[15]

Since by any valid characterization the gathering of solar energy at geostationary orbital level is a peaceful use of outer space, the limited applicability of the peaceful purposes provisions in Article 4, paragraph 2, of the Principles Treaty imposes no constraints on the capture or use of the solar energy resource. The general meaning assigned to "peaceful purposes" both in the Treaty and by the practice of States

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[14]For example, M. Markoff, "Disarmament and 'Peaceful Purposes' Provisions in the 1967 Outer Space Treaty," 4 Journal of Space Law 3 (1976).

[15]Ambassador Goldberg told the Senate Committee on Foreign Relations that the coverage of Article 4, paragraph 2, "relates only to the moon and other celestial bodies. . . ." Op. cit., p. 22. C. Q. Christol, "Article Four of the 1967 Principles Treaty: Its Meaning and Prospects for its Clarification," Proceedings of the 21st Colloquium on the Law of Outer Space of the International Astronautical Federation (1978).

clearly countenances the gathering of such high altitude solar energy and its transmission to Earth.

Nothing is to be gained if the solar energy gathered at orbital heights cannot be transmitted to Earth. The same legal considerations that govern the capture of such energy will apply to the right to transmit such solar energy to Earth. While the transmission is a free use of the space environment, and is authorized by the 1967 Principles Treaty, the radio frequency employed would have to avoid harmful interference with other valid uses of the radio spectrum. The use of the radio spectrum would consume nothing, need not be a permanent use, and serves the well-being of the general community through the exploitation of an inexhaustible resource.

The fact that the 1967 Principles Treaty does not extend the "peaceful purposes" concept to space per se cannot be construed as a denial of the fact that such gathering and transmission can serve peaceful, beneficial, and scientific purposes. The fact that solar energy is being gathered and used by existing space objects for their general operating purposes supports the view that this natural resource not only can be, but is being used for peaceful purposes.

At the present time, following the acceptance of the res communis concept and the underlying theme of the 1967 Treaty that the space environment is intended to be used for the general well-being of mankind, it can be asserted with confidence that high altitude solar energy is lawfully and freely available for peaceful, scientific, and beneficial purposes on the part of all who have the capacity to gather it and to apply it to such uses. This being the case, the legal problem, to the

extent that there is one, is not one of the right to gather and use the resource. As indicated previously, the hopefully resolved practically in the interests of full use, the area of major international discussion relates to the presence of an orbiting geostationary space object above an equatorial State.

Prospects for the lawful use of high altitude solar energy are not to be determined exclusively by interpretation of the language of the 1967 Treaty and perceptions of practices that may have ripened into customary international law. Nor is the lawful use to be determined wholly by the space resource States--powerfully influential though their outlooks may be.

4.4 Present Interest of COPUOS in Legal Use of Solar Energy

Although the United States had displayed an interest in developing a SPS at least as early as 1972, this subject did not come to the attention of COPUOS until 1975 at which time it asked the Secretariat to prepare a background paper. This resulted in "Solar Power Stations in Space."[16] In 1976 COPUOS recommended that the Secretary-General request States to submit information relating to the generation or transmission of solar energy by means of space technology. Such information was received in 1976 from three States, including the United States, and also from the European Space Agency.[17] A report was received from Argentina in 1977.[18]

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[16] U.N. Doc. A/AC.105/(XIX) CRP.1, June 1, 1976.

[17] U.N. Doc. 105/181, December 1, 1976.

[18] U.N. Doc. A/AC.105/181/Add. 1, February 15, 1977. Argentina had previously responded to a 1975 statement of the Chairman of COPUOS on sources of energy from outer space by supplying COPUOS in May 1976 with a working paper entitled "International Problems Arising from the Exploitation of Solar and other Related Energies." U.N. Doc. A/AC.105/L.91, June 9, 1976.

For additional submission was made by the Soviet Union.[19] This report was confined to an assessment of terrestrial uses of solar energy.

To the present the Scientific and Technical Sub-committee of COPUOS has served as a limited forum for the consideration of solar energy matters. In 1977 several States proposed that the subcommittee take a larger interest in both solar energy and materials processing in space. This was resisted by other States. They urged that for the time being most applications of technology for the utilization of solar energy took place on earth and not in space.[20] During its meeting in 1978, the Scientific and Technical Sub-Committee again reviewed its future role and work and made mention of solar energy platforms in space and the processing of materials in space. It decided that for the moment it should only be kept informed of developments.[21] The Legal Sub-Committee has not given direct attention to the issue. Thus, despite the importance to the space-resource States of gathering and transmitting high altitude solar energy to the Earth, there has not been much direct attention given to the subject at the UN at the present. That the legality of the gathering and transmitting of this space resource is of vital importance to all of the members of the community cannot be denied. Thus, what now exists may be likened to a calm before a possible storm. Political maneuvering is now taking place within COPUOS pointing in the direction of a new international conference to deal with the international law of the space environment. The nature of such discussions and the possible outcomes will be treated below.

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[19] U.N. Doc. A/AC.105/181/Add. 2, February 16, 1977.

[20] U.N. Doc. A/AC.105/195, p. 26, March 1, 1977.

[21] U.N. Doc. 105/216, p. 32, March 6, 1978.

Chapter Five

THE SPS AND STANDARDS RELATING TO EXPOSURE TO MICROWAVES

5.1 Transmission to Earth by Microwave of Solar Energy

An operational SPS will capture solar energy at geostationary orbital levels and will transmit such energy via microwaves to Earth. In an increasingly power-hungry world such energy will assist very materially in promoting the well-being of mankind. Coupled with the need to obtain and use this natural resource of outer space is the requirement that the capture, transmission, and use not cause detriment generally to the environment and more particularly to earth-based plants and animals.

The process of gathering and transmitting solar energy has been described:

> The electricity from the array would be used to power microwave generators which would feed a large microwave antenna which would transmit a focused microwave beam to a receiving antenna on the ground where the power could be converted to the appropriate voltage and frequency and fed into the local electricity network. Of the power generated by the solar cells, about 20 to 30 percent would be lost in the process of conversion to microwaves, transmission to the ground, and reconversion to electric current.[1]

At the present there has been little if any experience with the transmission of energy by microwave on a "wholesale" basis from space objects located at geostationary orbital levels. However, dangers and

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[1] Solar Power Stations in Space, U.N. Doc. A/AC.105/(XIX) CRP.1, p. 4, June 1, 1976.

harms resulting from too much exposure to microwaves are understood, and national and local governments have established safety standards relating to such exposure.

5.2 Protection Against Possible Harms from Microwaves

States have identified earth-based industrial and occupational standards to protect the safety of humans. Occupational standards for an eight-hour day range from 10 mW/cm^2 for the United States to 0.01 mW/cm^2 for the Soviet Union. The U.S. standard relates to tissue-heating potential.[2] An exposure level of 1.0 mW/cm^2 was assumed to be safe for continuous exposure of the general populace to microwave radiation by a joint DOE/NASA workshop in October 1977.[3] In planning for the future the United States NSAS has put forward as a proposed standard for SPS transmissions a microwave power density not to exceed 23 mW/cm^2 at the center of a beam emanating from a space object in geostationary orbit and 1 mW/cm^2 at the edge of a rectenna situated on Earth.[4]

However, the world community acting through both public and private institutions has given only an insignificant amount of attention to international microwave standards. There is no legally binding international treaty on microwave exposure standards.

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[2]U.S. Department of Labor, Occupational Safety and Health Administration, General Safety and Health Standards. OSHA 2206 (29 CFR 1910).

[3]Interim Environmental Guidelines for Satellite Power System (SPS) Concept Development and Evaluation, PRC Energy Analysis Co., pp. D-1, D-2, Figure D-1, June 1978, cited hereafter as Interim Guidelines.

[4]NASA, Solar Power Satellite Baseline Review by MSFC-JSC, p. 8, July 23, 1978.

Excessive amounts of microwave radiation can undoubtedly produce harms and injuries to a variety of subjects. Such radiation can have adverse biological effects. It is possible that such microwaves would be detrimental to the ionosphere.[5] Aircraft and birds in flight could experience detriment, but further study is required to determine if this is factual. Through excessive temperature increases there could be injury to the general ecosystem, including possible modifications in weather patterns. It should be emphasized that these are merely suggested possibilities, although it is known that excessive exposure to humans and other animals on the ground can produce adverse biological effects.

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[5]Glaser in discussing the environmental effects of the microwave beam refers to ionosphere propagation. He identifies several possible interactions of the microwave beam with the ionosphere, including displacement, phase fluctuations, dispersion, and fluxes. He states: The direct effect on high-power microwave transmission with densities of 20-30 mW/cm^2 is likely to be small, since the absorption at the 3 GHz frequency remains negligible, even with an order of magnitude increase in electron temperature and density. However, power densities greater than 100 mW/cm^2 could produce large horizontal electron density gradients that could cause significant beam displacement and dispersion."

He also stated: "Although only a small fraction of the microwave beam is absorbed, it is still significant compared to the natural thermal input to the ionosphere. For an incident flux of 20 mW/cm^2, the ionosphere ranges from 10 to 40 during the day and from 40 to 160 during the night. These significant changes in ionospheric properties will most likely be local and reversible, but they will have to be evaluated, particularly for continuous operation."

Further, "Given these considerations, it appears that microwave power densities above 20 mW/cm^2 could result in major changes in ionospheric properties. Microwave power densities greater than 20 mW/cm^2 could be employed once more data on these interactions have been obtained in experiments conducted with Earth-based as well as space-based transmitting antennas."

Moreover, "The effects of changes in ionospheric electron density caused by microwave power densities of 20 mW/cm^2 at the SPS operating frequency will have to be investigated for possible effects on other uses of the ionosphere." Peter E. Glaser, "Solar Power Satellites," op. cit., pp. 12-13.

Some of these concerns appear to be groundless. However, it should be borne in mind that a recent review of the literature on biological effects of microwave exposure reached the following conclusion: "Only intensive experimental study can reveal whether the SPS concept safely can be implemented."[6]

On the basis of present information, and taking into account the fact that many of the studies of biological effects were done with pulsed radiation and therefore do not necessarily apply to the continuous wave emissions projected for the SPS, it is known that safety standards will have to be established.[7] The same general prescription is, of course, applicable to all other objects likely to be impacted by SPS microwaves. However, it is probable that aircraft with passengers and cargo passing quickly through such a beam and birds in quick transit would not be adversely affected. No adverse effect on the ozone layer of the atmosphere is anticipated.[8]

Further research will be necessary to determine safety margins insofar as there is a possibility of harm to airspace and ecosystems. Measuring skills and equipment may have to be perfected since until the 1970s precise tools were lacking. Two areas of scientific measurement are critical to exposure standards. Densitometry is used to measure incident microwave

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[6]D. R. Justesen, H. A. Ragan, L. E. Rogers, A. W. Guy, D. J. Hjeresen, W. T. Hinds, and R. D. Philips, "Final Report, Compilation and Assessment of Microwave Bioeffects: A Selective Review of the Literature on Biological Effects of Microwaves in Relation to the Satellite Power System," Department of Energy, Pacific Northwest Laboratory for Division of Solar Energy, PNL-2634, UC-41, p. xiii, May 1978.

[7]Stanislaw Baranski and Przemyslaw Czerski, Biological Effects of Microwaves, p. 183, 1976.

[8]Interim Guidelines, op. cit., pp. D-1, D-2, Figure D-1. See Annex to this Chapter.

fields. Dosimetry measures absorbed energy in living organisms. On the basis of such measurements it will be necessary to establish exposure standards that will take into account immediate and long-term effects and to ascertain which of such effects may be benign or hazardous.

Baranski and Czerski differentiate between two different consequences of biological exposure. One, entitled "maximal comfort," takes into account the fact that "certain signs are observable but no differences between the functional efficiency of the organism in optimal conditions and on exposure are demonstrable."[9] The other, entitled "physiological compensation," gives special attention to the fact that "the exposure causes various disturbances and imposes a stress on the compensatory mechanisms . . . [but] no irreversible structural changes occur, i.e., exposure does not lead to deviations from the statistical norm."[10]

Under the circumstances, those who are obliged to formulate policies to cope with the uncertainty of the hazard will be obliged to be both imaginative and prudent. In writing about decision making in relation to the environment Hargrove has noted that:

> When it is prudent policy, in light of all the facts, to take action notwithstanding the inadequacy of the scientific knowledge available, then the tentative and stopgap nature of the action should be clearly recognized. When, on the other hand, prudent policy dictates forestalling action until more data is available, then this course should be regarded not as passivism but as the better-informed--and thus more effective--activism.[11]

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[9] Biological Effects of Microwaves, p. 183.

[10] Ibid.

[11] John L. Hargrove, Law, Institutions & the Global Environment, p. 41, 1972. Compare Carl Q. Christol, The International Legal and Institutional Aspects of the Stratosphere Ozone Problem, pp. 3-12, 1975.

The potential hazards of microwave radiation beamed to Earth from geostationary orbital level unquestionably will be very carefully assessed prior to a final policy commitment in favor of a SPS. The environmental issues will be measured not only in terms of the safety standards and limitations of solar energy but also will be compared with the environmental issues posed by alternative energy sources. In examining policy issues relating to such modest uses of solar energy as those permitting the "retail" heating of homes and office buildings, as contrasted with the "wholesale" supply of energy from a SPS, the Commission on Environmental Quality has stated:

> Necessarily there are uncertainties about technologies that are under development, but research and development efforts on all new sources can be planned so that the control of pollutants and other impacts is an integral part of R&D. Judged on environmental effects, solar technologies appear the least threatening of emerging alternatives although the impacts of large-scale solar electric powerplants are uncertain. In any case, the environmental effects of most solar technologies appear minor compared with known effects of coal and nuclear power.[12]

5.3 Efforts to Establish Protective Standards: Institutions

Following the scientific discovery in the 19th century that ionizing radiation produced biological effects, scientific societies established protective standards. At the First and Second International Congresses of Radiology in 1925 and 1928 two commissions were established, namely, the International Commission on Radiation Units and Measurements (ICRU) and the International Commission on Radiological Protection (ICRP). The

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[12] Environmental Quality, The Eighth Annual Report of the Council on Environmental Quality, p. 276, 1977.

League of Nations Health Organization published radiation protection recommendations in 1931. Publications of the International Labor Organization in 1932-1934 made substantial reference to the subject. A number of the organs and instrumentalities of the United Nations have examined the subject, and in 1955 the UN Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) was established. The International Atomic Energy Agency (IAEA), the World Health Organization (WHO), and the International Organization for Standardization (ISO), a non-governmental organization, have all issued numerous recommendations.

5.4 Efforts to Establish Protective Standards: Policies

In addition to the possibility of radiation hazards of a biological and environmental kind, there is also the possibility that the microwaves broadcast from geostationary orbital level would produce harmful interference with other users of radio frequencies. An assessment of the harmful interference situation was made above and will not be repeated here. Mention can be made of the fact, however, that just as human values and interests are at stake when it comes to deciding among such competing sources of energy as solar, nuclear, and fossil, so also values are involved in determining whether radio frequencies should be used to transmit solar energy or words or images. It is in this area that both the ITU and the United Nations with their respective technical and political capabilities may be able to assist in balancing competing values and interests.

It is expected that over time as microwaves are employed to forward solar energy to Earth that international agreements having the force of

law will result. Such agreements will identify or define valid international standards. The self-interest of countries bound by such agreements will lead largely to their self-enforcement. However, it is to be expected that there will be violations of or departures from the agreed standards. This will result in international liability and procedures will be required to secure the implementation of the agreements, including the assessment of monetary damages against the violator. This subject will be treated below when the 1972 "Convention on International Liability for Damage Caused by Space Objects" is analyzed.

5.5 The 1967 Principles Treaty and the Duty to Consult

Although the potential hazards of the transmission of energy by microwave will be most carefully assessed in laboratory situations before a SPS is put into operation, it is possible that limited experiments involving the beaming of microwaves from geostationary orbital level to Earth will be required in order to test the laboratory findings. Or, the initial broadcast could be of more substantial dimensions. Whether treated as an experiment or not the terms of Article 9 of the 1967 Principles Treaty are relevant. This Article imposes on a State embarking on an activity or experiment which would cause potentially harmful interference with the activities of other States bound by the agreement in their peaceful exploration and use of the space environment to undertake appropriate international consultations. Pursuant to the Article such consultations are to be undertaken prior to proceeding with such activity or experiment. In explaining the international commitment contained in this Article to the Committee on Foreign Relations of the U.S. Senate, Ambassador Goldberg stated:

> This we regard to be an important provision. It is one that we have pioneered in. We have long made it a principle that space activities ought to be conducted in such a manner so that the atmosphere of the earth is not contaminated by any experiments that are conducted in outer space. We regard this to be a very salutory provision, and one highly desirable in connection with the peaceful uses of outer space.[13]

Following this lead the Committee reported the Treaty to the Senate. The Committee stated that Article 9 called "upon parties to the treaty to conduct their space activities in a spirit of international cooperation and to take steps to avoid the contamination of outer space and celestial bodies. Any state party may request appropriate international consultation if it has reason to suspect that any activity may cause harmful interference with the peaceful exploration of outer space."[14]

This Article requires prior consultation only when it is reasonable to believe that such activity would cause potentially harmful interference. It does not give an objecting State a veto over the projected activity of another signatory. While the consultation must be carried out in good faith, the consulting States are not obliged to accept the judgment of the State asking for the consultation. As noted above, the general purpose of the Principles Treaty is to encourage the peaceful, scientific, and beneficial uses of the space environment. Article 9 cannot be read so as to defeat this major purpose of the agreement. Further, if one State were to establish a pattern of conduct in which it consistently

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[13] Treaty on Outer Space, Hearings before the Committee on Foreign Relations, United States Senate, 90th Cong., 1st Sess., Executive D, p. 42, 1967.

[14] Treaty on Outer Space, Executive Report No. 8 to Accompany Ex. D, United States Senate, 90th Cong., 1st Sess., p. 3, 1967.

caused harmful interference to the rights of others, the violator could expect to find that States experiencing such detriment would be engaged in conduct causing comparable harmful interferences to the initial violator of agreement.

It was suggested above that the radio spectrum is a world natural resource. Although in the view of some the resource is limited, it was suggested that science and technology have allowed this position to be challenged. Such a challenge, however, to be effective requires that international law and international organizations join together to establish substantive rights and procedures for the effective implementation of community policies. In the context of arriving at binding microwave exposure standards existing world institutions have a role to play. On the other hand, it might be possible to establish a new international institution designed to cope with the world space environment. Since the subject of international microwave exposure standards is a very special one, it could be made a part of a larger institution's responsibilities. Or, a highly functional body could be established to deal with the situation. The pros and cons of such approaches will be considered below in connection with an assessment of a proposed new world space law conference.

ANNEX

"Microwave effects - Microwave radiation is non-ionizing, so it does not affect biological materials in the way that ultraviolet, X-ray or nuclear radiation does. Its major effect on living tissue is heating caused by microwave absorption. If tissue is heated beyond certain limits, damage will result. . . . The peak intensity of the microwave beam reaching the Earth from a geosynchronous power plant is less than 1000 W/m^2, and the intensity drops to less than 100 W/m^2 at the edge of the antenna. Beneath the antenna the intensity is less than 10 Wm^2, so microwave intensities around and beneath the receiving antenna are completely safe for humans and wildlife. Occupants of metal-skinned, light aircraft flying through the beam would experience microwave intensities of 20-40 W/m^2 at the center, equal to the intensity of sunlight. Since the total exposure time is less than 5 minutes, it is doubtful that any damage would result. Birds will find that above the central region of the antenna they become uncomfortably warm, so they are expected to avoid that area. The animal experiments showed that the irradiated animals made every possible effort to remove themselves from the microwave field. Thus, although considerable specific investigation is required, particularly with respect to birds, the microwave beam should be safe both with respect to people and other forms of life. . . . The environmental impacts of geosynchronous power plants would be limited to the atmospheric effects of the space transportation system that raised the plant to orbit, atmospheric effects from the microwave power transmission system, and possibly a slight increase in local rainfall in the vicinity of the receiver/converter on Earth, similar to the heat-island effects of cities." J. Richard Williams, "Geosynchronous Satellite Solar Power," in H. J. Killian, G. L. Dugger, and J. Grey, eds., Solar Energy for Earth, an AIAA Assessment, pp. 69-70, April 21, 1975.

Chapter Six

LIABILITY FOR THE OPERATION OF THE SPS AND ITS COMPONENT PARTS

6.1 Genesis of Liability Concepts in Space Law

Man's ingenuous use of the space environment is unquestionably still at an infant stage. Uses, both old and new, will unquestionably result in misuses. International space law has been constructed on the basis that lawful uses are those that are peaceful and which are beneficial to mankind. Thus, international space law has been designed not so much to condemn misuse in general, but rather to prohibit particular conduct that is so unacceptable to the world community that it must be considered to be unlawful. In the absence of prohibition conduct is presumed to be lawful.

The first steps to establish an international legal regime for the space environment were taken by the UN General Assembly when it adopted Resolution 1348 (XIII) on December 13, 1958. The Ad Hoc Committee on the Peaceful Uses of Outer Space was asked to prepare a report on the legal problems to be foreseen. With regard to international responsibility and liability for damages formal culmination occurred with the inclusion in the 1967 Principles Treaty of Articles 7 and 9. Article 7 principles were confirmed and extended in the Convention on the International Liability for Damage Caused by Space Objects of March 29, 1972.[1]

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[1] 24 UST 2389, TIAS 7762. The Agreement entered into force for the United States on October 9, 1973. See Appendix C.

The Liability Convention has been characterized as "victim oriented." It was constructed to serve the needs of mankind. Space dangers may indeed be on the increase. More States and other users of the space environment are participating in space activities. Further, there is an ever enlarging and increasingly novel type of activity practiced or planned for man's newest exploitable environment. States are free, in general, to write their own laws for their own citizens. We are dealing here with the situation where international law requires a State to pay heed to the rights of foreign States and their nationals. The treaties dealing with liability for damages have created new dimensions of international tort law, i.e., the law that requires that unnecessary harms or wrongs not be imposed on juridical or natural persons, and if such were to eventuate that the wrongdoer be held accountable. International tort law, like the municipal variety, measures accountability in money damages.

Applying the foregoing to the SPS and its component parts there are three questions to be asked. First, does international tort law impose any liability upon those who place a space object into a geostationary orbital position? To date no authoritative world institution has the power to allocate orbital slots to space objects. So long as the res communis principle is in effect it is not wrong, nor is it unlawful, for a space object to use an orbital position, despite claims made by eight equatorial States to the contrary.[2] However, if there were a collision between such orbiting space objects, a fairly unlikely possibility, then

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[2]This position has been accepted by Soviet writers. See, for example, B. G. Dudakov, "International Legal Problems on the Use of Geostationary Orbit," Proceedings of the 19th Colloquium on the Law of Outer Space, pp. 407-409 (1977).

it would be possible to invoke the Liability Convention, as will be explained below.

Second, turning from the space object to its capture and transmission of solar energy, would there be liability for damage on the part of the owners or operators of the space object if harms were produced through causing exposure to the object's microwave transmissions? To this two answers can be given. As stated in a preceding chapter, at the present there are no internationally agreed on standards relating to the amount of microwave radiation that animals, plants, and inanimate objects can safely receive. In the absence of such international standards it could be argued that there could be no international legal liability. There could be no liability if there were no measurable standard of harm. On the other hand, there is a general expectation of prudence on the part of those who use possibly dangerous substances or instrumentalities. To understand the present state of the law on this matter will require an assessment of the two treaties mentioned above.

Third, again with reference to the transmission of energy in the form of radio broadcasts on assigned gigahertz frequencies, the question to be asked relates to tort liability for harmful interference with other broadcasts on the same frequencies, or, more generally, to the adverse effects of potentially harmful space activities. As in the preceding question the assumption is that the space object, which has been defined to include component parts, thereby includes the broadcasting equipment situated on or within the object. This, also, will require an assessment of the two treaties. In this case a sub-issue exists. Are money damages the proper remedy for harmful interference, or is the offended State

entitled to engage in the response of "jamming" in order to indicate its displeasure? Such action could induce responsive remedial conduct.

Generic to all three situations is the formal or treaty base for liability, which, pursuant especially to the Liability Treaty, varies depending on the spatial area in which the harm occurs. Despite different theories relating to proof of fault for different spatial areas, the 1972 Convention has an unlimited spatial application, for it encompasses the surface of the earth, airspace, and space objects that have left the surface of the earth or airspace. Also generic to the three situations is the measure of damages to be awarded in the event of a proven violation of the treaty expectations.

In seeking to respond to these three issues, and particularly the second and third, it will be sensible to enter a caveat. To the present no world tribunal has written an opinion in which answers have been provided. This means that reliance must be placed on the historic developments of this phase of space law including the language found in the agreements, the practices of the space-resource States and their nationals, the commentaries of scholars, and in particular the records of the negotiations including formal statements made by negotiators both during and after the conclusion of such negotiations.

The point was made in a preceding chapter that it can take a long time for a space law principle and more detailed rules to come into being. Under the heading "Legal Problems Susceptible of Priority Treatment" the Ad Hoc Committee on July 14, 1959 included the following in a report to the General Assembly:

> Since injury or damage might result from the launching, flight and return to earth of various kinds of space vehicles or parts thereof, a number of problems exist

> with respect to defining and delimiting liability of the launching State and other States associated with it in the space activity causing injury or damage. First of all there is the question of the type of interest protected; that is, the kind of injury for which recovery may be had. Second, there is the question of the type of conduct giving rise to liability: should liability be without regard to fault for some or all activities, or should it be based upon fault? Third, should a different principle govern, depending on whether the place of injury is on the surface of the earth, in the air space or in outer space? Fourth, should liability of the launching State be unlimited in amount? Finally, where more than one State participates in a particular activity, is the liability joint or several?[3]

This assessment of the liability issue was influenced by two considerations. The delegates to the UN in 1958 at the time of the adoption of General Assembly Resolution 1348 wished to cooperate internationally to reserve the space environment for peaceful uses and for the betterment of mankind. Also, they perceived that the liability of States for the uses of space objects would result from malfunctionings of space objects, per se, such as falling debris, or collisions with air or space-borne vehicles.

Between 1958 and the adoption of General Assembly Resolution 2777 (XXVI) on November 29, 1971, being the Liability Convention,[4] the UN had periodically given attention to the writing of a treaty dealing with international tort law for the space environment. Thus, in General Assembly Resolution 1721 (XVI) of December 20, 1961, provision was made that international law including the UN Charter, was to apply to outer space and celestial bodies.

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[3]U.N. Doc. A/4141, July 14, 1959.

[4]U.N. Doc. A/8528. The resolution received 93 votes in favor, none opposed, and four abstentions, e.g., Canada, Iran, Japan, and Sweden.

In General Assembly Resolution 1802 (XVII) of December 14, 1962 it was indicated that there should be liability for space vehicle accidents. Leading up to this determination were two draft conventions submitted to COPUOS by the United States. On September 11, 1962, COPUOS received "Draft Proposals on Liability for Space Vehicle Accidents," in which a launcher was to be accountable for "personal injury, loss of life, or property damage. . . ."[5] On December 8, 1962, the United States also submitted to COPUOS a "Draft Declaration of Principles Relating to the Exploration and Use of Outer Space," which stipulated that a launcher would "bear international responsibility for the launching, and is internationally liable for personal injury, loss of life, or property damage caused by such vehicle on the earth or in air space. . . ."[6] It will be noted that the spatial area excluded space, per se.

The Soviet Union also put forward a "Draft Declaration of the Basic Principles Governing the Activities of States in the Exploration and Use of Outer Space" in which reference was made to liability. It suggested on April 16, 1963 that "11. A State undertaking activities in outer space bears international responsibility for damage done to a foreign State or to its physical or juridical persons as a result of such activities."[7] The Soviet draft did not impose the spatial limits suggested by the United States.

On December 13, 1963, the General Assembly adopted Resolution 1962 (XVIII) "Declaration of Legal Principles Governing the Activities of

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[5]U.N. Doc. A/AC.105/L.5; U.N. Doc. A/5181, Annex III.

[6]U.N. Doc. A/C.1/881, p. 23.

[7]U.N. Doc. A/AC.105/C.2/L.6.

States in the Exploration and Use of Outer Space." In paragraph 5 it was provided that States bear international responsibility for national activities in outer space. In paragraph 8 it was agreed:

> Each State which launches or procures the launching of an object into outer space, and each State from whose territory or facility an object is launched, is internationally liable for damage to a foreign State or to its natural or juridical persons by such object or its component parts on earth, in air space, or in outer space.

On the same date the General Assembly requested COPUOS to prepare promptly a draft convention on liability for damage.

6.2 Liability Provisions in the 1967 Treaty: Article 7

However, COPUOS proceeded to draft the 1967 Principles Treaty, which made general provisions for liability along the lines illustrated in the foregoing documentation.[8] On January 25, 1967, the General Assembly adopted Resolution 2222 (XXI) which carried as an annex the Principles Treaty. Pursuant to Article 7 of this agreement, which entered into force on October 10, 1967, the principle was established that a launching State "is internationally liable for damage to another State Party to the Treaty or to its natural or juridical persons by such object or its component parts on the Earth, in air space or in outer space, including the Moon and other celestial bodies." Related to the principle of liability so established is the provision in Article 9 whereby States are required to conduct their activities in the space environment "with due regard to the corresponding interests of all other States Parties to the Treaty." They are required to avoid "harmful contamination" of the

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[8] Paul G. Dembling and Daniel M. Arons, "The Evolution of the Outer Space Treaty," 33 Journal of Air Law and Commerce 419 (1967).

space environment and to avoid "adverse changes in the environment of the Earth resulting from the introduction of extraterrestrial matter. . . ." Moreover, States are obliged to avoid activities or experiments in the space environment "that would cause potentially harmful interference with activities . . ." of other States in the peaceful use and exploration of the space environment.

6.3 Relationship Between Articles 7 and 9

The meaning accorded to these treaty terms and the relationship between Articles 7 and 9 was clarified in the testimony of Ambassador Goldberg in his testimony before the Senate Committee on Foreign Relations.[9] He stated that Article 7 was "designed to cover damage, physical, physical damage, from the consequences of launching a satellite."[10] This statement was a response to questioning by Senator Gore who had asked a hypothetical question as to the scope of the agreement. Senator Gore assumed that over time space objects would be employed in telecommunications with the possibility that jamming of broadcasts would occur. He noted that the treaty did not exclude such conduct, which he regarded as an international tort, and observed "The language of the treaty is clearly broad enough to cover such tort action as that to which I have hypothetically referred."[11] Ambassador Goldberg's response was that those who launch space objects are "internationally liable for damage to another state party by such object or its component parts on the earth, in air space,

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[9] Treaty on Outer Space, Hearings before the Committee on Foreign Relations, United States Senate, Executive D, 90th Cong., 1st Sess., 1967.

[10] Ibid., p. 39.

[11] Ibid.

or in outer space. I think any reasonable interpretation of that clause would mean physical damage. It was not intended to cover what you have talked about."[12]

The dialogue contained the following. Senator Gore stated that the agreement did not use the term "physical damage," but that "as a matter of fact, electronic damage is physical in nature. The jamming of a communications system is accomplished by physical phenomena. . . . If we are committing ourselves to liability for damages of an electronic nature in outer space with respect to radio and ray and various electronic communications, then this is a question, and I think a serious one."[13]

Ambassador Goldberg agreed with the seriousness of the issue. He then stated that the jamming situation was covered by Article 9. With respect to the meaning of this Article he stated:

> We did not establish a principle of liability which would become part of international law. We provided that if such interference may occur it should be the subject of appropriate international consultation. In other words, the two countries involved ought to take this matter up through diplomatic channels, that is what we provided, and that is the article of the treaty that relates to this type of interference, jamming, electrical interference, trying to stop a satellite by what measure you might take, and this is the subject of appropriate international consultation.[14]

The Committee continued to evidence its concern over Ambassador Goldberg's indication that Article 7 dealt only with "physical" damage. Senator Gore particularly wished it to be understood that electronic damage was not to be construed to be physical damage. Ambassador Goldberg

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[12] Ibid.

[13] Ibid., p. 71.

[14] Ibid.

responded that this was his understanding, too.[15] Senator Gore obtained agreement that Article 7 did "not include this electronic jamming and intereference which is dealt with in another article."[16] In the process, Senator Gore was obliged to accept a modification of his following formulations: "It is the understanding of the Committee that Article 7 pertains only to earthly physical damage that space activities may cause to the citizens or property of a signatory state."[17] The attention of the Committee was called to the fact that Article 7 referred to damages occurring not only on the earth but also in air space and in outer space, e.g., that the treaty was not limited to a situation where there was earth contact. Thus, Senator Gore acknowledged that his formulation, as stated above, had not been wholly accepted. When the Committee made its report to the Senate it excluded the "earthly" limitation suggested by Senator Gore. Thus, in the Committee Report the following language appears:

> The committee wishes to record its understanding that article VII pertains only to physical, nonelectronic damage that space activities may cause to the citizens or property of a signatory state.[18]

6.4 The Liability for Damages Convention of 1972

Following the drafting and entry into force of the Principles Treaty COPUOS resumed its deliberations on what was to become the Convention on

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[15] Ibid., pp. 75-76.

[16] Ibid., p. 76.

[17] Ibid., p. 74.

[18] Treaty on Outer Space, Executive Rept. No. 8 to Accompany Ex. D, 90th Cong., 1st Sess., p. 5, April 18, 1967. Cited hereafter as Executive Rept. No. 8.

International Liability for Damage Caused by Space Objects.[19] With the entry into force of the Liability Convention in 1973, legal negotiations that had been before COPUOS since March 1964, were brought to a conclusion.[20]

The Liability Convention contained no provisions affecting the res communis character of outer space at the geostationary orbital level nor did it deal with the right of States to make use of orbital slots or to capture and transmit solar energy. It covered the possibility of collisions, malfunctionings, and the consequences of such situations, including an assessment of the kinds of damages that might be recovered.

Moreover, this agreement did contain important provisions relating to a definition of a space object, including component parts, and the kinds of damage that could be caused. Unlike the Principles Treaty, this agreement identified spatial areas in which varying standards of proof of harm were applicable, clarified the nature of damages, identified principles of liability, made precise the parties who could be held responsible, defined who could be claimant, established claims procedures, fixed the rule of law to be applied to damages, and formalized the dispute resolving process.

Although relevant terms of Article 1 will be analyzed below, it will be helpful to identify briefly the articles that have relevance to the issues of collisions, malfunctionings, microwave exposures, and

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[19] 24 UST 2389, TIAS 7762. The agreement entered into force for the United States on October 9, 1973. It is set forth in Appendix B.

[20] N. M. Matte, Aerospace Law, pp. 153-174 (1977); Convention on International Liability for Damage Caused by Space Objects, Analysis and Background Data, Staff Report, Committee on Aeronautical and Space Sciences, United States Senate, Committee Print, 92nd Cong., 2nd Sess. (1972). Cited hereafter as Staff Report.

harmful interference with broadcasts. Article 1 (a) defines the term "damage." Article 1 (d) defines the term "space object."

Articles 2 and 3 identify the spatial areas in which activity by a space object can produce liability. These articles provide that the treaty has no spatial limitations, although a number were proposed during the negotiations. The spatial contours of these two articles have been summarized: "Provided that both the launching state and the state whose territory, nationals or property suffer damage are parties to the convention, the place where the damage occurs is immaterial notwithstanding that the damage may occur wholly within the territory of the launching state itself or within the territory of a non-contracting state. Nor is the nature of the property damaged material where the damage occurs on the surface of the earth. Elsewhere than on the surface of the earth, however, the Convention will only apply where damage is caused by a space object either to an aircraft in flight, or to another space object or to persons or property on board such a space object."[21]

Article 6 specifies circumstances in which the launcher will be exonerated from liability. Thus, where the event occurs on the surface of the earth or to aircraft in flight--carrying with it the rules of absolute liability--the launcher is exonerated if it can "establish that the damage has resulted either wholly or partially from gross negligence or from an act or omission done with intent to cause damage on the part of a claimant State or of natural or juridical persons it represents."

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[21] W. F. Foster, "The Convention on International Liability for Damage Caused by Space Objects," 10 The Canadian Yearbook of International Law, pp. 143-144 (1972). Foster's conclusions are based on a careful assessment of the negotiations as reflected in relevant United Nations documents.

However, no exoneration may be granted in cases where "the damage has resulted from activities conducted by a launching State which are not in conformity with international law . . ." including the UN Charter and the Principles Treaty.

Article 10 contains provisions fixing time limits within which a claim must be made. Paragraph 2 allows a State, which does not know of the damage-causing occurrence, one year following the date of the discovery of the damage to make the claim. The claimant must exercise due diligence to learn the facts in order to take advantage of the delayed claim procedure. Paragraph 3 permits the filing of revised claims "until one year after the full extent of the damage is known."

The 1972 Liability Convention has been characterized as having two central premises. As noted above, it is considered to be "victim oriented." Second, the agreement seeks to facilitate the effective use of the space environment, including resources situated there. Although the agreement has cast a wide cautionary net over space activities, nonetheless, it seeks to maintain a balance between use and liability for misuse. This perspective will influence the interpretations of the quoted treaty language.

6.4.1 Non-Violation by Placing SPS into Geostationary Orbit

The first issue in need of an answer is: Does a State have a right to introduce a space object into a geostationary orbital position, and if it does and this should lead to a collision or other malfunctioning of the satellite, is there a duty on the part of the launching State to pay damages? From the cited treaty terms it is clear that the Liability

Convention is based on the proposition that space objects can be placed legally into the space environment, including geostationary orbital level, and in order to support this principle the Convention contains substantive rules of international tort law applicable to the use of space objects. Article 1 in the definition of the term "damage" sought to bring clarity and greater precision to this concept than had been present in Article 7 of the Principles Treaty.

Article 1 (a) defined the term "damage" to mean "loss of life, personal injury or other impairment of health; or loss of or damage to property. . . ." The foregoing definition of damage follows the suggestions made by the United States in its September 11, 1962 "Draft Proposals on Liability for Space Vehicle Accidents," in its December 8, 1962 "Draft Declaration on Principles Relating to the Exploration and Use of Outer Space," and also drafts submitted to COPUOS in 1964 and in 1965.[22] The 1965 draft provided in Article 2 that damage occurring on earth, in air space, or in outer space may be "caused by the launching of an object into outer space, regardless of whether such damage occurs during launching, after the object has gone into orbit, or during the process of re-entry, including damage caused by apparatus or equipment used in such launching." In Article 1 of the draft damage was identified as meaning "loss of life, personal injury, or destruction or loss of, or damage to property."[23]

During the negotiations an effort was made to ascertain whether the expression "loss of life, personal injury or other impairment of health"

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[22] U.N. Doc. A/AC.105/C.2/L.8/Rev. 3, September 24, 1965, Staff Report, op. cit., p. 69.

[23] Ibid.

would cover what has been referred to in Western legal systems as "moral damage." Examples of moral damage are pain, suffering, and humiliation. The United States Department of State has taken the position that the Liability agreement "makes such claims possible by providing that compensation shall be determined 'in accordance with international law and the principles of justice and equity.'"[24] The quoted phrase is taken from Article 12 of the Convention. The State Department opinion may assist in resolving a problem area set forth in the 1972 Staff Report prepared for the use of the Senate Committee on Aeronautical and Space Sciences. The Report suggested that there could be certain "problems" in determining if the following would be compensible under the agreement: "interest from the time of the accident, consequential damages such as loss of future earnings or loss of profits, loss of use of property, costs of prosecuting the claim, pain and suffering, invasion of privacy, and loss of consortium."[25]

The ambiguous situation relating to moral damages has been noted by several commentators. Matte had written: "It is difficult to say precisely what kind of damage is covered: loss of profits, interest, sentimental value, pain and suffering?"[26] Further, "It is left open, to be decided in each case by the parties concerned, or, failing their agreement, by a claims commission. The same goes for what was called 'indirect' damage or damage which is not the direct result of the activity in question. Basically, this is a question of what relationship of cause

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[24] Executive Rept. No. 92-38, op. cit., p. 7.

[25] Staff Report, op. cit., p. 33.

[26] Matte, op. cit., p. 157 (1977).

and effect or what degree of causality is required to bring out liability."[27]

Foster attributes the ambiguity relating to moral damages to the diversity of national laws on this subject. He calls attention to the lack of a detailed consideration of this matter by COPUOS, and correctly notes that the 1972 Convention does not deal specifically with the subject. Nonetheless, he concludes that "despite the problems involved in placing money values on pain and suffering, and loss of capacity to enjoy life, compensation may be awarded for such losses."[28] On the whole, it is believed that the terms of the agreement, as viewed in the light of all of the negotiations, do support the view that remuneration for general damages, including pain, suffering, humiliation, and loss of capacity to enjoy life would be properly allowable if they should result from the unlawful use of the space environment. Such misuse, of course, would include the harms produced by collisions or other malfunctionings.

Article 1 in defining damage to include "loss or damage to property" clearly encompasses harms produced by the collision or malfunctioning of a space object or a component part with some other tangible entity. Such harm serves as an illustration of what has been described as "direct" damage within the coverage of the agreement. It has been observed that "undoubtedly, the definition covers direct damage, i.e., an injury, loss or damage flowing directly or immediately from, and as the probable and natural result, of the launching State's space object. In other words, it clearly covers instances where the space object is the proximate cause

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[27] Ibid.

[28] Foster, op. cit., p. 173.

of the injury, loss or damage."[29] Direct damage as the result of collision or malfunctioning resulting in space object debris falling back to earth is compensable under the terms of the agreement.

During the negotiations the issue was raised as to indirect or consequential damage. As opposed to direct damage, namely, an "injury, loss or damage flowing directly or immediately from, and as the probable and natural result, of the launching State's space object,"[30] a consequential damage would be that which did not result directly or immediately from the act, but only from some of the consequences or results of the act.[31] Illustrative of this form of damage might be the loss of consortium resulting from injury to a spouse or to the need for a replacement employee in the event of harm to an injured employee. The United States urged that the agreement did not include consequential damage. In its view the agreement "holds a launching State liable for damage traceable directly to the launching, flight and re-entry of a space object or associated launch vehicle but does not cover what some delegations earlier called remote or indirect damage and for which there is only hypothetical causal connection with a particular space activity."[32] The basis for such consequential damage depends on an earlier physical harm to a person other than the person asserting consequential damage. The line between a physical and nonphysical damage is often blurred. In the United States, for example, nonphysical harm may be produced via psychic injury where there has been no physical contact between the harmed person and the

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[29] Staff Report, p. 23.

[30] Staff Report, p. 23.

[31] Ibid.

[32] Ibid., p. 24.

injury producing event. Our law allows for recovery for trespass even when there has not been a physical harm.

In summary, direct damage and moral damage resulting from a collision or malfunctioning of space objects, are recoverable under the terms of the agreement. To the extent that indirect damages fall under the heading of moral damages they would be included. Use of the space environment for peaceful and beneficial purposes is not an international tort. Damages cannot be recovered for the use of an orbital slot, although misuse of a geostationary orbital position could produce conditions under which damage might occur. Article 1 by defining damages and also identifying who engages in the launching of a space object confirms the right to use space objects. The definitional process in specifying conditions of liability for misuse confirmed the right to use.

6.4.2 Incurrence of Liability from Microwave Radiation

The second issue relates to harm caused by the transmission to Earth of microwaves that may have harmful non-ionizing effects on plants, animals, and the environment in general. Article 1 of the Liability Convention defines damage to include loss of life, personal injury or other impairment of health as well as loss of or damage to property belonging to identifiable natural or juridical persons. Claimants are narrowly defined. Thus, only natural or juridical persons can experience the stated harms. The agreement does not accord to the world community in a general sense any right to put forward environmental claims.

Nonetheless, by extending tort rights to natural and juridical persons it may be expected that their immediate self-interests will also

offer some protection to general environmental needs. Comment has been made as to the wide scope of the protection accorded to human beings under Article 1.

> From the broad terminology used in this definition it is clear that all injuries to persons are covered whether or not they are accompanied by objective or substantially harmful physical or psychopathological consequences provided they at least result in an "impairment of health." Moreover, it is immaterial whether the injuries are suffered through physical impact with a space object or result from biological, chemical or radiological contamination emanating from a space object.[33]

During the negotiations of the Liability Convention much concern was expressed over radiological contamination emanating from a space object. Nuclear damages are covered by the agreement. It has been suggested that the inclusion of this area of potential harm was an effort on the part of the negotiators "to cover by its provisions the widest possible scope of harmful effects of space activities."[34] An assessment of these discussions is relevant to the issue of damages caused by microwave emissions. Certain basic similarities are present. Both nuclear harm and that produced by microwave transmissions are produced by radiating sources. Both result from man-made activities. Differences are based on the amount of detriment that could be caused and by the geographical range in which the detriment would occur.

Since, as noted above, it is immaterial whether harm is produced by biological, chemical, or radiological contamination, it would equally

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[33]Foster, op. cit., p. 155. See Chapter Five and the Annex thereto.

[34]Jerzy Rajski, "Convention on International Liability for Damage Caused by Space Objects--An Important Step in the Development of the International Space Law," Proceedings of the 17th Colloquium on the Law of Outer Space 245 (1975).

appear to be immaterial as to the extent or immediate source of such contamination. Thus, to the extent that radiological contamination falls within the scope of the Liability Convention it would be expected that harms produced by microwaves would also be covered by the agreement. It has been reported that an Argentinian symposium has come to the conclusion that "any damage caused by the use of solar energy by means of space technology is damage in the terms of paragraph (a) of Article 1 of the 1972 Convention on international liability for damage caused by space objects."[35] Since solar energy is, in effect, "used" when it is forwarded to Earth via microwave transmissions, it is at least possible that the Argentinian position is consistent with the conclusion dealing solely with microwave broadcasts.

Foster has analyzed the difficulties presented by the issue of nuclear damage in the drafting of the Liability Convention. He has reported that three alternatives faced the negotiators. One was to exclude nuclear damage from the agreement and to provide a separate treaty specifically dealing with the subject. The second was to exclude the subject from the Liability Convention but to seek a revision of the International Convention on Civil Liability for Nuclear Damage to cover the problem. The third was to include nuclear damage in the Liability Convention.[36] After reviewing six proposals on this subject submitted to COPUOS, he concluded that the majority of the negotiators held the opinion that the Liability Convention would extend to nuclear damage. He supported his conclusion with the following reasons advanced by COPUOS:

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[35] U.N. Doc. A/AC.105/PV.177, p. 3, July 27, 1977.

[36] Foster, op. cit., p. 155, fn. 63.

(a) the Outer Space Treaty did not provide for the exclusion of such damage;

(b) a claimant state would face serious difficulties in distinguishing between nuclear damage and damage caused by the impact, or the exploding of a space object;

(c) nuclear damage does not arise solely through the effects of radiation but also from heat, light and explosions and it is thus very similar in many respects to non-nuclear damage;

(d) unlike other types of nuclear hazards where the risks could be assessed and which were accepted by potential victims, nuclear damage caused by a space object was impossible to foresee and even more impossible to assess in advance;

(e) the compensation being sought by the claimant state would be no different to that payable for other types of damage.[37]

All delegates finally concluded that nuclear damage should be included within the coverage of the agreement. Further, despite the arguements presented by the United States which wished to fix the maximum amount that could be recovered from this source of injury, it was agreed that there should be no monetary limitation on nuclear damage.

Nuclear damage would result from the malfunctioning of a component part of a space object, such as a nuclear-powered motor on board and a part of the payload of the satellite. The launching State would be legally accountable for the damages that resulted. The Soviet Union as a party to the Liability Convention has acknowledged the applicability of the foregoing interpretation in accepting the validity of the Canadian claim for damages growing out of the Cosmos 954 event. It would seem that States employing microwave frequencies for the transmission of energy, which could have adverse effects and consequential damages by

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[37] Ibid., pp. 156-157.

way of loss of life, personal injury or other impairment of health, as well as damage to property, would be equally liable under the 1972 Convention.

A further reason for assessing liability against a State using a microwave transmission, which produces harm, has been advanced. This arises from the fact that biological, chemical, and radiological contamination may produce harms that are not observable immediately or even within an extended time period. This possibility was contemplated by the negotiators. They solved it by providing in Article 10 (2) that claims might be filed within a fixed time after the fact of harm had been discovered. This provision was designed for harms resulting from nuclear radiation but would also appear to be applicable to harms produced by microwaves.

From what has been said above it would appear that both microwave radiation directed toward the Earth and also at geostationary orbital level, as well as harms produced in the collection of solar energy at high atmospheric levels would be governed by the terms of the 1972 agreement. It will be recalled that it operates without regard to geographic and spatial constraints. Persons and property situated on the Earth, in airspace, or on board a space object are entitled to the protection of the agreement, even though the means for ascertaining liability are different.[38]

The fact that such harm, if any, resulting from the collection of solar energy and its transmission via microwave, would be the product of

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[38]Absolute liability is the test for the payment of compensation for harms caused on the surface of the Earth or to aircraft in flight. In other areas the test is fault.

a component part of the space object, rather than the space object per se, would not relieve the launching State from liability.

Article 1 (d) defined the term "space object" to include "component parts of a space object as well as its launch vehicle and parts thereof." COPUOS has been consistent in its efforts to define or to describe a space object. Thus, pursuant to Article 1 (b) of the Convention on Registration of Objects Launched into Outer Space, November 12, 1974, "The term 'space object' includes component parts of a space object as well as its launch vehicle and parts thereof."[39] Thus, for definitional purposes, the concept of a "space object" has a wide meaning.

Doubt has been expressed as to adequacy of the definition of a space object.[40] This was troublesome to the Senate Committee on Foreign Relations in 1972. It obtained a memorandum from the Department of State which indicated that "space object" would include "the payload and fuel."[41] The memo continued: "It appears to be the view of most international lawyers that the term 'space object' includes any object launched by man for the purpose of orbiting or escaping the celestial body from which it is launched. . . . The test is not only whether the object does go into orbit or beyond, but also whether any object which is launched by rocket propulsion is intended to go into orbit or beyond. . . . It should

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[39] U.N. Doc. A/9812. This agreement entered into force on September 15, 1976. The United States is a party to the agreement.

[40] Staff Report, p. 25.

[41] Convention on International Liability for Damage Caused by Space Objects, U.S. Senate, Committee on Foreign Relations, Executive Report 92-38 to Accompany Ex M, 92nd Cong., 2nd Sess., p. 9, The Executive Report refers to public hearings conducted on August 3, 1972. These were not printed, but much of the testimony received by the Committee appears in the Executive Report.

be noted that in practice no difficulties have so far arisen from the lack of precise definition of a space object, and we do not foresee the emergence of serious problems for some time in the future."[42] No definition was given to "component parts." It has been suggested that the definition of a space object is, in effect, a "non-definition."[43] This outcome resulted from the opinion of the COPUOS Legal Sub-committee that the term "space object" had a reasonably understood and clear meaning and that it was only necessary to include in a definition all the component parts and equipment of a space object which could cause damage."[44] The "payload" of a space object, as an aspect of its component parts, must be conceived of in a practical sense. Such a payload will include everything associated with the operating space object, both inside of it and attached to it on the outside. For example, the sensing and communications systems directed to observing and maintaining contact with the Earth and other objects in orbit, as well as the life support systems of the object, are encompassed in the term component parts and are a part of the "payload." It can be assumed that the component part would also include the hardware involved in the collection and transmission of high altitude solar energy from a geostationary orbiting space object to earth via microwave frequencies. To the present there has been no disposition to prohibit the installation of such sensing, transmitting, and other electronic equipment on space objects. Nor is it anticipated that such a prohibition claim could ever be made or justified, since

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[42] Ibid., pp. 9-10.

[43] Foster, op. cit., p. 145.

[44] Ibid.

without such equipment the legitimate uses of the space environment could not take place.

The conclusion can be drawn that the commonplace term "payload" is intended to include the totality of the space object, including its component parts, and of necessity the property on board. Without equating the payload to the space object and component parts it has, nonetheless, been suggested "that not only damage caused by the object itself, but also that caused by the payload, by the functioning of scientific instruments on board, and by anything that has become detached from or thrown out of the space object, will be covered by the Convention."[45]

However, Foster has asserted that "persons and property on board a space object are not encompassed by the term 'space object.'"[46] It appears to be his position that only if such property became detached from the space object would the 1972 Convention not govern liability caused by the detached property. Even that position is subject to a condition envisaged by him. He states:

> Of course, in some instances, the property on board a space object may be other space objects which are to be placed in orbit or deposited in outer space and are designed for movement in outer space. Where this occurs, damage caused by these latter objects, after they become detached from the original space object, would be covered by the Convention.[47]

It can be assumed that the broadcasting equipment used by a geostationary space object for transmitting microwaves to Earth would not be voluntarily

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[45]Matte, op. cit., p. 157 (1977). U.N. Doc. A/AC.105/C.2/SR.94, 95, 97.

[46]Foster, op. cit., p. 158.

[47]Foster, op. cit., p. 159.

detached from the space object within or upon which it has been installed. Although it is certainly property on board the space object, it is also equally certainly a component part of the object. In support of the view that the transmitting equipment is a part of the space object, it can be asserted that such parts include all of the mechanisms actively used to further the functions and objects of the space object. On the other hand, it would be possible for "property on board" not to have utility in furthering such functions, especially those not having a relationship to the external contacts or activities of the space object. Thus, it is possible to maintain that component parts include those needed to allow the space object to achieve its assigned mission, including obtaining an orbital position, and having arrived there to facilitate the successful functioning of the orbital goal. That such goal was sensing, or broadcasting of words or images, or forwarding energy via microwave emissions to Earth would all seem to be equally supportable. Misuse of space objects, including component parts, in the furtherance of such objectives would result in liability under the 1972 Convention if damage had been produced thereby. In view of the foregoing it is clear that a launching State would be internationally liable for harm produced by microwaves emanating from a space object, including its component parts.

6.4.3 Harmful Interference and the Matter of Damages

The third issue involving national liability for the use of the space environment relates to microwave transmissions that may constitute a harmful interference with other radio broadcasts or electronic transmissions. As a sub-issue is the question of whether a country so interfered

with could have resort to jamming in the event that monetary damages were not available as compensation for the harmful intereference.

At the time that the 1967 Principles Treaty was being considered by the United States Senate much concern was expressed that electronic signals could be interefered with so as to produce nonphysical but nonetheless very real detriment. It will be recalled that the Senate attached an understanding to the meaning of Article 7 of the Principles Treaty whereby it recorded its view that the Article pertained only to physical, nonelectronic damage that might be caused by space activities to the citizens or property of a signatory State.[48]

Considering the attention given to this issue by the Senate in 1967, as described above, it is quite remarkable that the printed documentation of the Committee on Foreign Relations referring to its hearings on the Liability Convention indicates that the matter went unnoticed. Before the Senate gave its advice and consent to the Liability Convention the Senate Committee on Aeronautical and Space Sciences had prepared an analysis in which attention was called to the 1967 Senate position.[49] It may be assumed that insofar as the Senate did not affirmatively modify its 1967 stand with regard to the exclusion of electronic jamming from the 1972 Convention, since it made no specific references to Article 9 of the Principles Treaty, the United States has kept the obligation of Article 9 securely in place. In specific terms this would mean that if the launching and use of a SPS, as an activity or experiment, were considered to be a potentially harmful interference with the activities of another State

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[48] Executive Report No. 8, op. cit., p. 5.

[49] Staff Report, op. cit., p. 24.

which produced damages, that recourse could be had to the diplomatic consulations required by Article 9 of the 1967 Principles Treaty but not to the terms of the 1972 Liability Convention.

Article 9 contains two major concerns. First, it draws attention to the need to protect the global environment. Second, and more specifically, it endeavors to protect the competing activities in the space environment of the space-resource States. The spatial applicability of Article 9 has been raised in connection with sensing by space objects and the prospective use of the DBS. It has been suggested that "insofar as the interpretation of consultation clauses in this context is concerned, it is submitted that potentially harmful interference with the functioning of foreign broadcasting satellites (a peaceful use of outer space) is covered by the consultation clauses."[50]

While it is clear that Article 9 establishes a firm duty to engage in consultations in the event of threatened harms, the Article does not constitute a veto over space uses or activities on the part of States. But, if a State were to refuse to carry out the obligation to consult this would undoubtedly open the door to the dispute resolving procedures contained in the Charter of the United Nations, which pursuant to Article 3 of the Principles Treaty govern the relationships of the parties to the 1967 agreement. Despite the firm duty to consult, "the formal scope of obligations under the consultation clauses of the Space Treaty

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[50] Jerzy Sztucki, "International Consultations and Space Treaties," Proceedings of the 17th Colloquium on the Law of Outer Space, p. 159 (1975). Compare, Istvan Herczeg, "Introductory Report, Provisions of the Space Treaties on Consultation," op. cit., p. 141. He observed that the Article 9 consultations are "extraordinary," e.g., they "are convened dependent upon definite events or contingencies."

is extremely limited. Their effectiveness is still more limited. If interpreted formally, they leave ample room for States to obstruct international cooperation in space and to take arbitrary decisions in disregard for 'corresponding interests' of other states."[51] The Liability Convention makes no direct reference to consultation in the event of potentially harmful interference with activities in the peaceful exploration and use of the space environment, although Article 21 dealing with multinational assistance to areas threatened by large-scale detriment implies the need for some kind of consultation in order to make such assistance effective.

Whether international agreements do or do not require wide-ranging international consultations prior to a State's embarking on a course of action that may have potentially harmful effects on the environment generally or on the space-activity interests of another State, there is a need to take into account elementary considerations of humanity. Thus, the World Court in the Corfu Channel case stated that the foregoing standard was both general and well-recognized and imposed an international responsibility on States not to expose lives to unnecessary danger.[52]

Jamming of electronic transmissions has been reserved to denying the reception of ideologically objectionable materials intentionally broadcast across international boundaries. General principles of international cooperation, as well as the Article 9 duty to consult, suggest that jamming of microwave transmissions of solar energy would be unlawful. No State has a lawful right to deny the capture and transmission of solar

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[51] Sztucki, op. cit., p. 167.

[52] ICJ, 1949, p. 22.

energy by another State, since the solar energy resource is a free and unlimited resource and is available to those who possess the scientific and technical capabilities to use it. Just as the vessels of one State on the high seas are not to be disturbed in their peaceful use of the high seas by the vessels of another State, so must the SPS of one State be allowed to freely gather and transmit such energy via microwaves. If in the course of such an event some harm befalls another State, the appropriate remedy is consultation with the prospect of monetary compenstation for provable harm or a termination of the harm-producing activities. In the process of identifying the facts relating to a case of alleged harmful interference there could be recourse to the ITU or private scientific organizations, such as COSPAR.

6.5 International Law Applies to Harms Caused to SPS

In the preceding pages emphasis has been placed on the possibility that compensable harms might in some manner result from the operation of a SPS. It should be kept in mind that it might also be possible to cause harm to a SPS. The foregoing rules of law and attendant political conditions would protect the one as well as the other as a general proposition, although in some situations the detailed provisions of the 1972 Liability Convention would make distinctions, for example, a different standard of proof would apply to harms occurring on the Earth or to aircraft in flight as opposed to all other areas.

In conclusion, it should be remembered that both of the treaties received the measured approval of the space-resource States. They perceived that their respective interests would be well served. It is to be expected

that they will seek the effective implementation of the agreements in order to serve their perceived interests.

More specifically, answers have been provided for the three questions that were posed. First, under international law it is permissible for a State to place a space object, including a SPS, into geostationary orbit. International law imposes liability for collisions and malfunctionings while in orbit. Second, where direct harm, including physical and non-physical or moral harm resulting from such direct harm, has been produced as a result of microwave transmissions, international law allows those harmed to recovery monetary compensation. The standard of compensation is set forth in Article 12 of the Liability Convention. The standard is a uniform one. This means that there cannot be divergent views as to the monetary value of harm resulting from different and competing legal systems. Recovery can be based on the malfunctioning of the space object, including its component parts. An injured person does not have to show intent to harm in order to recover. Such parts include transmitting equipment able to broadcast microwaves carrying the solar energy gathered at geostationary orbital level. Third, in the event that such radio transmissions were to constitute a harmful interference with other activities or experiments involving the peaceful uses of the space environment there is a duty to engage in diplomatic consultations with States asserting the possibility of harm. Scientific bodies exist that could assist in ascertaining the factuality of such claims of harmful interference. The duty to consult does not accord to the State seeking such consultation the right to veto the proposed use of or activity in the space environment. Jamming is not an allowable means to express disapproval of the potentially harmful

conduct of the space-resource State. The efforts to protect individual claimants also serve to protect more general environmental needs. This means, of course, that no unusual legal prohibitions confront the possible employment of a SPS. The scope and quality of international tort law should offer encouragement to those who may wish to embark on SPS programs.

Chapter Seven

PROSPECTS FOR A NEW INTERNATIONAL CONFERENCE ON SPACE ENVIRONMENT LAW

7.1 Proposals for a Space Law Conference

Not all States consider a full review of the current state of the international law of the space environment to be premature. Beginning in 1974 there have been proposals by a number of States for a conference on either space applications or outer space matters.

A number of forums conceivably exist for the development of space law. Attention has previously been called to the role of the UN through COPUOS and the ITU. In 1968 the UN sponsored a Conference on the Exploration and Peaceful Uses of Outer Space in Vienna.

Although some States have actively urged a new conference along the 1968 lines, other States have resisted the suggestions. In arriving at a decision to convene such a conference there are policy issues relating to possible outcomes as well as timing to be considered. Important national wants and needs would undoubtedly be placed on the agenda including issues affecting the effective operation of a SPS and the possible formation of a formal regulatory regime affecting peaceful uses of and activities taking place in the space environment.

The Scientific and Technical Sub-committee of COPUOS in 1974 recommended that the views of UN members be obtained regarding the convening of a UN conference on space applications. This was endorsed by COPUOS. This resulted in an inquiry by the Secretary-General to members

seeking advice on (1) whether they favored the convening of such a conference on space applications "in the next few years,"[1] (2) what should be the principal objectives to be obtained, (3) considering the need for preparatory work, what should be the appropriate time and location, and (4) whether the members would be interested in participating if such a meeting were to be held.

7.2 Different Assessments Regarding the Worth of a Conference

Responses have been varied. As an alternative, a number of States called attention to plans under way for a UN-sponsored Conference on Science and Technology for Development.

Representative views indicate a need for a clear demonstration of the need and usefulness of such a conference, the need be satisfied that the preparations for the conference would produce reasonable hopes that the meeting would be useful, the need to avoid competition with other scheduled UN conferences, the need to consider a future date--such as 1980 or later--, the need to know the precise aims of the proposed conference, the need for an agenda item on the assistance likely to be received by the LDCs from space applications, the need not to duplicate the functions successfully being performed by COPUOS, the need to determine if such a conference were really necessary following an assessment of the accomplishments of the Conference on Science and Technology for Development, and the fact that the machinery of COPUOS adequately would serve all aspects of the outer space debate during the decade of

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[1]Question of Convening a United Nations Conference on Space Applications, U.N. Doc. A/AC.105/142, p. 1, January 16, 1975.

the 1970s.[2]

Although the space-resource States did not specifically associate their rather luke-warm approval of a new conference to any substantive issue that might be raised, it is possible to conjecture that they wished to have an adequate amount of time to plan their positions relating to solar energy and geostationary level orbits prior to giving full support to the conference. They were aware of the positions that had been taken in COPUOS and at the WARC BS by the equatorial countries relating to sovereignty over spatial areas and the natural resources situated in such areas.

Thus, Colombia gave notice that these issues would come before the proposed conference. It stated in 1977 that it had on numerous occasions called attention to the "sovereignty which it exercises over its segment of the geostationary orbit and has expressed its interest in and its position on the possibility of States reaching agreement through joint efforts in a fair and equitable definition of outer space, respecting the rights of sovereignty possessed and exercised by equatorial countries."[3]

That the equatorial countries would not be able to count on the support of some of the LDCs was indicated by the position of Papua New Guinea. After noting that the Republic of Indonesia had advised the 1977 WARC BS of its intent to follow the Bogotá Declaration and "other principles of international law," Papua New Guinea stated in the event

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[2]The foregoing positions were advanced by Canada, the United Kingdom, the United States, and the Soviet Union. U.N. Docs. A/AC.105/142/Add. 1 through Add. 14, April 9, 1975 to February 27, 1978. For more specific positions of the United States and the Soviet Union see U.N. Docs. A/AC.105/PV.176, pp. 46 and 56, July 27, 1977, and A/AC.105/PV.178, p. 16, July 28, 1977.

[3]U.N. Doc. A/AC.105/Add. 9, p. 3, December 19, 1977.

that it should acquire a television broadcasting satellite of its own that it would be necessary to put it into an orbit over the equator above Indonesia. Therefore, Papua New Guinea, consistent with its own position at the WARC BC, stated that it considered "the use of the geostationary orbit is not subject to sovereignty rights of any country and should be used to benefit all mankind."[4] Papua New Guinea expressed its willingness for a task force to be set up within COPUOS preparatory to the proposed conference. But when recommendations were made relating to the Bogotá Declaration, such recommendations would have to be "studied carefully before any consent is given of its final recommendation to the United Nations Committee for the Peaceful Uses of Outer Space."[5]

Israel forthrightly acknowledged some skepticism as to the utility of such a conference because of the limited performances of some of the UN-sponsored conferences and because of the political pitfalls associated with them. Nonetheless, assuming adequate preparation, it was considered that the conference might have "as one of its major subject areas the possible implementation of an international project designed to facilitate the utilization of outer space for the transmission to earth of unharnessed energy from the sun."[6] Support for the proposed conference was in part based on the view that the benefits to be derived from solar energy should be equally distributed. This "could be better met by an international effort rather than by separate national projects."[7]

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[4] Ibid., p. 8.

[5] Ibid.

[6] U.N. Doc. A/AC.105/142/Add. 14, p. 2, February 27, 1978.

[7] Ibid.

In August 1978, it was reported that the United States and the Soviet Union had given their approval to a new conference on outer space, but had sought to limit the scope of such a conference. The conference, when held, according to the report would take place no sooner than 1983, no sooner than 2-3 years after the General Assembly had given its approval to the conference, and only after the results of the Conference on Science and Technology for Development were in. Further, the space-resource States wished to focus the work of the conference on scientific and technical considerations rather than on legal-political issues. The equatorial States and some of the LDCs have favored wide-ranging legal and political discussions. The United States appears to oppose negotiating on the claims of the equatorial States to sovereignty in the areas superjacent to them. The United States also does not consider the problem of the definition/delimitation of airspace and outer space to be a pressing one.[8]

7.3 Factors Involved in the Convening of a Conference

It is beyond the scope of the present paper to assess all of the problems attendant upon the convening of a UN-sponsored international space conference. However, it is in order to mention several considerations that would contribute to the ultimate success of the work of such a meeting.

In the first place, as suggested above, there is an absolute need to be assured that all of the participants have a relatively similar understanding of the basic scientific and technological facts involved

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[8]Craig Covault, "Nuclear-Powered Spacecraft Study Set," Aviation Week & Space Technology, p. 45, August 7, 1978.

in the exploration and use of the space environment. Only after there is relatively common agreement as to the validity of given facts will it be possible for the participants to move toward the legal and political considerations that will come before them. Every attempt will have to be made to avoid the early politicization of the conference. In this regard, important lessons can be learned from the lack of agreement and for the moment, at least, the lack of success of the United Nations Conference on the Law of the Sea. By comparison, the preparation that was obtained at the time of the 1958 Law of the Sea Conference could be emulated. In that situation the International Law Commission was responsible for the preliminary studies and drafts of the treaties that were agreed to in 1958. For the proposed space law conference the preliminary work could be undertaken by working groups within COPUOS, and such bodies would be expected to have very substantial technical assistance from such public institutions as ITU, WHO, ICAO, IMCO, IAEA, and ESA, among others. It would also require advice and guidance from such private international bodies as COSPAR and IAF, among others. Only after such groundwork had been done would it be permissible for the national-interest positions of States to be advanced so that suitable decisions of a legal-political character might be arrived at. Since many members of the United Nations do not have a sophisticated understanding of the science and technology of the space environment, and since in many cases the LDCs are woefully understaffed when confronted by contemporaneous conferences at the UN, the use of working groups could provide a suitable educational opportunity.

In the second place, it should be understood at the outset that, even assuming a firm grasp of the facts and a common political will, that

the final product of the conference will cost and consume an enormous amount of time. This point must be understood lest false hopes be built up only to be destroyed. In the most general terms it should be recalled that all of the important, formal, political-legal decisions taken regarding the space environment have taken a very long time. Moreover, a number of important issues that have attracted the attention of COPUOS for many years have not been, as yet, resolved.

7.3.1 Negotiation of the 1967 Principles Treaty: Lessons

So that this point will not be lost sight of, a brief historical account will be given of the steps leading to the entry into force of the 1967 Principles Treaty. This will be supplemented by additional illustrations, which, in the interest of brevity will simply identify the time when formal discussions began with an account of where such negotiations have been brought as of the present. Illustrations will be provided for treaties and for agreements involving the establishment of international organizations.

It is possible to trace the genesis of the Principles Treaty back to the 12th session of the General Assembly's disarmament committee. On August 29, 1957, a proposal was made by the United Kingdom and supported by other western powers for the control of weapons in outer space. Discussions took place in October and November 1957, which led to a call for the establishment of a technical committee to work out an inspection system. Its purpose was to insure that the space environment would be used exclusively for peaceful and scientific purposes.

On December 13, 1958, the General Assembly established an 18-member Ad Hoc Committee on the Peaceful Uses of Outer Space. On December 12,

1959, the Committee was made permanent. Between September 10, 1962 and April 16, 1963 five draft proposals were received by COPUOS from four States. All of the proposals contained principles to be incorporated into a UN declaration relating to the exploration and use of outer space.[9] Following lengthy negotiations the Committee submitted a resolution entitled "Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space" to the General Assembly. This was adopted in December 1963.[10]

During the following two years COPUOS focused on writing a liability convention and on the needs of astronauts and space objects in distress. On December 21, 1965, the General Assembly asked COPUOS to give consideration to the drafting of an international agreement setting forth the legal principles governing the activities of States in the exploration and use of the space environment. Following careful negotiations in COPUOS, and at its recommendation, the General Assembly unanimously adopted Resolution 2222 (XXI) on December 19, 1966. This resolution contained the Principles Treaty, and the General Assembly invited all States to sign and ratify it. Upon having received the requisite number of ratifications the treaty entered into force in October 1967. If it is accepted that the serious negotiations for the treaty began only in 1962, it took about five years for an existing and structured international organization to produce this Treaty. Had it not been for the willingness of the United States and the Soviet Union to press for the acceptance of the agreement it could have taken longer. Moreover, within the United States propitious political

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[9]Carl Q. Christol, The International Law of Outer Space, pp. 459-482, 1966.

[10]General Assembly Resolution 1963 (XVIII).

considerations assisted in moving the proposed treaty from a talk stage into reality. Success also had been dependent on encouraging the Soviet Union to forego the essentially negative position that it had taken at least down to 1965.

7.3.2 Difficulties in the Negotiations of Agreements: Other Illustrations

The Convention on International Liability for Damage Caused by Space Objects, which entered into force in 1972, had its genesis in a proposal submitted by the United States to COPUOS on June 8, 1962. In the intervening years COPUOS had incorporated into the 1967 Principles Treaty an article on liability for damage.

The International Agreement on Assistance to and Return of Astronauts and Objects Launched into Outer Space resulted from a draft proposal submitted by the United States to COPUOS on October 24, 1964. Following negotiations it entered into force in 1968. General provisions on this subject were contained in the 1967 Principles Treaty.

The Convention on Registration of Objects Launched into Outer Space had its genesis at least as early as 1961. By a General Assembly Resolution States were requested to submit to COPUOS, through the UN Secretary-General, information related to launchings. Following negotiations the treaty entered into force in September 1976. General provisions on this subject were also contained in the 1967 Principles Treaty.

The foregoing international agreements are those that have been negotiated at the United Nations and are presently in force. There have been serious and extended efforts to obtain international consent on other important subjects.

In 1959, the Ad Hoc Committee on the Peaceful Uses of Outer Space took into account the need to effect a definition of outer space. By 1978, this subject was still before COPUOS, but under the title "Questions relating to the definition and/or delimitation of outer space and outer space activities, also bearing in mind questions relating to the geostationary orbit." As seen above, this is an exceedingly complex and highly charged legal-political issue. An immediate resolution of this issue is not predicted.

In 1961, the General Assembly adopted Resolution 1721 (XVI) in which it was observed that "communications 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 that "there is a need to prepare the way for the establishment of effective operation satellite communications." However, it was not until December 1966, that the General Assembly gave its approval to the formation of a Working Group to inquire into direct broadcasting by satellite. At the present time, the Legal Sub-committee of COPUOS is engaged in elaborating a set of draft principles governing the use by States of artificial earth satellites for direct television broadcasting. Some States have taken the position that the agreement should provide that States may impose restraints--in effect, requiring State consent prior to broadcasting--upon broadcasts. This has resulted in an impasse, in part, because of the commitment of the United States to freedom of expression.

In 1968, the General Assembly in adopting Resolution 2453B (XXIII) made formal reference to remote sensing. At the present time, the Legal Sub-committee of COPUOS is endeavoring to produce a treaty dealing with

the legal implications of remote sensing of the earth from space, which would consist of a set of principles. Again, there are major differences among committee members. An early resolution is not likely.

In 1970, Argentina submitted a draft to COPUOS for a treaty on the Moon.[11] An alternate draft was submitted by the Soviet Union in June of 1971.[12] Negotiations have disclosed varying opinions on several aspects of the proposed agreement. From 1972 through April 1978, almost thirty drafts were considered relating to provisions dealing with the natural resources of the Moon. During the same period about fifteen drafts were considered relating to the scope of the treaty. Adding to the complexity of the situation were about twenty other drafts relating either to the question of timing or to the issue of information relating to activities in the space environment and to the submission of other information concerning Moon missions.[13] A resolving of the legal issues involving the acquisition of Moon resources has proven most intractable. Rights to ocean resources, including in particular the manganese nodules lying on the deep seabed, have also plagued the United Nations Third Conference on the Law of the Sea. By September 1978, there had not been agreement on the disposition of such deep seabed resources, even though the issue had been raised as early as 1967 when the UN placed on its agenda the subject of Principles Governing the Sea-bed and the Ocean Floor, and the Subsoil Thereof, Beyond the Limits of National Jurisdiction.[14]

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[11] U.N. Doc. A/AC.105/C.2/L 71 and Corr. 1.

[12] U.N. Doc. A/8391 and Corr. 1.

[13] U.N. Doc. A/AC.105/196, Annex I, pp. 2-3, 26, 34-35, April 11, 1977.

[14] U.N. Doc. A/6695, p. 1, August 18, 1967.

In passing it should be noted that there are very similar legal problems confronting negotiations on both outer space and ocean problems. On December 17, 1970, the General Assembly adopted a Declaration of Principles on the ocean which provided in part:

> 1. The sea-bed and ocean floor, and the subsoil thereof, beyond the limits of national jurisdiction (hereinafter referred to as the area), as well as the resources of the area, are the common heritage of mankind.
>
> 2. The area shall not be subject to appropriation by any means by States or persons, natural or juridical, and no State shall claim or exercise sovereignty or sovereign rights over any part thereof.[15]

The first paragraph of Resolution 2749 is for all intents and purposes identical with the most recent Austrian Moon draft Article 11, paragraph 1. The second paragraph of Resolution 2749, although somewhat different in wording than Article 2 of the 1967 Principles Treaty, conveys essentially the same restrictions upon the claim or exercise of sovereignty.

Not only is the language of the two documents essentially identical, but the competing interests on the part of States for the exploration and use of the areas, including their resources, are essentially parallel. Hence, the discussions in COPUOS have been carefully observed by the law of the sea negotiators, and vice versa. Such negotiations at the law of the sea conference have been very materially influenced by positions taken by representatives of the LDCs. They also perceive that they have or may have much to gain from the final agreement relating to the use and distribution of Moon resources. Difficulties in each of the forums have proven to be self-reinforcing. It should also be noted that COPUOS negotiations on Moon resources have affected discussions of the boundary

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[15] General Assembly Resolution 2749 (XXV).

definition/delimitation, to direct broadcast satellites, and sensing. COPUOS meets annually for several weeks, as do its two sub-committees. Under such time constraints it has been impossible to obtain final drafts on the foregoing four subjects for submission to the General Assembly in treaty form.

Because of competing national interests and the foregoing time constraints, the proposal to hold a second international conference on space activities has appealed to some States. Other States, being aware of the slowness of past negotiations, have urged the critical importance of adequate preparation prior to the convening of such a new conference.

The ITU possesses an interest in spectrum/orbit issues. Unlike COPUOS, the ITU can be described as an ongoing legislative conference engaged in essentially, but certainly not exclusively, technical matters. It is a fact that by linking radio frequencies to orbital slots that ITU has interjected itself more into the political arena than at a time when it was primarily involved with the registration and allocation of radio frequencies and in efforts to prevent against harmful interference.[16]

The periodic World Administrative Radio Conferences of the ITU are normal and regular meetings. Unlike problems of the UN that may require an international conference, it is not necessary for the ITU to determine if such conferences should be scheduled. It is expected that they will be held. For the ITU there is only the problem of arranging a suitable date for such meetings.

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[16]The institutional involvement of the ITU in outer space activities has been set out in its "Seventeenth Report by the International Telecommunication Union on Telecommunication and the Peaceful Uses of Outer Space." U.N. Doc. A/AC.105/213, December 22, 1977.

Further, the ITU can determine that periodic regional conferences will be held. The 1977 WARC BS determined that a conference for Region 2 would be held prior to 1982. With this kind of structure, including its non-stop bureaucracy consisting of the IFRB, and the International Radio Consultative Committee, the ITU possesses characteristics that may allow for a more effective decisional process, in its limited technical area, than presently at the disposition of the UN, including COPUOS. This is not to say that the ITU necessarily possesses all of the skills and attributes required for an early resolution of pressing political-legal matters. The ITU possesses a current record of success in technical matters. The most recent major success of the UN was the conclusion of the Liability Convention in 1972.

7.4 Characteristics of a Possible New International Space Organization

If the UN were to convene a Conference on Space Applications during the mid-1980s, if not before, it is possible that the agenda would call for the establishment of an outer space regime to facilitate the exploration and use of space environment resources. Attention could be directed to the nature and functions of a new or a modified international institution in order to serve the needs of such a regime.

Again, political-legal considerations would have to be taken into account. It is to be expected a considerable amount of time would be expended in arriving at the characteristics of such an instrumentality. It would be probable that the international agreement making provision for substantive legal principles, standards, and rules would also contain the structure of the organization. Consequently, with both substance

and structure as a part of the undertaking, even though the preparatory work for the conference were to have been organized in detail, it is not likely that such a body will emerge in even the near future.

Evidence supporting the slow gestative periods for such new or modified international organizations is readily available. As in the case of the examples of the amount of time consumed in the realization of international agreements with a substantive focus, so here, one large membership body will be treated in detail. One regional body will be treated in detail. In the other cases brief mention will be made of the structure, including voting procedures. The dates between the inception of the proposal and its fruition will be identified. In all of the illustrations an effort has been made to select organizations combining a legal-political and a scientific and technical focus.

The International Atomic Energy Agency has been selected to reflect an institution having both scientific and political-legal concerns. Its membership exceeds 100 countries. The membership is drawn from the advanced States, from the Soviet bloc, and from the LDCs.

The genesis of the organization was President Eisenhower's address to the UN General Assembly on December 8, 1953. Serious negotiations resulted in the Statute of the Agency. The agreement was signed on October 26, 1956. The original agreement, now modified in some respects, entered into force on July 29, 1957.

The IAEA was forecast as an international broker to facilitate the development of atomic power plants. Nuclear materials and equipment were to be supplied to nations with the understanding that such materials were to allow for the application or development of atomic energy for

peaceful purposes.[17]

When it was recognized that the world's supply of fissionable materials was greater than first estimated, such materials became commodities on international markets. Thus, the IAEA has not become the principal international supplier that had been contemplated. The IAEA has coordinated its activities with the UN, and has rendered technical assistance to the LDCs in the use of atomic energy. Member States are not obliged to satisfy their requirements for atomic materials only from the IAEA.

From the structural point of view, the IAEA operates through a General Conference, a Board of Governors, and a large, technically qualified Secretariat. The chief administrative officer is titled Director General. There are presently 32 members on the Board of Governors. Their selection is based on a complex formula designed to assure that countries with differing needs and wants will be equitably represented.[18] Unlike many international organizations, the Board of Governors possesses important operating authority. The Board is responsible to the General Conference.

Despite the need for the conference that wrote the Statute to deal with technical matters, and despite the rather novel authority conferred on the Board of Governors, it took less than four years to move this organization from the drawing board into reality.

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[17]Article 3, paragraph 1. 8 UST 1093, TIAS 3833.

[18]The 1956 Statute provided for a Council of 25 members. This was modified in 1961 (8 UST 1095, TIAS 5284), and again in 1970 (24 UST 1637, TIAS 7668). With the 1970 change the Board of Governors is to consist of 32 members drawn from eight regions of the world. It should be noted that regional representation on the governing councils of international organizations is now regarded as a fair way to effect allocations of memberships.

A second illustration is the European Space Agency (ESA). Unlike many international organizations, ESA came into being through the consolidation of two preexisting bodies, namely, the European Space Research Organization (ESRO) and the European Launcher Development Organization (ELDO). ESA, which is essentially a technical management organization, has larger powers than its progenitors.

ESA was the result of a resolution adopted by the European Space Agency in November 1968. On May 30, 1975, the ESA convention was signed in Paris, and it came into existence as a de facto international organization. The de jure status of ESA was made dependent on the ratification of the agreement by the 10 States composing ELDO.

The ESA treaty made provision for mandatory and optical programs. Those identified as mandatory were scientific and research oriented, while the optional programs were concerned more with the operation of space objects. ESA has been charged with the production of Spacelab for use in the Space Shuttle.

The Agency is engaged in specific activities on behalf of its members. Such activities include general studies, education, and documentation. Its programs involve scientific satellites, communications satellites, and space transport systems and can involve cooperation with non-member States. "For all these activities and programs, the Agency had a budget amounting to $374 million U.S. dollars in 1975, and $491 in 1976. For 1977, the budget forecast was approximately $557 million. The level of resources proposed for the period 1978-1979-1980 amounts to a total of $1,491 million U.S. dollars."[19]

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[19] M. Bourély, "The European Space Agency's Contribution to the Development of Space Law," Proceedings of the 19th Colloquium on the Law

The principal decision-making authority of ESA is the Council. Depending on the nature of the decision to be taken, the majority ranges from a simple majority to unanimity, with the agency's budget requiring unanimous approval. The daily operations are under the supervision of a Director General. He is supported by a scientific, technical, administrative and clerical staff.

In making decisions, the Council creates rules of international law binding on its members. Such rules can also bind non-member States, if they so agree, and other international organizations. ESA has also been described as a subject of space law, since "in executing its programs and activities, it must comply with the international rules governing space, some of which apply specifically to international organizations."[20]

By comparison the socialist bloc space organization, INTERSPUTNIK, was first proposed in 1968. The international agreement creating it was signed on November 15, 1971. The agreement entered into force on July 12, 1972. The formation of INTELSAT also took little time. Following the adoption by Congress in 1962 of the Communications Satellite Act,[21] an International Plenipotentiary Conference on Interim Arrangements for a Global Commercial Communications Satellite System was convened on July 21, 1964. By August 20, 1964, the Agreement on Interim Arrangements had been concluded and signed by 11 States. Within the next few months

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of Outer Space 21 (1977). See also, N. M. Matte, Aerospace Law, pp. 62-65 (1977). A brief summary of ESRO and ELDO is contained in International Cooperation and Organization for Outer Space, Staff Report, Committee on Aeronatuical and Space Sciences, United States Senate, Doc. No. 56, 89th Cong., 1st Sess., pp. 505-542 (1965).

[20] Bourély, op. cit., p. 22.

[21] 47 UST 701 et. seq.

eight more States signed.[22] Both INTERSPUTNIK and INTELSAT brought with them their own institutional arrangements.

The International Maritime Satellite System (INMARSAT) is the newest international organization dealing with outer space matters. INMARSAT was first suggested at the Inter-Governmental Maritime Consultative Organization (IMCO) in the early 1970s. A draft convention was negotiated between 1972 and 1974 by IMCO's Panel of Experts on Maritime Satellites. A formal conference was convened in 1975. Efforts failed to work out differing viewpoints among the members of IMCO. However, a second session of the Conference met between February 9 and February 28, 1976. With the benefit of documents prepared by an intersessional Working Group, and following comprehensive discussions, the major terms of the agreement were finalized on February 27, 1976. However, several issues were not resolved. One related to voting rights. Others were more technical and included the possibility of declaring reservations and the languages to be employed in the working sessions of the new institutions. A third session of the Conference finally reached agreement on September 3, 1976.

The Council of INMARSAT serves as the principal administrative arm of the organization. Membership on the Council is to be based on the principle of equal geographical representation with due regard for the interests of the LDCs. Some of the seats on the Council are reserved to States on the basis of their investment shares in the undertaking.[23]

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[22] International Cooperation in Outer Space: A Symposium, Committee on Aeronautical and Space Sciences, United States Senate, Document No. 92-57, 92nd Cong., 1st Sess., pp. 437-441 (1971).

[23] The Council is to consist of 18 representatives of signatories having the largest investment shares in INMARSAT. Additionally, there will be four members elected by the Assembly, which is to be composed of all of the parties. The four are to be elected without regard to their

The Director-General is appointed by the Council upon the nomination of members. Issues to come before INMARSAT have been identified as procedural and substantive. Procedural matters must obtain the approval of a majority of members present and voting. Substantive matters can also be approved by a majority of votes cast by the members present and voting, but in this situation it will be necessary for the majority to include at least two-thirds of the weighted votes of the qualified voting constituencies.

The common structural characteristics of INTELSAT, INTERSPUTNIK, and INMARSAT have been found to be influenced by their economic goals. Thus, these three enterprises are "structured as traditional administrative or regulatory intergovernmental organizations."[24] It has been suggested that the structure of these operating entities should not follow political or bureaucratic models but rather should be based on a corporate model. This was explained as following the "investment/use" principle, thereby representing "when translated into the form of an investment share, the fundamental determinant of the extent of each participant's financial rights and obligations as well as of his voting and management rights."[25]

When the world community has endeavored to establish a new international organization to deal with the resources of the ocean, the process

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investment shares. By this procedure it was hoped to honor the principle of just geographical representation taking into account the interests of the LDCs. U.N. Doc. A/AC.105, 169, p. 2, March 16, 1976. See also Nandasiri Jasentuliyana, "The Establishment of an International Maritime Satellite System," 2 Annals of Air and Space Law 323 (1977).

[24]Wulf von Kries, "Key Features of International Satellite Enterprises," Proceedings of the 19th Colloquium on the Law of Outer Space, p. 310 (1977).

[25]Ibid.

of obtaining a treaty has been as slow as, if not slower than, the arrangements dealing with the space environment. Thus, at the close of the sixth session of the UN Third Law of the Sea Conference on July 15, 1977, final agreement had not been reached on the governing structures for the deep seabed and ocean floor area. This issue first came to the attention of the UN in 1967. However, full-scale negotiations had begun only in 1970, and had been institutionalized in the form of the conference only in 1974.

Since the law of the sea conference has accepted basic legal principles very similar to those set out in Articles 1 through 3 of the 1967 Principles Treaty, the plan for institutions to manage ocean resources is relevant.[26] The 1977 ocean text calls for the formation of a governing instrumentality to be known as the Authority, and it will function through an assembly, a council, a secretariat, an enterprise, and will be assisted in the resolution of legal disputes by a Sea-bed Disputes Chamber of the Law of the Sea Tribunal.[27] A principal reason for the inability of the law of the sea conference to bring its negotiations to an end with an acceptable treaty relates specifically to the exploitation of the mineral resources on the deep seabed and ocean floor. The approach taken by this conference may well provide some important instruction to those who may, at some future time, wish to form an international institution to deal with the natural resources of the space environment.

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[26]Article 136 of the 1977 text provides that "The Area and its resources are the common heritage of mankind," thus not employing the comparable expression "province of mankind" found in Article 1, paragraph 1, of the Principles Treaty. Article 137 of the 1977 text follow Article 2 of the Principles Treaty in excluding sovereignty in the Area.

[27]Articles 154-192.

If a Conference on Space Applications is to be convened in the not-too-distant future, and if it is to suggest the formation of a new international space agency, some attention should be given to the research and conclusions of students of international organization. Writing in 1973 on the assumption that there was a need for a regime for earth resources experiments, two scholars have provided a mixed prototype somewhat fashioned on the technical experience of the ITU, but also blending in experience and insights obtained from organizations having major political-legal ramifications.[28]

7.5 A Final Comment on Conference Strategies

At the beginning of this Chapter it was indicated that if a United Nations Conference on Space Applications or Outer Space Matters were to be held that it would be necessary that the Participants come into possession of essentially the same set of scientific and technological facts. It was also stated that the final product of the conference would consume an enormous amount of time and effort. The foregoing assessment would seem to offer abundant proof of this fact.

Thirdly, it should be noted that such a United Nations Conference would be costly in terms of money. At the request of COPUOS the

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[28] George A. Codding, Jr. and M. Beheshti, "An International Agency for Earth Resources Experiments," 1 Journal of Space Law 1 (Spring, 1973), p. 40. A somewhat more modest formulation is set forth in an "Outline Swedish Proposal for an International Organization to Govern the Operation of Earth Surveying Satellites," in Valerie Hood, Mary E. Kimball, David A. Kay, A Global Satellite Observation System for Earth Resources: Problems and Prospects, p. 155 (1977). For a more general assessment of international institutional problems see D. W. Bowett, The Law of International Institutions, pp. 273-340 (1967); Frederick L. Kirgis, Jr., International Organizations in their Legal Setting, Documents, Comments and Questions (1977).

Secretariat conducted an inquiry in 1974 and 1975 to determine the financial implications of such a conference. On the assumption that the conference would be held in New York City and that it would last for ten days, the Secretariat provided as an estimated cost the sum of $422,700.[29] This represents out-of-pocket costs to the UN. The total costs to participating States and international organizations can only be estimated, but would undoubtedly run into many millions of dollars.

In addressing the issue of whether it will be possible to construct an adequate international regime, based on sound principles of international law, that would allow for the effective, equitable, and economic gathering and transmitting of solar energy from geostationary orbital level to Earth, the foregoing three considerations will have to be weighed. There are many other considerations that cannot be treated here. Among the strategies that would have to be considered would be whether the suggested multilateral approach through a United Nations Conference would be the best way to proceed. Arguments can be made that the subject matter involved in the gathering and transmission of solar energy might be treated on a bilateral basis, with the knowledge that it is much easier for two like-minded persons to arrive at an agreement than for many having disparate points of view.

Other strategies that might be taken into account have to do with the independence of the proposed regime or entity. Since the UN has been perceived by some as a highly politicized institution, it has been suggested that a new body should keep a suitable distance from the UN, lest the misadventures of the latter have an adverse impact on the new institution.

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[29] U.N. Doc. A/AC.105/179, p. 10, October 1, 1976.

It would, of course, be possible for the new regime to be brought into existence by a resolution of the General Assembly rather than through the treaty process. For example, following a resolution adopted at the 1972 UN Conference on the Human Environment the General Assembly on December 15, 1972[30] created the United Nations Environment Program (UNEP). Like the institutions formed via the treaty process the UNEP possesses a well-considered organizational structure. In this instance it consists of a governing council of 58 members, a secretariat, an Environmental Fund, an Environment Co-ordination Board, and an Executive Director. In this case, as in the others, one of the more difficult problems to be resolved was the size and basis for representation on the Governing Council.

From the foregoing certain conclusions, involving political and legal policy matters, can be suggested. For the foreseeable future only those countries that have been described as space-resource States have the capacity to explore and use high altitude solar energy. Moreover, these same States have the greatest need to obtain and use alternative energy sources, including solar energy on a "wholesale" basis.

Such States will be obliged to accept the world community judgment that such solar energy as well as the geostationary orbital slots constitute a natural resource of the world. As such, neither the energy nor the slots fall under the sovereignty of any State, the claims of eight of the equatorial States to the contrary notwithstanding. Nonetheless, it is evident that the space-resource States are anxious to cooperate with all countries in arriving at decisions relating to the capture and transmission to Earth of the solar energy of outer space.

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[30] A/RES/2997 (XXVII).

World institutions are slow to be conceived and brought into effective operation. As needs for solar energy increase, and if the world community is overly slow in developing regimes that can take into account the province of mankind or common heritage of mankind concepts, then it is quite likely that the resource States will have to proceed alone or with similarly situated and motivated countries to obtain their energy from geostationary orbital level. Even though this scenario may be the first to be placed into effect, nonetheless, it may be anticipated that ultimately a world regime will have a certain amount of authority regarding both orbital slots and the resource of solar energy, per se. The kind of authority to be granted to such a regime can take on many colorations. This issue is not likely to be resolved in the forthcoming UN Conference on Space Applications or Outer Space Matters.

When such a regime does come into existence, if it does, a decision will have to be made whether it should be associated with the UN or whether it would have a more independent status.

Chapter Eight

CONCLUSION

In formulating a present and future policy for the effective operation of a SPS it is necessary to place scientific and technological facts in a political-legal context. The methodology of this White Paper has been to identify such facts. Building on such facts there has been a further search for and clarification of existing political-legal outlooks or values. Only through a combination of the best of these essentials is it possible to arrive at decisions that may have some hope of surviving for at least a short time. As new facts come on line and as new perceptions of man's needs and wants are identified there will be change. Through the application of the indicated methodology it is hoped that the change will be orderly and that it will serve basic human needs.

In the context of this analysis it has become evident that the nature of the area in which a SPS might function is not perceived the same way by all observers. Thus, the linked orbit/spectrum resource has been described as limited world natural resource. While there is little reason to doubt that it is a world natural resource, there is evidence that it may not be quite so limited as proclaimed. These who have accepted the first formulation have also considered the resource to be unitary, that is, they have treated orbital slots, and the solar energy located at geostationary orbital level, as essentially one and the same. Confusions of this sort can make the jobs of authoritative

decision makers in the political-legal arena more difficult than they ought to be.

An objective of such decision makers is to obtain international agreement on the availability of geostationary orbital areas for a SPS, to obtain microwave frequency allocations to facilitate the purposes of a SPS, and to establish international microwave exposure standards so that a SPS will not produce harms from non-ionizing radiation. In both short- and long-term perspectives such agreement may lead potential users into areas of conflict, competition, cooperation or coordination, and compromise. This process involves many actors. Principally involved are the scientists and technical experts, the legal-political figures--with their security advisers at their elbows--, representatives of public and private international organizations, and in the background are those who rely on the intelligence and training of such personalities, namely, the general public. In the international space law field such competition has not excluded cooperation, particularly where common interests have been perceived. In the formation of the 1967 Principles Treaty and the 1972 Liability Agreement the consensus required at COPUOS necessitated cooperation and compromise on the part of the United States and the Soviet Union. Each was able to make concessions and each was able to bring allies to accept such judgments.

The United States has been a major proponent of an orderly international space law regime. This has facilitated use of the space environment pursuant to the res communis principle. It has also resulted in formal means to impose liability and consequent damages for misuse. Although the liability net was widely thrown, it was not cast so

indiscriminately as to prevent innovative and creative uses of the space environment. In urging the adoption of the Liability Agreement the United States did not depart from its obligation under Article 9 of the Principles Treaty. This requires consultation among States concerned over activities or experiments in the space environment that could have potentially harmful consequences. If it were thought that the SPS could be productive of such harms, it would be the duty of the United States to seek consultation prior to the use of such a space object. As a firm proponent of Article 9 there could be no doubt that the United States would offer such consultation. However, the consultation involves diplomatic cooperation and compromise. It does not constitute a veto by another State of a proposed U.S. activity.

The assessment of international rights and duties for a SPS has produced supportable conclusions. First, since the spatial level at which a geostationary space object would orbit is not subject to national appropriation by claim of sovereignty or by any other means, a nation-state can use but cannot establish sovereignty in that area. The right to use the orbital level, in order to avoid charges of a "de facto" or "de jure" claim of appropriation, would have to be temporary, e.g., non-exclusive. No preemptive right to the orbital slot would be created by such temporary or non-exclusive use.

Second, for the same reasons that the orbital slot area is subject to the res communis principle, the solar energy located at geostationary orbital levels is a res communis. Even more than the orbital slot the solar energy is an unlimited and ever-renewing natural resource.

Third, the radio spectrum is a world natural resource. For it to be used equitably, efficiently, and economically it is necessary that

frequencies be allocated to specific users. The ITU has been charged with this function, and the allocation and registration of frequencies have been accomplished in a competent manner. The ITU has no enforcement powers other than seeking cooperation by States in their own best interests. This has minimized harmful interferences. This appeal to self-interest in the long run is one of the more effective ways--short of large-scale violence--for an international agreement to be implemented. Not having to pay damages is based on self-interest.

The ITU has the legal authority to allocate microwave frequencies, although the initial assignment can be made by States. This means that the State possesses the legal authority to use a frequency and, potentially, such use could result in conflict with another State. However, the powerful influence of national self-interest serves to obtain conformity with the allocations.

The ITU has associated frequency allocations with orbital slot allocations. At the present time the ITU has no power respecting the allocation of orbital slots, although in the past several States have suggested that the ITU might be given such new powers. However, the ITU in Article 33, paragraph 2, of the 1973 Convention must take account of the fact that States "in using frequency bands for space radio services . . . shall bear in mind that radio frequencies and the geostationary satellite orbit are limited natural resources. . . ." This Article also takes note of the fact that using States shall have radio frequencies and orbital slots at their disposition "according to their needs and the technical facilities at their disposal."

Fourth, although international legal standards do not exist on the amount of non-ionizing radiation that may be received by plants, animals,

and intangible materials without causing harm, the Liability Convention takes into account the fact that radiation can produce injury. It was noted, if nuclear damage, under treaty terms, can be made the basis for a recovery of monetary damages, that the same reasoning may be applied to the radiation produced by microwaves. While it remains to be seen what kind of ionizing radiation would be produced in transmitting solar energy to Earth via microwaves, if any or at all, nonetheless, in the event that harms were produced a body of legal rules and procedures now exists which would allow recovery to take place.

Emphasis has been placed throughout on the terms of international agreements. Treaties serve the purpose of providing clarity respecting legal rights and duties. While substantial practices of States, which have ripened into customary international law, produce legal rights and duties, the rapidly expanding needs of the space-resource States are better served by the formal treaty process. Customary law may be slow to develop, although this need not be the case. Moreover, it may be variously interpreted depending on ideologies, developmental status, and the capacity to understand and respond to scientific and technological facts. Moreover, assumed national interests can be consulted in more detail and with greater care in the writing of a binding treaty than in the emergence of customary law. Both space-resource and non-resource States presently seem to be in accord that formal agreements are a preferred route to travel.

The acceptance of the res communis principle in the 1967 Treaty has given it a firm legal base in the international law of the space environment. This principle is directly related to the further principle that

the use of the space environment shall be for the benefit and in the interests of all countries and shall be the province of mankind. Responses by the LDCs, who are considered to be the beneficiaries of this commitment, have been twofold. On the one hand, some States urge the sharing of such resources. On the other hand, there have been rather insistent claims on the part of eight equatorial States that the equatorial portion of the space environment, where space objects can remain in geostationary orbit, belongs to such claimants. To most observers this claim is diametrically opposed to the language and purpose of the Treaty. Whether this difference can be resolved via negotiations, including the proposed new International Conference on Space Law remains to be seen.

The ultimate success of a SPS will depend in part on the amount of good will the United States will be able to receive in connection with the endeavor. If tensions were to develop on the part of either the LDCs, which would hope to share in the benefits available through the presence of solar energy, or the equatorial States, which might become unreconciled because their claims received no attention, full success might not be obtainable. However, such outlooks would have been imaginary if the SPS were not able to demonstrate its assumed potential. Thus, a strategy on the part of the resource States could be to proceed without consulting the present interests and positions of such States in order to prove the viability of the concept. This proven, it would then be time to engage in discussions of specifics. In the process the space States might take the position that the project was going forward vigorously, that rewards were expected to be substantial, and that their ongoing commitment to the 1967 Principles Treaty would allow for the required

sharing. Such sharing would depend on entering into suitable commercial relationships. Such States aware of the sharing expectation, and possibly experiencing present and probably future shortages in energy, might be induced to cooperate now in the hope of obtaining future benefits. If, as is believed to be the case, there is a present urgency to develop reliable sources of solar energy, in order to avoid ongoing or expected adversity, the members of the world community would be more receptive to proposals for a SPS.

It is clear, if solar energy in the future is to be obtained on a "wholesale" basis from the space environment, that there will be a need to effect ways to distribute such energy to users. Since the resource is an international resource, it may be anticipated that the distribution will take place internationally and that the distribution will be the product of the decision of an international institution. It is possible that such an organization would be authorized to allocate microwave frequencies to the most desirable social uses. For example, it might have to determine whether there was a greater need for energy than for the transmission of words or symbols. That institution will presumably be more than a set of laws.

It will take the form of an international organization based on a charter which will allocate legal powers and duties to the organization. The organization could be a new one, or it could be the product of the revision of an existing entity. A critical issue before national decision makers would be the powers of such a body. These could range all the way from having the power to grant orbital allocations to a simple coordination of orbital slots planned to be used by member States. It

could be given the power to distribute solar energy, or it might be authorized to fix functional standards rather than having distributive powers.

As noted in Chapter Seven, States have enormous difficulties in reaching agreement on how to authorize the allocation of resources. At the present the world community lacks experience with the multinational management of technologically-based programs on a global scale. Neither the UN nor the ITU have attempted such activities, and the plan provided in the Third United Nations Conference on the Law of the Sea for a Seabed Authority has not received approval on the part of the more than 150 participants in that meeting. The experience of INTELSAT, based as its structure is upon a business as opposed to a bureaucratic model, could be instructive. The precise substantive powers of such an organization will have to be fitted to the mission that will be assigned to it. Agreement on its procedural powers will also pose difficulties. It is safe to suppose that over time there will be increasing demands for the formation of an international space agency.

The final success of a SPS will depend on the identification and resolution of important international political-legal issues. These will have to make provisions for the availability of geostationary orbital positions, uninterfered with microwave frequencies, and protection against the harmful effects of ionizing radiation. It will also be necessary to allow such an international organization to have power commensurate with its duty to protect the general well-being of mankind.

Chapter Nine

RECOMMENDATIONS FOR FURTHER STUDY

Further areas of study can be identified in several ways. There are areas that are essentially international, while others are national. Some of these have long-range characteristics, while others are short-range. Unfortunately, this analytical approach is marred by the fact that such distinctions are blurred by reality. We live in an "intermestic" era. Nonetheless, the foregoing distinctions will be attempted. Recommended approaches will be identified.[1]

Assuming the scientific and technological viability of a SPS, as well as the legality of its use, there is a long-range and short-range need--both internationally and nationally--to build a constructive and supportive attitude towards its use. To this end the fact will have to be established that a SPS will be used exclusively for peaceful, that is, non-aggressive, purposes; that its use would not produce excessive harms--and in the event that damages were to occur that they would be compensable--; and that through international agreement some means would be provided to share in the benefits derived from the SPS delivery of solar energy to Earth. At the world level many international bodies--both public and private--will be involved in the formation of policies allowing the realization of the above goals. Domestically it is to be expected that all elements of our pluralistic society will wish to be consulted. The national, state, and local governments will have important

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[1]The recommendations are set out in Appendix K in tabular form.

roles to play. Within these structures the executive and legislative branches will fix policies, and they will be aided by administrative agencies, such as the Federal Communications Commission.

In dealing with so large and varied interests--frequently competing--there will be a need for a comprehensive and ongoing presentation of scientific-technological and political-legal facts. This can only be accomplished if a versatile research program is continued. With the dissemination of the results of studies such as this it will be possible for authoritative decision makers to arrive at valid decisions. As has been noted, facts are illusive and they tend to change. Consequently, continuing research and the publication of findings will be required. In the United States congressional hearings are useful in calling attention to wants and needs. At the world level there is a pressing need to bring facts to the attention of delegates to international conferences, especially to representatives of the LDCs. However, it is frequently too late to obtain changes in national policies at the time of the convening of such conferences. There is a need that such research findings be supplied to foreign governments and to the secretariats of international organizations as soon as the findings are available. Mere dissemination may not be enough.

This White Paper has called attention to the belief on the part of many that a more substantial world regime than now exists should be created in order to deal with the uses of and activities in the space environment. An assessment of such expectations will require a very substantial effort. The problems encompassed here are numerous and complex. There is a very considerable urgency to obtain clarification

on existing issues.

It may be decided, after suitable reflection, that the present regime is adequate both for the near and the more distant future. On the other hand, the consistent rendering of the theme for a new instrumentality makes it imperative to examine its potential function and its prospects.

Among the issues that will have to be examined, and possibly resolved, are: authority conferred on it in its charter, universality as opposed to the formation of regional bodies, relationship with existing international institutions, and the acceptability of such an agency to States, including particularly the space-resource countries.

The charter terms of such an entity would include substantive matters such as whether it was to be a regulatory body or whether it was to serve more as a consultative instrumentality; whether, for example, it would be assigned the power to allocate orbital slots to States that might insist on the right to use and reuse the same orbital position; whether, in the event of competing demands for the transmission of solar energy by microwave as opposed to the transmission on the same frequencies of words or symbols, the regime could make preferred allocations; whether the powers of the body should be intentionally quite modest at the outset, with the assumption being that as it proved its capacity to regulate or offer wise consultation that its power would be extended; whether its powers would relate only to the allocation of preferred orbital positions; whether its powers would be large enough for it to make disposition of the world solar energy resource; whether in so doing it would be able to measure the wants and needs of States making special claims, such as the equatorial States or the LDCs, based on the size of their populations,

or the needs of the general public, or commerce, and industry for such energy; whether it would have the same powers in relation to the non-equatorial States; whether it would possess powers in the air space and in the space environment so that a single regime would exist for the area above Earth; whether it should be given dispute-resolving powers, and others.

From the procedural point of view it would be necessary to determine whether it would follow a business as opposed to a bureaucratic model. The former might allocate greater voting rights to States investing the larger amounts of money and effort in the SPS. The latter might follow the practices in the UN of one country-one vote. Many procedural complexities would have to be worked out. The present trend should be taken into account. This has been for the acceptance of the principle of sovereign equality and equality of voting. Such a possibility might make the entity less attractive to the space-resource States, but this would have to be studied.

Such States might conclude that an essentially universal entity would not serve their best interests. Thus, they might be willing to consider a limited-membership institution. Or, presumably, the distribution of uses of the space environment resources could be effected by a series of bilateral arrangements. It is probable that the use up to the present of such bodies as the UN and the ITU would preclude such a possibility. On the other hand, there is a respectable view that the UN may become overly politicized in their assessments of the uses of world resources. This would possibly suggest the consideration of alternative institutions.

Assuming that the UN may lay claim to the larger governance of the space environment, it would still be possible for it to serve as an "umbrella-type" structure over a number of regional institutions. For example, in May 1978, five Andean States met to consider the feasibility of a regional space program.[2] ESA maintains contacts with COPUOS at the present time.

Whether or not the UN takes on larger powers relating to the governance of the space environment, it will be obliged to maintain contacts with the specialized agencies, with members of the UN family, and with representatives of non-governmental organizations. Any new space regime would be confronted by the same need.

It would be expected that the regime would have as a part of its structure suitable technical bodies. Their functions could parallel those now exercised by the ITU's International Frequency Registration Board and its International Radio Consultative Committee. Whether a new space regime is established or not, there will still be a very great need to insure that COPUOS and the ITU are assigned clear-cut responsibilities in the spectrum/orbit area. With the formation of a new regime this same problem would be manifest. There is a need for a very careful assessment of the respective governing powers and interests at the UN, ITU, and a possible new regime in this precise area.

A new regime would also provide, collect, and distribute a considerable amount of factual data. This would include, but not be limited to, data on the use of orbits, safety requirements, distance requirements,

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[2]These States are Bolivia, Colombia, Ecuador, Peru, and Venezuela. They were joined by representatives of the world business community and by special guests from other countries, including governmental spokesmen.

station-keeping procedures, access to and removal from orbital position, and the plans of States and other juridical persons to engage in orbital activities. If manufacturing were to take place in the space environment, it would be desirable for such an institution to be able to exercise some control over both lower orbits, transfers from a lower orbit to a higher orbit, and the management of traffic patterns employed by such space objects. Such data would also be maintained concerning the employment of radio frequencies by such space objects, with some emphasis being given to the possibility that a single space object could effectively utilize a number of frequencies without causing harmful interference. Not only the problem of acquiring such data but also the conditions surrounding its dissemination should be studied. Would, for example, the same practices be followed that are now present in the data acquired by Landsat?

In considering the future of the UN, the ITU, and a possible new space entity it will be necessary to continue to observe the plans and activities of the UN and the ITU in particular. Thus, the UN is presently committee to a Conference on Technical Cooperation among Developing Nations and another on Science and Technology for Development. As has been noted, there is also a discussion going on at COPUOS on whether there should be a Conference on Space Law or Applications. The last mentioned may be convened as early as 1983. While the first two may have only a general interest to the gathering and transmission of solar energy from orbital level to Earth, the last conference will certainly be faced with the views of the eight equatorial States that they can exercise national sovereignty at geostationary orbital level above the equator. The presentation of such claims at any of these conferences will have an enormous

impact on the positions and strategies of the space-resource States. An assessment of the support likely to be gathered for such claims from other States, and the political costs to the space-resource States in responding to such claims will have to be investigated. In this connection, the lack of present success on Moon treaty negotiations and law of the sea negotiations hinges in a very substantial degree on varying viewpoints relating to the use of natural resources. A careful study ought to be undertaken in which common perspectives and policies are identified. A good bit of attention has been given to the respective positions of States participating in the law of the sea negotiations, and there is an abundance of literature. The same amount of attention has not been given to the COPUOS-based discussions on Moon resources. It would be a worthwhile undertaking to determine if consistent positions have been taken in both forums. In weighing the capacity of COPUOS to deal with the problem of the spectrum/orbit it must be recalled that COPUOS is currently engaged in long-continuing discussions on sensing, direct broadcast satellites, the Moon treaty, and the issue of the definition or delimitation of the space environment. The last two mentioned issues would certainly be a major factor in the success of the projected Conference on Space Law or Applications. It would seem to be prudent to examine the bearing of these issues on the proposed conference in order to forecast possible positions of States and the likelihood of success in such a conference. As previously noted, some of the UN-sponsored conferences have become heavily enmeshed in political discussions having no relationship to the purpose of the conference. The possibility that this might have an impact on the proposed conferences should cause some

concern. Substantive expectations need to be analyzed with this in mind.

One way to allow the proposed conference to focus on space law or application would be to induce the private scientific community to support the objective of supplying the Earth with solar energy. One of the great attributes of the International Geophysical Year was the initiative and leadership evidenced by scientists acting as individuals and without direction from national governments. As individuals, and through their respective scientific societies, all collected together in the International Council of Scientific Unions, they were able to advance human knowledge and the cause of international understanding. Will it be possible to mobilize this worldwide community in support of the gathering and bringing to Earth of solar energy in "wholesale" amounts? The Council's Committee on Space Research has provided technical information to COPUOS, but what is now suggested is a greater involvement on the part of such private individuals in the national and international political process. Ultimately, their influence will be felt in the issues here under consideration. What role might they be willing to play, and how soon? What can governments do to encourage such voluntary involvements?

One of the functions of the world scientific community will be to supply facts as to whether the spectrum/orbit is in reality a limited resource. Since the ITU has defined the resource as a limited natural resource, States have expressed the fear that the advanced States will establish monopolies. The concerns of the non-resource States are very real that the advanced States will make use of their scientific and technological capabilities in order to reserve such energy resources

exclusively to their own use. As a result of this many non-resource-States have advanced the view that there should be a sharing of such solar energy. How should such sharing be arranged?

The legal-political arena will ultimately dispose of the claims over the use, including the sharing, of the solar energy resource. All of the institutions that have been mentioned above, and others, will be involved in effecting the community decisions relating to such sharing. The product of both the claims of States and the decisions of such institutions, especially when the latter are clothed in legal form, such as an international treaty or convention, will govern the use of such resources.

What has just been suggested indicates that there are several ways for the international law of the space environment to come into being. One is through the acceptance of peaceful and beneficial practices. This is known as customary international law. The other is the more formal international agreement process that results from detailed negotiations. Both can be aided by duly considered resolutions of the UN General Assembly, especially when the adoption has been by unanimous vote. With respect to space resources the preferred approach up to the present has been that of formal agreements. These agreements have been the particular product of the space-resource States, and it is true that their terms benefit such countries. With the voting control of the General Assembly now in the hands of the LDCs, the with the augmented COPUOS being more heavily populated with the LDCs, as well as equatorial countries, the question has been raised whether such forums should be employed in the future when space environment law is being formulated.

The alternative would be to look at the practices of the space-resource States and to attempt to connect such practices with customary international law. Just as the role of the UN will continue to be a substantial one in the development of space-environment law, so, also will attention be given to the importance of the practices of the space-resource States. It will be necessary to follow these developments with care. Suitable attention to the issue followed by relevant research efforts will help clarify the policy options.

Attention has been called on several occasions to the importance of the concepts of "Common Heritage of Mankind" and "Province of Mankind" to evolving space-environment law. A clarification of the meaning of these terms--both in law and in practice--is one of the most critical issues requiring further assessment. The meaning given to them will have a critically important impact on the use of space-environment resources, including demands for the sharing of such resources. Such meaning will influence man's activities in the space environment, and will constitute a possible modification, if truly accepted, in the res communis principle. This principle allows the first to arrive to use without appropriating in the exclusive sense of exercising sovereignty. The "Mankind" principles place greater emphasis on sharing, the formation of governing regimes, the protection of the environment generally, and the special claims and interests of the LDCs. Hence, any sensible national policy must take into account, if not be based on, the meaning of and world support given to such concepts. Of special importance will be the need to determine if the "Mankind" principles are thought to apply to both the energy resource, the orbital position resource, and the radio spectrum resource.

Both short range and longer range, it will be necessary to reassess the meaning of the terms of the 1967 Principles Treaty and its general viability. In addition to those legal problems that have already been mentioned, it will be necessary to establish more clearly than at present the respective rights of juridical persons, other than States and international intergovernmental organizations, to make use of and engage in activities in the space environment. They, as well as States and such organizations, may feel compelled to capture and transmit solar energy from geostationary orbital level to Earth. Either as private business entities operating wholly within a given nation-State, and thus subject to its domestic laws, or as private business consortia operating from several nation-States, and thus subject to a multiplicity of national laws, they may have certain legal rights in the space environment. Although it might be assumed that their financial resources were inadequate to carry out SPS operations, the legal question still remains as to their rights under the Principles Treaty. Or, they might act in a supportive role for a governmentally organized and owned SPS. The domestic legal ramifications of such a relationship are worthy of inquiry.

A further inquiry based on the Principles Treaty is also in order. Article 4, paragraph 2, limits the requirement of exclusively peaceful uses to the Moon and other celestial bodies. There are several interpretations as to whether the language of the Article can be so severely limited as to exclude the peaceful uses requirement from outer space, per se. Without endeavoring to resolve this issue at this time it should be mentioned that this is a subject worthy of further inquiry. It has particular relevance to general security considerations relating to the

safety of a SPS against the detrimental or hostile conduct of non-national forces. If human beings are ultimately to depend on "wholesale" solar energy for their needs, it would not be advisable to allow a figurative umbilical cord to be affixed to the SPS.

The question is not as to the existence of such a cord. Rather the question is what can be done to protect both the SPS and its capability to deliver energy to Earth. If it might be anticipated that intentional harms might be directed toward a SPS, it might be advisable to establish either a national or international police force in the space environment to offer whatever protection it might be able to muster. In the fairly recent past attention has been given to the possibility that the Soviet Union has in operational use a space object able to interfere with other space objects, if not in fact able to neutralize their use. Recently, the United States has found itself under increasing pressure to field an anti-satellite capability of its own in response to Soviet activities in this area. The United States has a goal of maintaining its right of passage through and operations in space without interference.

The respective security needs of nations relating to the effective use and operation of a SPS require a political-legal assessment of the seeming capabilities of such space objects. Inquiry might now be directed toward a clarification of the legal right of a State to engage in anti-satellite activities under the terms of the Principles Treaty, whether the terms of the agreement should be reconsidered in order to prevent such uses if in fact they are not permitted, and, might even consider the possibility of reviving the notion that there should be complete disarmament of the space environment. An approach in which all States

would be consulted should be balanced against the possibility of a bilateral agreement between the United States and the Soviet Union in which they would engage not to place any armaments of any kind into the space environment. An assessment of the better forum in which to deal with the security issue would be timely.

If national conduct is to be influenced by the international law established in the 1967 Principles Treaty, the 1972 Liability Convention, and the 1973 ITU Convention and Final Protocol, it would appear to be wise to extend national acceptance of such agreements. It is a surprising fact that only 35 States are parties to all of these agreements.[3] An assessment of the fact that only one African State is on the list or only three South American countries have accepted these commitments would be highly instructive. Such a study should contain policy recommendations as to means and strategies employable in enlarging the clientele for these agreements. A wholly separate, but associated issue, relates particularly to the legal force of the Principles Treaty with respect to non-parties. At the present there are 75 States parties to this agreement including all of the space-resource States. Have they by this Treaty and by their practices developed a body of international law--customary as well as formal--that establishes principles, standards, and rules for all countries--signatory or not? Clarification of this situation might ease the decisional process in the United States as it plans for the use of a SPS.

Much of what has been identified above relates to further national and international assessments of both long-range and short-range problems.

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[3]See Appendix E and F.

It is also suggested that international short-range inquiries should be made respecting the possibility that microwaves can, in fact, produce harms. At the world level this could be undertaken by the WHO in collaboration with both public and private international bodies. At home the Department of Health, Education, and Welfare, in cooperation with many other interested governmental and private groups could be encouraged to focus on the subject. At the international level the ITU should be encouraged to continue its assessment of the accuracy of microwave beams. National bodies should work independently and consult with the ITU. As the ITU readies for the 1979 WARC and the 1982 regional conference all involved United States governmental bodies should be studying the positions to be advanced. In such planning it would be expected that suitable consultations would be carried on with other States having interests common to those of the United States. Suitable preparations will also have to be made for the proposed UN Conference on Space Law and Applications.

The policy positions of the United States, if they are to be soundly based, require research appraisals of the kind set forth in this White Paper. Such policy positions require a high degree of coordination at home between agencies and levels of government and experts in the areas of science, technology, law and politics. An intelligent blend of facts and values can and ought to be the ingredients of our decisional process.

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MULTILATERAL

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

Done at Washington, London, and Moscow January 27, 1967;
Ratification advised by the Senate of the United States of America April 25, 1967;
Ratified by the President of the United States of America May 24, 1967;
Ratification of the United States of America deposited at Washington, London, and Moscow October 10, 1967;
Proclaimed by the President of the United States of America October 10, 1967;
Entered into force October 10, 1967.

BY THE PRESIDENT OF THE UNITED STATES OF AMERICA

A PROCLAMATION

WHEREAS the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, was signed at Washington, London, and Moscow on January 27, 1967 in behalf of the United States of America, the United Kingdom of Great Britain and Northern Ireland, and the Union of Soviet Socialist Republics and was signed at one or more of the three capitals in behalf of a number of other States;

WHEREAS the text of the Treaty, in the English, Russian, French, Spanish, and Chinese languages, as certified by the Department of State of the United States of America, is word for word as follows:

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

The States Parties to this Treaty,

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

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

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

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

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

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

TIAS 6347

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, [1]

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

[1] TS 993; 59 Stat. 1031.

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.

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The moon and other celestial bodies shall be used by all States Parties to the Treaty exclusively for peaceful purposes. The establishment of military bases, installations and fortifications, the testing of any type of weapons and the conduct of military maneuvers 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 astronauts as envoys of mankind in outer space and shall render to them all possible assistance in the event of accident, distress, or emergency landing on the territory of another State Party or on the high seas. When astronauts make such a landing, they shall be safely and promptly returned to the State of registry of their space vehicle.

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

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

Article VI

States Parties to the Treaty shall bear international responsibility for national activities in outer space, including the moon and other celestial bodies, whether such activities are carried on by governmental agencies or by non-governmental entities, and for assuring that national activities are carried out in conformity with the provisions set forth in the present Treaty. The activities of non-governmental entities in outer space, including the moon and other celestial bodies, shall require authorization and continuing supervision by the appropriate State Party to the Treaty. When activities are carried on in outer space, including the moon and other celestial bodies, by an international organization, responsibility for compliance with this Treaty shall be borne both by the international organization and by the 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 into outer space, including the moon and other celestial bodies, and each State Party from whose territory or facility an object is launched, is internationally liable for damage to another State Party to the Treaty or to its natural or juridical persons by such object or its component parts on the Earth, in air space or in outer space, including the moon and other celestial bodies.

Article VIII

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

Article IX

In the exploration and use of outer space, including the moon and other celestial bodies, States Parties to the Treaty shall be guided by the principle of co-operation and mutual assistance and shall conduct all their activities in outer space, including the moon and other celestial bodies, with due regard to the corresponding interests of all other States Parties to the Treaty. States Parties to the Treaty shall pursue studies of outer space, including the moon and other celestial bodies, and conduct exploration of them so as to avoid their harmful contamination and also adverse changes in the environment of the Earth resulting from the introduction of extraterrestrial matter and, where necessary, shall adopt appropriate measures for this purpose. If a State Party to the Treaty has

reason to believe that an activity or experiment planned by it or its nationals in outer space, including the moon and other celestial bodies, would cause potentially harmful interference with activities of other States Parties in the peaceful exploration and use of outer space, including the moon and other celestial bodies, it shall undertake appropriate international consultations before proceeding with any such activity or experiment. A State Party to the Treaty which has reason to believe that 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 requests by other States Parties to the Treaty to be afforded an opportunity to observe the flight of space objects launched by those States.

The nature of such an opportunity for observation and the conditions under which it could be afforded shall be determined by agreement between the States concerned.

Article XI

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

Article XII

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

Article XIII

The provisions of this Treaty shall apply to the activities of States Parties to the Treaty in the exploration and use of outer space, including the moon and other celestial bodies, whether such

activities are carried on by a single State Party to the Treaty or jointly with other States, including cases where they are carried on within the framework of international inter-governmental organizations.

Any practical questions arising in connection 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 United States of America, the United Kingdom of Great Britain and Northern Ireland and the Union of Soviet Socialist Republics, 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 their 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 of and 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 the States Parties to the Treaty and thereafter for each remaining State Party to the Treaty on the date of acceptance by it.

Article XVI

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

Article XVII

This Treaty, of which the English, Russian, French, Spanish and Chinese 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.

BOGOTA DECLARATION

FIRST MEETING OF EQUATORIAL COUNTRIES*

The undersigned representatives of the States traversed by the Equator met in Bogotá, Republic of Colombia, from November 29 through December 3rd, 1976 with the purpose of studying the geostationary orbit that corresponds to their national terrestrial, sea, and insular territory and considered as a natural resource. After an exchange of information and having studied in detail the different technical, legal, and political aspects implied in the exercise of national sovereignty of States adjacent to said orbit, have reached the following conclusions:

1. The Geostationary Orbit as a Natural Resource

The geostationary orbit is a circular orbit on the Equatorial plane in which the period of sideral revolution of the satellite is equal to the period of sideral rotation of the Earth and the satellite moves in the same direction of the Earth's rotation. When a satellite describes this particular orbit, it is said to be geostationary; such a satellite appears to be stationary in the sky, when viewed from the earth, and is fixed on the zenith of a given point of the Equator, whose longitude is by definition that of the satellite.

This orbit is located at an approximate distance of 35,871 Kmts. over the Earth's Equator.

Equatorial countries declare that the geostationary synchronous orbit is a physical fact linked to the reality of our planet because

*The expression "Equatorial Countries" throughout the text means those states of the world traversed by the Equator.

its existence depends exclusively on its relation to gravitational phenomena generated by the earth, and that is why it must not be considered part of the outer space. Therefore, the segments of geostationary synchronous orbit are part of the territory over which Equatorial states exercise their national sovereignty. The geostationary orbit is a scarce natural resource, whose importance and value increase rapidly together with the development of space technology and with the growing need for communication; therefore, the Equatorial countries meeting in Bogotá have decided to proclaim and defend on behalf of their peoples, the existence of their sovereignty over this natural resource. The geostationary orbit represents a unique facility that it alone can offer for telecommunication services and other uses which require geostationary satellites.

The frequencies and orbit of geostationary satellites are limited natural resources, fully accepted as such by current standards of the International Telecommunications Union. Technological advancement has caused a continuous increase in the number of satellites that use this orbit, which could result in a saturation in the near future.

The solutions proposed by the International Telecommunications Union and the relevant documents that attempt to achieve a better use of the geostationary orbit that shall prevent its imminent saturation, are at present impracticable and unfair and would considerably increase the exploitation costs of this resource especially for developing countries that do not have equal technological and financial resources as compared to industrialized countries who enjoy an apparent monopoly in the exploitation and use of its geostationary synchronous orbit. In

spite of the principle established by Article 33, sub-paragraph 2 of the International Telecommunications Convention, of 1973, that in the use of frequency bands for space radiocommunications, the members shall take into account that the frequencies and the orbit for geostationary satellites are limited natural resources that must be used efficiently and economically to allow the equitable access to this orbit and to its frequencies, we can see that both the geostationary orbit and the frequencies have been used in a way that does not allow the equitable process of the developing countries that do not have the technical and financial means that the great powers have. Therefore, it is imperative for the equatorial countries to exercise their sovereignty over the corresponding segments of the geostationary orbit.

2. Sovereignty of Equatorial States over the Corresponding Segments of the Geostationary Orbit

In qualifying this orbit as a natural resource, equatorial states reaffirm "the right of the peoples and of nations to permanent sovereignty over their wealth and natural resources that must be exercised in the interest of their national development and of the welfare of the people of the nation concerned," as it is set forth in Resolution 2692 (XXV) of the United Nations General Assembly entitled "permanent sovereignty over the natural resources of developing countries and expansion of internal accumulation sources for economic developments."

Furthermore, the charter on economic rights and duties of states solemnly adopted by the United Nations General Assembly through Resolution 3281 (XXIX), once more confirms the existence of a sovereign right of nations over their natural resources, in Article 2 sub-paragraph 1, which reads:

"All states have and freely exercise full and permanent sovereignty, including possession, use and disposal of all their wealth, natural resources and economic activities."

Consequently, the above mentioned provisions lead the equatorial states to affirm that the synchronous geostationary orbit, being a natural resource, is under the sovereignty of the equatorial states.

3. Legal status of the Geostationary Orbit

Bearing in mind the existence of sovereign rights over segments of the geostationary orbit, the equatorial countries consider that the applicable legal considerations in this area must take into account the following:

a) The sovereign rights put forward by the equatorial countries are directed towards rendering tangible benefits to their respective people and for the universal community, which is completely different from the present reality when the orbit is used to the greater benefit of the most developed countries.

b) The segments of the orbit corresponding to the open sea are beyond the national jurisdiction of states and will be considered as common heritage of mankind. Consequently, the competent international agencies should regulate its use and exploitation for the benefit of mankind.

c) The equatorial states do not object to the free orbital transit of satellites approved and authorized by the International Telecommunications Convention, when these satellites pass through their outer space in their gravitational flight outside their geostationary orbit.

d) The devices to be placed permanently on the segment of a geostationary orbit of an equatorial state shall require previous and expressed authorization on the part of the concerned state, and the operation of the device should conform with the national law of that territorial country over which it is placed. It must be understood that the said authorization is different from the coordination requested in cases of interference among satellite systems, which are specified in the regulations for radiocommunications. The said authorization refers in very clear terms to the countries' right to allow the operation of fixed radiocommunications stations within their territory.

e) Equatorial states do not condone the existing satellites or the position they occupy on their segments of the Geostationary Orbit nor does the existence of said satellites confer any rights of placement of satellites or use of the segment unless expressly authorized by the state exercising sovereignty over this segment.

4. Treaty of 1967

The Treaty of 1967 on "The Principles governing the activities of states in the exploration and use of outer space, including the moon and other celestial bodies," signed on January 27 of 1967, cannot be considered as a final answer to the problem of the exploration and use of outer space, even less when the international community is questioning all the terms of international law which were elaborated when the

developing countries could not count on adequate scientific advice and were thus not able to observe and evaluate the omissions, contradictions and consequences of the proposals which were prepared with great ability by the industrialized powers for their own benefit.

There is no valid or satisfactory definition of outer space which may be advanced to support the argument that the geostationary orbit is included in the outer space. The legal affairs sub-commissioned which is dependent on the United Nations Commission on the Use of Outer Space for Peaceful Purposes, has been working for a long time on a definition of outer space, however, to date, there has been no agreement in this respect.

Therefore, it is imperative to elaborate a juridical definition of outer space, without which the implementation of the Treaty of 1967 is only a way to give recognition to the presence of the states that are already using the geostationary orbit. Under the name of a so-called non-national appropriation, what was actually developed was technological partition of the orbit, which is simply a national appropriation, and this must be denounced by the equatorial countries. The experiences observed up to the present and the developments foreseeable for the coming years bring to light the obvious omissions of the Treaty of 1967 which force the equatorial states to claim the exclusion of the geostationary orbit.

The lack of definition of outer space in the Treaty of 1967, which has already been referred to, implies that article II should not apply to geostationary orbit and therefore does not affect the right of the equatorial states that have already ratified the Treaty.

5. Diplomatic and Political Action

While article 2 of the aforementioned Treaty does not establish an express exception regarding the synchronous geostationary orbit, as an integral element of the territory of equatorial states, the countries that have not ratified the Treaty should refrain from undertaking any procedure that allows the enforcement of provisions whose juridical omission has already been denounced.

The representatives of the equatorial countries attending the meeting in Bogotá, wish to clearly state their position regarding the declarations of Colombia and Ecuador in the United Nations, which affirm that they consider the geostationary orbit to be an integral part of their sovereign territory; this declaration is a historical background for the defense of the sovereign rights of the equatorial countries. These countries will endeavor to make similar declarations in international agencies dealing with the same subject and to align their international policy in accordance with the principles elaborated in this document.

Signed in Bogotá 3rd December 1976 by the Heads of Delegations.

Geraldo Nabcimento Silva
Observateur du BRESIL

Sara Ordoñez de Lodoño
Colombia

Tchitche Linguissi
Congo

José Ayala Lasso
Ecuador

Soehardjono
Indonesia

Petersan John Kinya
Kenya

Khalid Younis Kinene
Uganda

Wabali Bakitambisa
Zaire

MULTILATERAL

Convention on International Liability for Damage Caused by Space Objects

Done at Washington, London, and Moscow March 29, 1972;
Ratification advised by the Senate of the United States of America October 6, 1972;
Ratified by the President of the United States of America May 18, 1973;
Ratification of the United States of America deposited at Washington, London, and Moscow October 9, 1973;
Proclaimed by the President of the United States of America November 21, 1973;
Entered into force with respect to the United States of America October 9, 1973.

BY THE PRESIDENT OF THE UNITED STATES OF AMERICA

A PROCLAMATION

CONSIDERING THAT:

The Convention on International Liability for Damage Caused by Space Objects was signed at Washington, London, and Moscow on March 29, 1972 in behalf of the United States of America, the United Kingdom of Great Britain and Northern Ireland, and the Union of Soviet Socialist Republics, the depositary governments, and was signed at one or more of the three capitals in behalf of a number of other States, a certified copy of which Convention is hereto annexed;

The Senate of the United States of America by its resolution of October 6, 1972, two-thirds of the Senators present concurring therein, gave its advice and consent to the ratification of the Convention;

The President of the United States of America ratified the Convention on May 18, 1973, in pursuance of the advice and consent of the Senate;

The United States of America deposited its instrument of ratification on October 9, 1973, in accordance with the provisions of paragraph 2 of Article XXIV of the Convention; and

Pursuant to the provisions of paragraph 4 of Article XXIV of the Convention, the Convention entered into force for the United States of America on October 9, 1973;

NOW, THEREFORE, be it known that I, Richard Nixon, President of the United States of America, proclaim and make public the said Convention to the end that it shall be observed and fulfilled with good faith on and after October 9, 1973 by the United States of America and by the citizens of the United States of America and all other persons subject to the jurisdiction thereof.

IN TESTIMONY WHEREOF, I have signed this proclamation and caused the Seal of the United States of America to be affixed.

DONE at the city of Washington this twenty-first day of November in the year of our Lord one thousand nine hundred seventy-three and of the Independence of the United States of America the one hundred ninety-eighth.

[SEAL]

RICHARD NIXON

By the President:
HENRY A. KISSINGER
Secretary of State

CONVENTION ON INTERNATIONAL LIABILITY FOR
DAMAGE CAUSED BY SPACE OBJECTS

The States Parties to this Convention,

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

Recalling the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, [1]

Taking into consideration that, notwithstanding the precautionary measures to be taken by States and international intergovernmental organizations involved in the launching of space objects, damage may on occasion be caused by such objects,

Recognizing the need to elaborate effective international rules and procedures concerning liability for damage caused by space objects and to ensure, in particular, the prompt payment under the terms of this Convention of a full and equitable measure of compensation to victims of such damage,

Believing that the establishment of such rules and procedures will contribute to the strengthening of international cooperation in the field of the exploration and use of outer space for peaceful purposes,

Have agreed on the following:

[1] TIAS 6347; 18 UST 2410.

ARTICLE I

For the purposes of this Convention:

(a) The term "damage" means 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;

(b) The term "launching" includes attempted launching;

(c) The term "launching State" means:

(i) A State which launches or procures the launching of a space object;

(ii) A State from whose territory or facility a space object is launched;

(d) The term "space object" includes component parts of a space object as well as its launch vehicle and parts thereof.

ARTICLE II

A launching State shall be absolutely liable to pay compensation for damage caused by its space object on the surface of the earth or to aircraft in flight.

ARTICLE III

In the event of damage being caused elsewhere than on the surface of the earth to a space object of one launching State or to persons or property on board such a space object by a space object of another launching State, the latter shall be liable only if the damage is due to its fault or the fault of persons for whom it is responsible.

ARTICLE IV

1. In the event of damage being caused elsewhere than on the surface of the earth to a space object of one launching State or to persons or property on board such a space object by a space object of another launching State, and of damage thereby being caused to a third State or to its natural or juridical persons, the first two States shall be jointly and severally liable to the third State, to the extent indicated by the following:

(a) If the damage has been caused to the third State on the surface of the earth or to aircraft in flight, their liability to the third State shall be absolute;

(b) If the damage has been caused to a space object of the third State or to persons or property on board that space object elsewhere than on the surface of the earth, their liability to the third State shall be based on the fault of either of the first two States or on the fault of persons for whom either is responsible.

2. In all cases of joint and several liability referred to in paragraph 1 of this article, the burden of compensation for the damage shall be apportioned between the first two States in accordance with the extent to which they were at fault; if the extent of the fault of each of these States cannot be established, the burden of compensation shall be apportioned equally between them. Such apportionment shall be without prejudice to the right of the third State to seek the entire compensation due under this Convention from any or all of the launching States which are jointly and severally liable.

ARTICLE V

1. Whenever two or more States jointly launch a space object, they shall be jointly and severally liable for any damage caused.

2. A launching State which has paid compensation for damage shall have the right to present a claim for indemnification to other participants in the joint launching. The participants in a joint launching may conclude agreements regarding the apportioning among themselves of the financial obligation in respect of which they are jointly and severally liable. Such agreements shall be without prejudice to the right of a State sustaining damage to seek the entire compensation due under this Convention from any or all of the launching States which are jointly and severally liable.

3. A State from whose territory or facility a space object is launched shall be regarded as a participant in a joint launching.

ARTICLE VI

1. Subject to the provisions of paragraph 2 of this article, exoneration from absolute liability shall be granted to the extent that a launching State establishes that the damage has resulted either wholly or partially from gross negligence or from an act or omission done with intent to cause damage on the part of a claimant State or of natural or juridical persons it represents.

2. No exoneration whatever shall be granted in cases where the damage has resulted from activities conducted by a launching State which are not in conformity with international law including,

in particular, the Charter of the United Nations [1] and the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies.

ARTICLE VII

The provisions of this Convention shall not apply to damage caused by a space object of a launching State to:

(a) Nationals of that launching State;

(b) Foreign nationals during such time as they are participating in the operation of that space object from the time of its launching or at any stage thereafter until its descent, or during such time as they are in the immediate vicinity of a planned launching or recovery area as the result of an invitation by that launching State.

ARTICLE VIII

1. A State which suffers damage, or whose natural or juridical persons suffer damage, may present to a launching State a claim for compensation for such damage.

2. If the State of nationality has not presented a claim, another State may, in respect of damage sustained in its territory by any natural or juridical person, present a claim to a launching State.

3. If neither the State of nationality nor the State in whose territory the damage was sustained has presented a claim or notified its intention of presenting a claim, another State may, in respect of damage sustained by its permanent residents, present a claim to a launching State.

[1] TS 993; 59 Stat. 1081.

ARTICLE IX

A claim for compensation for damage shall be presented to a launching State through diplomatic channels. If a State does not maintain diplomatic relations with the launching State concerned, it may request another State to present its claim to that launching State or otherwise represent its interests under this Convention. It may also present its claim through the Secretary-General of the United Nations, provided the claimant State and the launching State are both Members of the United Nations.

ARTICLE X

1. A claim for compensation for damage may be presented to a launching State not later than one year following the date of the occurrence of the damage or the identification of the launching State which is liable.

2. If, however, a State does not know of the occurrence of the damage or has not been able to identify the launching State which is liable, it may present a claim within one year following the date on which it learned of the aforementioned facts; however, this period shall in no event exceed one year following the date on which the State could reasonably be expected to have learned of the facts through the exercise of due diligence.

3. The time-limits specified in paragraphs 1 and 2 of this article shall apply even if the full extent of the damage may not be known. In this event, however, the claimant State shall be entitled to revise the claim and submit additional documentation after the expiration of such time-limits until one year after the full extent of the damage is known.

ARTICLE XI

1. Presentation of a claim to a launching State for compensation for damage under this Convention shall not require the prior exhaustion of any local remedies which may be available to a claimant State or to natural or juridical persons it represents.

2. Nothing in this Convention shall prevent a State, or natural or juridical persons it might represent, from pursuing a claim in the courts or administrative tribunals or agencies of a launching State. A State shall not, however, be entitled to present a claim under this Convention in respect of the same damage for which a claim is being pursued in the courts or administrative tribunals or agencies of a launching State or under another international agreement which is binding on the States concerned.

ARTICLE XII

The compensation which the launching State shall be liable to pay for damage under this Convention shall be determined in accordance with international law and the principles of justice and equity, in order to provide such reparation in respect of the damage as will restore the person, natural or juridical, State or international organization on whose behalf the claim is presented to the condition which would have existed if the damage had not occurred.

ARTICLE XIII

Unless the claimant State and the State from which compensation is due under this Convention agree on another form of compensation,

the compensation shall be paid in the currency of the claimant State or, if that State so requests, in the currency of the State from which compensation is due.

ARTICLE XIV

If no settlement of a claim is arrived at through diplomatic negotiations as provided for in article IX, within one year from the date on which the claimant State notifies the launching State that it has submitted the documentation of its claim, the parties concerned shall establish a Claims Commission at the request of either party.

ARTICLE XV

1. The Claims Commission shall be composed of three members: one appointed by the claimant State, one appointed by the launching State and the third member, the Chairman, to be chosen by both parties jointly. Each party shall make its appointment within two months of the request for the establishment of the Claims Commission.

2. If no agreement is reached on the choice of the Chairman within four months of the request for the establishment of the Commission, either party may request the Secretary-General of the United Nations to appoint the Chairman within a further period of two months.

ARTICLE XVI

1. If one of the parties does not make its appointment within the stipulated period, the Chairman shall, at the request of the other party, constitute a single-member Claims Commission.

2. Any vacancy which may arise in the Commission for whatever reason shall be filled by the same procedure adopted for the original appointment.

3. The Commission shall determine its own procedure.

4. The Commission shall determine the place or places where it shall sit and all other administrative matters.

5. Except in the case of decisions and awards by a single-member Commission, all decisions and awards of the Commission shall be by majority vote.

ARTICLE XVII

No increase in the membership of the Claims Commission shall take place by reason of two or more claimant States or launching States being joined in any one proceeding before the Commission. The claimant States so joined shall collectively appoint one member of the Commission in the same manner and subject to the same conditions as would be the case for a single claimant State. When two or more launching States are so joined, they shall collectively appoint one member of the Commission in the same way. If the claimant States or the launching States do not make the appointment within the stipulated period, the Chairman shall constitute a single-member Commission.

ARTICLE XVIII

The Claims Commission shall decide the merits of the claim for compensation and determine the amount of compensation payable, if any.

ARTICLE XIX

1. The Claims Commission shall act in accordance with the provisions of article XII.

2. The decision of the Commission shall be final and binding if the parties have so agreed; otherwise the Commission shall render a final and recommendatory award, which the parties shall consider in good faith. The Commission shall state the reasons for its decision or award.

3. The Commission shall give its decision or award as promptly as possible and no later than one year from the date of its establishment, unless an extension of this period is found necessary by the Commission.

4. The Commission shall make its decision or award public. It shall deliver a certified copy of its decision or award to each of the parties and to the Secretary-General of the United Nations.

ARTICLE XX

The expenses in regard to the Claims Commission shall be borne equally by the parties, unless otherwise decided by the Commission.

ARTICLE XXI

If the damage caused by a space object presents a large-scale danger to human life or seriously interferes with the living conditions of the population or the functioning of vital centers, the States Parties, and in particular the launching State, shall examine the possibility of rendering appropriate and rapid assistance to the State which has suffered the damage, when it so requests. However, nothing in this article shall affect the rights or obligations of the States Parties under this Convention.

ARTICLE XXII

1. In this Convention, with the exception of articles XXIV to XXVII, references to States shall be deemed to apply to any international intergovernmental organization which conducts space activities if the organization declares its acceptance of the rights and obligations provided for in this Convention and if a majority of the States members of the organization are States Parties to this Convention and 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.

2. States members of any such organization which are States Parties to this Convention shall take all appropriate steps to ensure that the organization makes a declaration in accordance with the preceding paragraph.

3. If an international intergovernmental organization is liable for damage by virtue of the provisions of this Convention, that organization and those of its members which are States Parties to this Convention shall be jointly and severally liable; provided, however, that:

(a) Any claim for compensation in respect of such damage shall be first presented to the organization;

(b) Only where the organization has not paid, within a period of six months, any sum agreed or determined to be due as compensation for such damage, may the claimant State invoke the liability of the members which are States Parties to this Convention for the payment of that sum.

4. Any claim, pursuant to the provisions of this Convention, for compensation in respect of damage caused to an organization which has made a declaration in accordance with paragraph 1 of this article shall be presented by a State member of the organization which is a State Party to this Convention.

ARTICLE XXIII

1. The provisions of this Convention shall not affect other international agreements in force in so far as relations between the States Parties to such agreements are concerned.

2. No provision of this Convention shall prevent States from concluding international agreements reaffirming, supplementing or extending its provisions.

ARTICLE XXIV

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

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

3. This Convention shall enter into force on the deposit of the fifth instrument of ratification.

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

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

ARTICLE XXV

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

ARTICLE XXVI

Ten years after the entry into force of this Convention, the question of the review of this Convention shall be included in the provisional agenda of the United Nations General Assembly in order to consider, in the light of past application of the Convention, whether it requires revision. However, at any time after the

Convention has been in force for five years, and at the request of one third of the States Parties to the Convention, and with the concurrence of the majority of the States Parties, a conference of the States Parties shall be convened to review this Convention.

ARTICLE XXVII

Any State Party to this Convention may give notice of its withdrawal from the Convention 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 XXVIII

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

APPENDIX D

COMPARISON CHART OF SIGNATORY NATIONS FOR THREE TREATIES*

1967 OST - Treaty on principles governing the activities of states in the exploration and use of outer space, including the moon and other celestial bodies. Done at Washington, London, and Moscow January 27, 1967. 18 UST 2410; TIAS 6347; 610 UNTS 205.

1972 LIABILITY - Convention on the international liability for damage caused by space objects. Done at Washington, London, and Moscow March 29, 1972. 24 UST 2389; TIAS 7762.

1973 ITU - International telecommunication convention, with annexes and protocols. Done at Malaga-Torremolinos, October 25, 1973. TIAS 8572.

* As of January 1, 1978.

NATION	1967 OST	1972 LIABILITY	1973 ITU
Afghanistan	---	---	YES
Albania	---	---	YES
Angola	---	---	YES
Argentina	YES	---	YES
Australia	YES	YES	YES
Austria	YES	---	YES
Bahamas, The	YES	---	YES
Bahrain	---	---	YES
Bangladesh	---	---	YES
Barbados	YES	---	YES
Belgium	YES	YES	---
Benin	---	YES	---
Botswana	---	YES	---
Brazil	YES	YES	YES
Bulgaria	YES	YES	YES
Burma	YES	---	YES
Burundi	---	---	YES
Byelorussian Soviet Soc. Rep.	YES	---	YES
Canada	YES	YES	YES
Cape Verde	---	---	YES
Central African Empire	---	---	YES

NATION	1967 OST	1972 LIABILITY	1973 ITU
Chile	---	YES	YES
China, People's Republic	---	---	YES
China, Republic	YES	YES	---
Colombia	---	---	YES
Comoros	---	---	YES
Cuba	---	---	YES
Cyprus	YES	YES	YES
Czechoslovakia	YES	YES	YES
Denmark	YES	YES	YES
Djibouti	---	---	YES
Dominican Republic	YES	YES	---
Ecuador	YES	YES	YES
Egypt	YES	---	YES
El Salvador	YES	---	YES
Ethiopia	---	---	YES
Fiji	YES	YES	YES
Finland	YES	YES	YES
France	YES	YES	YES
Gambia, The	---	---	YES
German Democratic Republic	YES	YES	YES
Germany, Federal Republic	YES	YES	YES
Ghana	---	---	YES
Greece	YES	YES	YES
Guinea	---	---	YES
Guinea-Bissau	---	---	YES
Guyana	---	---	YES
Haiti	---	---	YES
Hungary	YES	YES	YES
Iceland	YES	---	YES

NATION	1967 OST	1972 LIABILITY	1973 ITU
India	---	---	YES
Indonesia	---	---	YES
Iran	---	YES	YES
Iraq	YES	YES	YES
Ireland	YES	YES	YES
Israel	YES	YES	YES
Italy	YES	---	---
Jamaica	YES	---	YES
Japan	YES	---	YES
Jordan	---	---	YES
Kenya	---	YES	---
Korea, Democratic People's Republic	YES	---	YES
Korea, Republic	YES	---	YES
Kuwait	YES	YES	YES
Laos	YES	YES	YES
Lebanon	YES	---	---
Lesotho	---	---	YES
Liberia	---	---	YES
Libya	YES	---	YES
Liechtenstein	---	---	YES
Luxembourg	---	---	YES
Madagascar	YES	---	YES
Malawi	---	---	YES
Malaysia	---	---	YES
Maldives	---	---	YES
Mali	YES	YES	YES
Malta	---	---	YES
Mauritania	---	---	YES
Mauritius	YES	---	YES

NATION	1967 OST	1972 LIABILITY	1973 ITU
Mexico	YES	YES	YES
Monaco	---	---	YES
Mongolia	YES	YES	YES
Morocco	YES	---	YES
Mozambique	---	---	YES
Nepal	YES	---	YES
Netherlands, The	YES	---	YES
New Zealand	YES	YES	YES
Nicaragua	---	---	YES
Niger	YES	YES	---
Nigeria	YES	---	YES
Norway	YES	---	YES
Oman	---	---	YES
Pakistan	YES	YES	YES
Panama	---	YES	YES
Papua New Guinea	---	---	YES
Paraguay	---	---	YES
Philippines	---	---	YES
Poland	YES	YES	YES
Portugal	---	---	YES
Qatar	---	---	YES
Romania	YES	---	YES
Rwanda	---	---	YES
San Marino	YES	---	YES
Sao Tome and Principe	---	---	YES
Saudi Arabia	YES	YES	YES
Senegal	---	YES	YES
Sierra Leone	YES	---	YES
Singapore	YES	YES	YES

NATION	1967 OST	1972 LIABILITY	1973 ITU
Somalia	---	---	YES
South Africa	YES	---	YES
Spain	YES	---	YES
Sri Lanka	---	YES	---
Surinam	---	---	YES
Swaziland	---	---	YES
Sweden	YES	YES	YES
Switzerland	YES	YES	YES
Syrian Arab Republic	YES	---	YES
Tanzania	---	---	YES
Thailand	YES	---	YES
Togo	---	YES	YES
Tonga	YES	---	YES
Trinidad and Tobago	---	---	YES
Tunisia	YES	YES	YES
Turkey	YES	---	---
Uganda	YES	---	---
Ukranian Soviet Socialist Republic	YES	YES	YES
Union of Soviet Socialist Republics	YES	YES	YES
United Arab Emirates	---	---	YES
United Kingdom	YES	YES	YES
United States	YES	YES	YES
Upper Volta	YES	---	---
Uruguay	YES	YES	---
Vatican City	---	---	YES
Venezuela	YES	---	---
Viet Nam, Socialist Republic	---	---	YES
Yugoslavia	---	YES	YES
Zaire	---	---	YES
Zambia	YES	YES	---

APPENDIX E

LIST OF NATIONS WHICH ARE SIGNATORY TO ALL THREE TREATIES

(1967 Principles, 1972 Liability, 1973 ITU)

Australia
Brazil
Bulgaria
Canada
Cyprus
Czechoslovakia
Denmark
Ecuador
Fiji
Finland
France
German Democratic Republic
Germany, Federal Republic
Greece
Hungary
Iraq
Ireland
Israel
Kuwait
Laos
Mali
Mexico
Mongolia
New Zealand
Pakistan
Poland
Saudi Arabia
Singapore
Sweden
Switzerland
Tunisia
Ukranian Soviet Socialist Republic
Union of Soviet Socialist Republics
United Kingdom
United States

SOURCE: TREATIES IN FORCE, 1978, Department of State Publication 8934, Pp. 362-3, 367-8.

TOTAL: 35

NATIONS BY AREA WHICH ARE SIGNATORY TO THREE TREATIES

(1967 Principles, 1972 Liability, 1973 ITU)

WESTERN EUROPE

DENMARK
FINLAND
FRANCE
GERMAN DEMOCRATIC REPUBLIC
GERMANY, FEDERAL REPUBLIC
IRELAND
SWEDEN
SWITZERLAND
UNITED KINGDOM

ASIA AND PACIFIC

AUSTRALIA
FIJI
LAOS
MONGOLIA
NEW ZEALAND
PAKISTAN
SINGAPORE

MIDDLE EAST

IRAQ
ISRAEL
KUWAIT
SAUDI ARABIA
TUNISIA

EASTERN EUROPE

BULGARIA
CZECHOSLOVAKIA
HUNGARY
POLAND
UKRANIAN SOVIET SOCIALIST REPUBLIC
UNION OF SOVIET SOCIALIST REPUBLICS (USSR)

MEDITERRANEAN

CYPRUS
GREECE

AFRICA

MALI

SOUTH AMERICA

BRAZIL
ECUADOR

NORTH AMERICA

CANADA
MEXICO
UNITED STATES

TOTAL: 35

APPENDIX G

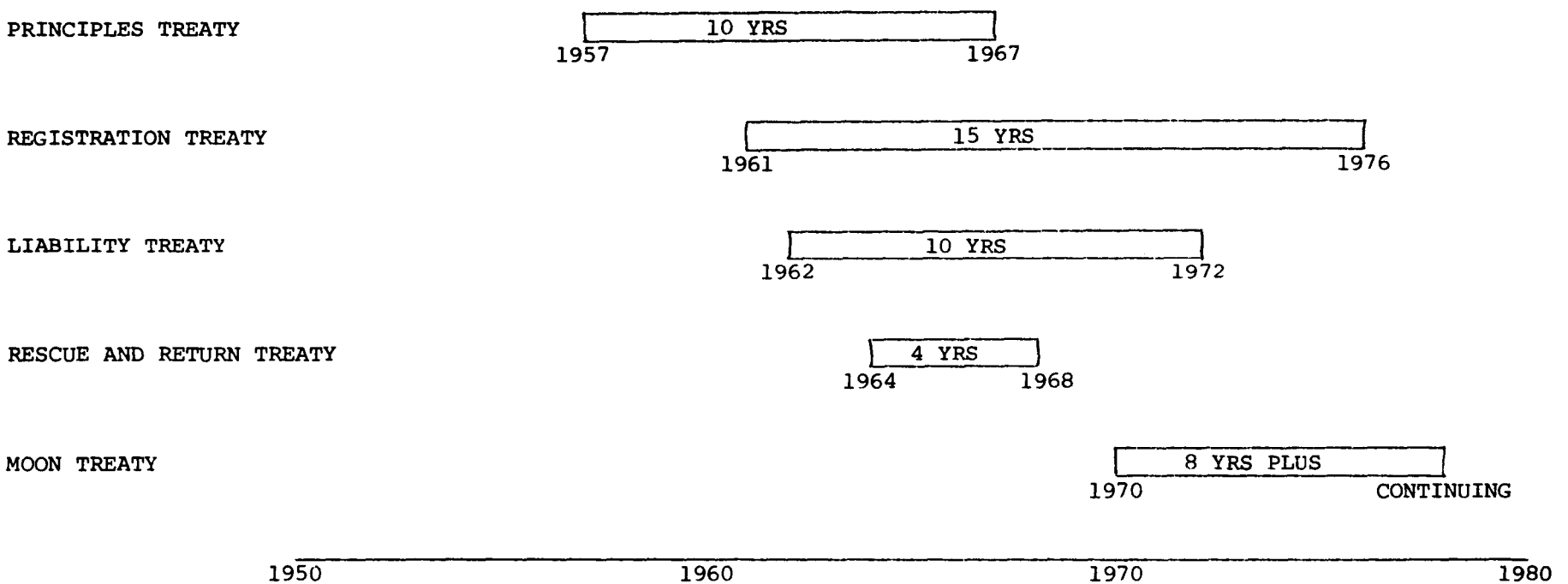
EQUATORIAL NATIONS AND FOUR TREATIES

(1967 Principles, 1971 WARC, 1972 Liability, and 1973 ITU)

NATION	1967 PRINCIPLES	1971 WARC	1972 LIABILITY	1973 ITU
BRAZIL	YES	YES	YES	YES
COLOMBIA	---	---	---	YES
CONGO	NOT A PARTY			
ECUADOR	YES	---	YES	YES
GABON	NOT A PARTY			
INDONESIA	---	---	---	YES
KENYA	---	---	YES	---
PERU	NOT A PARTY			
SOMALIA	---	---	---	YES
UGANDA	YES	---	---	---
ZAIRE	---	---	---	YES

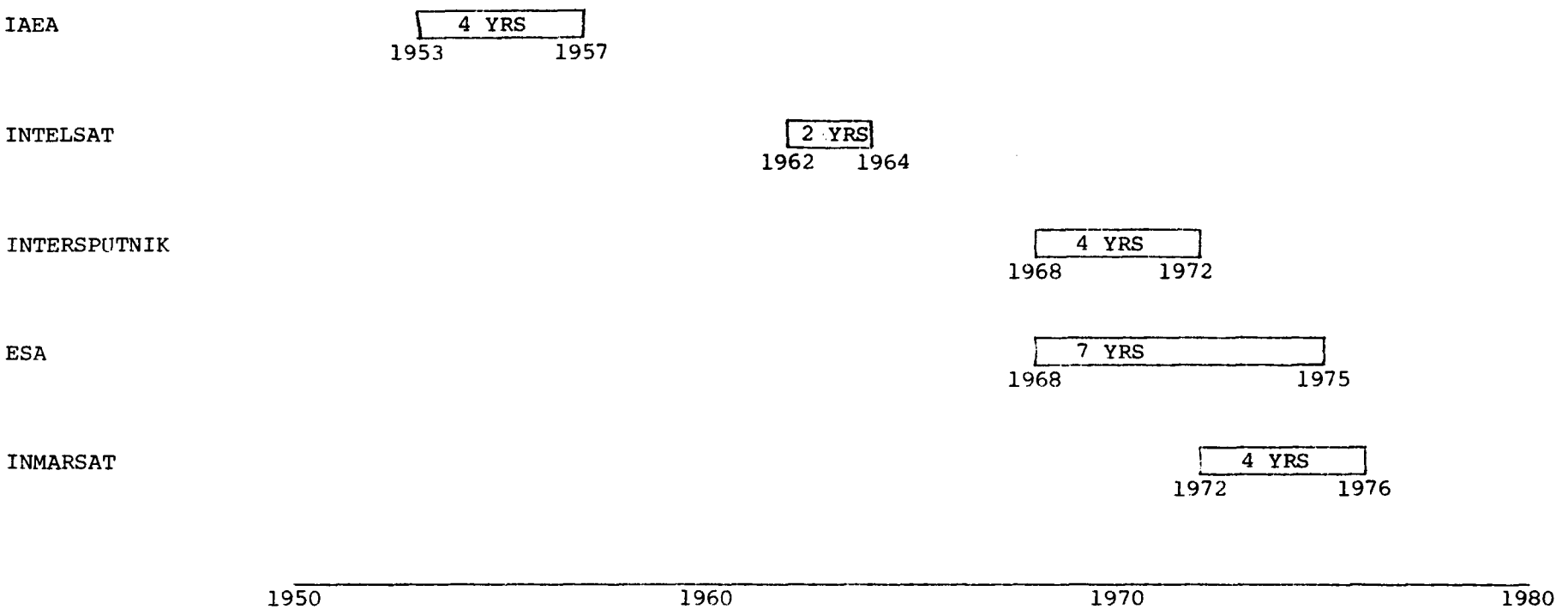
APPENDIX H

TIME FRAME CHART FOR TREATIES



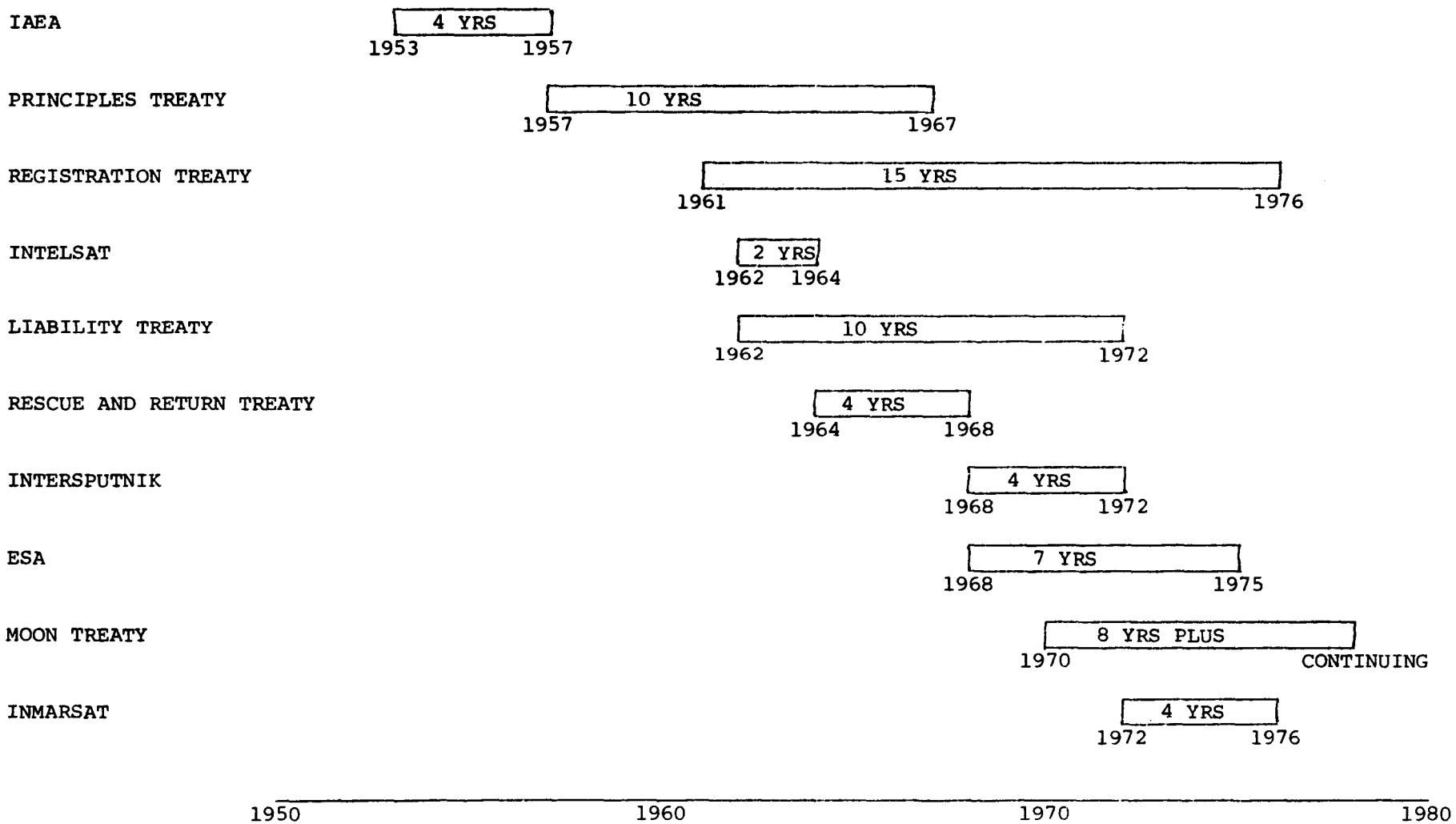
APPENDIX I

TIME FRAME CHART FOR ORGANIZATIONS



APPENDIX J

TIME FRAME CHART FOR TREATIES AND ORGANIZATIONS



APPENDIX K

SUBJECTS FOR FURTHER STUDY

Short Range
(1 to 5 years)

NATIONAL FOCUS	INTERNATIONAL FOCUS
1. Build Favorable Public Opinion	
Political: Congressional Hearings	COPUOS
Scientific: Professional Bodies	ICSU, IAF
Legal: Professional Bodies	
American Society of International Law	Foreign International Law Associations
American Bar Association	Foreign Bar Associations
American Branch, International Law Assoc.	International Law Association
American Branch, International Institute of Space Law	International Institute Space Law
2. Scientific Facts	
MHz Spectrum Availability	ITU, COPUOS, COSPAR
Orbit Availability, Problem of Limits	ITU, COPUOS, COSPAR, IAF
Microwave Damage Potential, Preparation of Draft International Agreement	WHO, ICSU, International Organization for Standards
Space Debris	COSPAR, IAF
Perfection of Means to Acquire and to Disseminate Data	Global Data Processing System Global Telecommunication System International Federation for Information Processing
3. Legal Situation	
Status of *res communis* Principle	COPUOS, UN Conference on Space Law
Influence of Bogota Declaration	COPUOS, UN Conference on Space Law, OAS
Assessment of "Mankind" Concepts	COPUOS, 3rd UN Conference on The Law of the Sea
Common Heritage of Mankind	UN Conference on Space Law
Province of Mankind	
Proposed Moon Treaty	COPUOS, UN Conference on Space Law
Natural Resources	
Common Heritage of Mankind	
Revision of Article 4 (2), Principles Treaty, Application to Outer Space, per se	COPUOS, UN Conference on Space Law
National Security	Bilateral Negotiations, USA and USSR, Other Space Resource States
Interception of SPS	

NATIONAL FOCUS	INTERNATIONAL FOCUS
Jamming of Microwaves	
Rights of Natural Persons and International Intergovernmental Organizations	COPUOS, UN Conference on Space Law
Construction of ITU Convention, Article 33, Efficient Use, Economic Use, Equitable Access	ITU Members
Assessment of International Agreements on Solar Energy	UN Secretariat, COPOUS, COSPAR

4. Policies for Multinational Conferences

Preparation for Scheduled Conferences	1978 UN Conference on Technical Cooperation Among Developing Nations 1979 WARC, role of ITU on allocation of Orbital Positions Late 1970s, UN Conference on Science and Technology for Development 1982 (approx.) Region 2 WARC BS Role of ITU on Orbital Positions. 1983 (approx.) UN Conference on Space Law, Role of UN and ITU on Orbital Positions, Assessment of Respective Roles of UN and ITU
Policy Planning for Formation of World Space Agency or Regime Scope, Powers (substantive, e.g., exclusive vs. shared), (procedural, e.g., business vs. bureaucratic), structure	COPUOS, UN Conference on Space Law
Relationship of UN and ITU to other Specialized Agencies of UN	COPUOS, UN Conference on Space Law
Gaining More Ratifications to Existing International Agreements	
1967 Principles Treaty	COPUOS
1972 Liability Convention	COPUOS
1971 WARC ST	ITU
1973 ITU	ITU
1977 WARC BS	ITU
Relationship between UN and ITU with Non-Governmental Organizations	UN, ITU, AND NGOs
Relationship between UN and ITU with Scientific Community, with Possibility of a New IGY or Comparable Entity for SPS.	UN, ITU, ICSU

NATIONAL FOCUS	INTERNATIONAL FOCUS
5. Policies for Regional Conferences	
Preparation for Small Groups	Andean Group, ESA
6. Policies for Bilateral Negotiations	
Preparation for Negotiations Common Security Interests Policing of Space Environment Disarmament of the Environment	USA-USSR, USA-Other Space Resource States

Long Range
(more than 5 years from date)

NATIONAL FOCUS	INTERNATIONAL FOCUS
1. Monitoring All Agreements Previously Arrived At	
2. Perfection of Institutions Agreed To	
3. Modification of Plans and Activities as a Result of Changes in Facts and Political-Legal Outlooks During the Preceding Period	