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Summary:

The thesis deals with general international regulatory problems which have arisen due to the new technological development of communication by satellite. As the International Telecommunication Union is the oldest regulatory body in this field the first chapter examines the origins, history and development of the Union. In the second chapter the role of the ITU in the space age is examined with particular reference to communications by satellite.

In the first part of the third chapter the various types of communication satellites are discussed. In the latter half of that chapter there is a brief outline of the existing communication satellite system - Intelsat - as well as of the proposed Intersputnik global system and of the Canadian Telesat programme.

In the concluding chapter some major legal and organizational problems evolving from communication by satellite are discussed; and recommendations for an international regulatory agency to cope with these problems are considered.

INTERNATIONAL REGULATION OF TELECOMMUNICATIONS BY SATELLITE - Devine

Towards International Regulation of Telecommunications by Satellite

by T. Joseph Devine

being a thesis submitted to the Faculty of Graduate Studies and Research in partial fulfilment for the degree of Master of Laws

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INTRODUCTION

The development of communications by satellite has been the most dramatic single event in the telecommunications revolution of the past decade. It was but eleven years ago that the Soviet Union put the first artificial earth satellite into orbit; today television broadcasting and other types of communication by satellite are such an integrated part of the technology of telecommunications as to be largely taken for granted by the peoples of the developed nations. In the same fashion as the general technical revolution of the twentieth century, the revolution in telecommunications is gaining momentum; the next ten years promise increasingly impressive developments.

The assimilation of any major technological development is difficult for society. Legal and political direction, management and regulation of such growth are essential. In international telecommunications, this need has not been adequately met in the past, and the problem will be compounded with the advances promised by the future. "The Western world is at a point where the policy and legal problems inevitably created by . . . new

technology should be of greater concern than the admittedly demanding task of solving the technical difficulties which each new science or technology inevitably faces."(1) International telecommunications have developed, in the main, within a legal vacuum.

This dissertation will examine the history and the present state of the international regulation of telecommunications by satellite, and will suggest an approach to the problem for the future. As will be seen in chapter I, international regulation in this field has been mainly limited to the control of the radio frequency spectrum by the International Telecommunication Union -- a function performed with reasonable effectiveness since the turn of the century. An attempt will then be made to examine the limited role of the International Telecommunication Union in the present age of communications by satellite. The third chapter will review technological developments in the field of communications by satellite and will indicate what the immediate future promises in this area. Existing communications satellite systems

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(1) Samuel D. Estep, "International Lawmakers in a Technological World: Space Communications and Nuclear Energy", 33 Geo. Wash. Law Rev. 162, at p. 162.

will also be described. The international legal problems posed by these developments will be outlined in chapter IV, and an attempt will be made to suggest an approach to the Herculean task of developing legal regulation and organization in this field for the future.

CHAPTER I

The International Telecommunication Union
Its History, Evolution and Purpose

PART 1: Origins of the ITU

The International Telegraph Union, progenitor of the present ITU, was established at Paris in 1865 by a multilateral treaty.(1) According to Clark, the negotiations resulting in this treaty were promoted by Napoleon III who, "at the height of his imperial glory and neglecting no means which would centralize the world in France, moved to secure a European entente by the scarcely visible wires of telegraphic solidarity."(2) Napoleon III may have

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(1) International Telegraph Convention of Paris (1865), 56 British and Foreign State Papers, 294. All of the States participating in the preparation of this treaty were European. In attendance, upon invitation of the Emperor Napoleon III, were representatives of Austria, Baden, Bavaria, Belgium, Denmark, Spain, France, Greece, Hamburg, Hanover, Italy, the Netherlands, Portugal, Prussia, Russia, Saxony, Sweden-Norway, Switzerland, Turkey and Wurttemburg. As the Union was envisaged as primarily European in scope, no invitation was sent to states of other continents. See G. A. Codding Jr., The International Telecommunication Union: An Experiment in International Cooperation, Leiden, E. J. Brill, 1952, p. 21.

(2) Arthur C. Clark, International Communications (1931).

envisaged a purely European entente, but the Telegraph Union did not remain so for long. By 1875 the Union had considerably enlarged its membership as governmental administrations from Asia and Africa were admitted.(3) Though the purpose of the Telegraph Union was to secure uniform tariff and regulations for telegraphic correspondence, it is significant that technical matters alone did not provide the boundaries of the Union's jurisdiction. For example, the 1865 treaty contained a provision assuring everyone -- not merely the sovereign members of the Union -- the right to correspond by means of the international telegraph. As Henry Glazer points out, although the treaty did not prescribe the means by which individuals were to enforce this right, it is still remarkable that personal rights were considered at all in a treaty drawn when the concept of state sovereignty was on the upswing.(4)

The next system of rapid long distance communications to be developed was the telephone. As early as 1876, Alexander Graham Bell transmitted speech over wires. In

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(3) Ibid., p. 110.

(4) Henry J. Glazer, "The Law Making Treaties of the International Telecommunication Union Through Time and Space", 60 Michigan Law Review 269 (1962), p. 272, n. 12.

1885, regulations governing the International Telephone Service were included in the International Telegraph Regulations. The absorption of the telephone required little basic change in the structure of the Union.(5) The same cannot be said for the regulatory measures necessary for the third system of rapid long distance communication -- radio; a separate convention for radio telegraph was ultimately negotiated.(6)

Whereas today the central problem of international radio regulation is the allocation of frequency bands,(7) the earliest regulations were necessitated by the outrageous practices of the commercial wireless companies. The Marconi Wireless Company attempted to establish a world-wide monopoly by contracting with its users to employ its equipment operated by its own operators which would

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(5) At the Berlin Telegraph Conference (1885), which was an administrative conference, five general paragraphs involving telephone were added to the Telegraph Regulations; at the London Telegraph Conference (1903), the five paragraphs were expanded to 15 articles containing over 60 paragraphs. "From 1903, therefore, the Union could be entitled the International Telegraph and Telephone Union." Codding, op. cit., p. 32.

(6) Glazer, op. cit., p. 273, and Codding, op. cit., p.79.

(7) See Chapter I, note 17 infra.

communicate only with other Marconi users.(8)

The effect of such practices was soon felt from a financial standpoint and in relation to safety of life at sea. As a result, the German government convened a preliminary radio conference in Berlin in 1903.(9) This conference produced the first International Radio Telegraph Convention, signed in 1906 by 27 countries.(10) Article 3 of this Convention was designed to overcome the monopolistic yearnings of commercial radio companies by providing that coastal and ship stations were "bound to exchange wireless telegrams reciprocally without distinction of the wireless telegraph system adopted by such stations." The Convention also dealt with minimum technical standards for apparatus and operators as well as with questions of rates. Article 2 established two wave lengths for public correspondence and required contracting parties to submit data concerning the location of broadcast

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(8) Codding, op. cit., p. 83.

(9) The preliminary conference was attended by the following countries: Austria, France, Germany, Great Britain, Hungary, Italy, Russia, Spain and the United States. Ibid, n. 13, p. 84.

(10) See ibid., n. 32, p. 89, and Berlin Radiotelegraph Convention, Nov. 3, 1906 (37 Stat. 1565, 1574, 1576, 1581, T.S. No. 568), U.K. State Papers, Vol. CXXXVII, 1906.

stations, radio system used, wave lengths used, the nature of the service and times of broadcast.(11) This Convention was revised but not greatly altered by the London Radio-telegraph Conference of 1912 which adopted a radio-telegraph convention, final protocol and service regulations.(12)

PART 2: The Washington Radio-Telegraph Conference

The technological advances in radio communication made by all major powers during the First World War necessitated a radical revision of international regulations. Since 1912, short-wave frequencies had come into use, operational technique had come in for tremendous improvement, the number of radio stations had vastly increased, as had the idea of commercial broadcasting.

The first post-war conference, held in Washington in 1927 and attended by representatives of over eighty countries, attempted to deal with these changes. The scope of the Convention signed at the conclusion of this

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(11) Codding, op. cit., p. 95.

(12) International Radio-Telegraph Convention, Final Protocol and Service Regulations signed at London, 5th July 1912. T.S. 1913, No. 10, U.K. State Papers, Vol. LXXXI, 1913.

conference[13] had to be considerably larger than that of the London Convention of 1912. The emphasis in the earlier conventions had been placed on the regulation of maritime radio. The Washington Convention had to deal with all problems of unintentional interference caused by the growing number of large, powerful stations. The convention enlarged its applicability to interference from national stations by stating: "An internal or national radio communication service which is likely to cause interference with other services outside the limits of the country in which it operates is considered as an international service from the viewpoint of interference."[14]

The permanent International Bureau set up pursuant to the Berlin Convention of 1906[15] was strengthened by the establishment of an International Technical Consulting Committee on Radio Communications.[16] Its purpose was to

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(13) Radio-Telegraph Convention and General Regulations signed at Washington, 25th November 1927, 84 L.N.T.S. 97.

(14) Ibid., Article I of the Convention.

(15) Berlin Radio-telegraphic Convention, op. cit., supra n. 10, Article 13, and Radio Regulations Articles XXXVII and XXXVIII.

(16) Washington Radio-Telegraph Convention, op. cit., supra n. 13, Article 17.

study technical and related questions pertaining to radio and to advise the International Bureau on questions submitted to it by participatory administrations or private enterprise. This Committee is important, as it is the forerunner of the CCIR, a body whose functions are considered in this paper at a later stage.

The most outstanding changes are to be found not in the Convention itself but rather in the detailed regulations annexed to it. These regulations dealt, among other things, with the requirement of radio for air navigation, the accidental achievement of intercontinental communications by means of short-wave transmissions, and interference caused by primitive apparatus which wastes space in any frequency band in which it operates.

The most significant development of this Washington Conference for purposes of this paper was the adoption of the principle of allocating frequencies to radio communication services, rather than to countries. Thus, bands of frequencies are identified by the type of communication service offered -- such as broadcasting, amateur or maritime mobile.(17) The regulations set

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(17) For a detailed description of the ITU's methodology for the allotment of radio spectrum space which is

aside channels from 10 to 100 kilocycles[18] per second chiefly for long distance transoceanic service, channels from 100 to 500 for ship to shore and aircraft service, and channels from 500 to 1500 for broadcasting. Also there were certain frequency bands reserved for radio amateurs.

(cont'd.)

equally applicable in 1969, see Irvin Stewart, "The International Radio-Telegraph Conference of Washington", 22 American Journal of International Law 28, 48 (1928); also Glazer, op. cit., n. 37, p.278 where the author notes: "Under the scheme of allocating to 'services' rather than 'sovereigns' bands of frequencies in the radio spectrum (see infra no 18 this paper) are identified by a type of radio communication service such as broadcasting, amateur, or maritime mobile. A number of non-adjacent bands in the spectrum are then allocated to the services so identified in certain cases with different allocations for different geographic regions. Today, allocations by the ITU are made in three regions: Region I embraces Western Europe, all of the U.S.S.R. and Africa; Region II includes all of the Western Hemisphere; and Region III roughly all of Asia excluding the U.S.S.R. The radio frequency spectrum then is occupied in three ways; in frequency, in times, and in geographic location."

(18) See Codding, op. cit., n. 66, p. 94: "The product of the frequency and wavelength is the velocity of the radio wave which is equal to the velocity of light (300,000 kilometers per second). Therefore, both the wavelength (given in meters) and the frequency (given in kilocycles /kc/s/ or megacycles /mc/s/) can be used to define the particular radio wave employed by a radio station." At the earlier conference of the Union the term "wavelength" was used. However, it was later felt by engineers and scientists involved

Finally it should be noted that at this conference the delegates adopted a resolution which invited the Union's governmental members to consider the possibility of combining the telegraph and radio-telegraph conventions. This resolution arose out of the delegates' agreement that such an amalgamation would yield closer collaboration on questions common to both line (telegraph, telephone) and radio communication and would avoid unnecessary duplication. The delegates also agreed to schedule the next radio-telegraph conference at the same time as the next International Telegraph Conference. Thus it was at Madrid in 1932 that the International Telegraph Union and the International Radio Telegraph Union became the International Telecommunication Union.(19)

(cont'd.)

that a more accurate and logical definition of radio wave could be given in terms of "frequency". Hence, at the London Conference of 1912, it was decided that both terms would be acceptable, and finally at the Atlantic City Conference in 1947, the use of "wavelength" was dropped entirely. Note however, that terminilogy is still a matter for serious discussion -- the scientists and engineers being far from agreed on the desirability of the use of "frequency" to define radio waves. See ibid. n. 145, p. 114.

(19) Though an International Radiotelegraph Union was never established as a legal entity, a leading authority suggests that it is not erroneous to use

PART 3: Madrid Telecommunication Conference, 1932; Cairo Convention, 1938.

A joint meeting of plenipotentiaries held in Madrid in 1932 resulted in the fusion of the Telegraph Convention of 1875 and the Radiotelegraph Convention of 1927 into a single International Telecommunications Convention.(20) The new term, 'telecommunications', was defined as "any telegraph or telephone communication of signs, signals, writings, images, and sounds of any nature, by wire, radio, or other systems or processes

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this title to indicate the signatories or adherents to these early radiotelegraph conventions. See ibid., p. 6 et seq.
See also ibid., p. 140: "Since a Radiotelegraph Union did not really exist, it was impossible to replace it."
However, the Madrid Telecommunications Convention (see n. 20, infra), Article 8, provided for the abrogation and replacement of the International Radio Telegraph Conventions of Berlin (1906), London (1912) and Washington (1927), and the Regulations annexed to them as well as the International Telegraph Conventions of Paris (1865), Vienna (1868), Rome (1872) and St. Petersburg (1875) and the Regulations annexed to them.

(20) Telecommunications Convention, General Radio Regulations, Additional Radio Regulations, Additional Protocol (European), Telegraph Regulations and Telephone Regulations, signed at Madrid, 9th December 1932, 151 L.N.T.S. 4.

of electric or visual (semaphore) signalling."[21] It is of interest to note that the present definition set out in the International Telecommunication Convention (Montreux Revision 1965)[22] Annex 3, has been expanded to take account of the tremendous growth and complexity of modern methods of rapid long distance communication. It reads: "any transmission, emissions or reception of signs, signals, writing, images and sounds of intelligence of any nature by wire, radio, optical or other electromagnetic systems."

Articles 16 and 17 of the Madrid Convention served to bring the consultative committees on telephone, telegraph and radio, as well as the International Bureau, into relationship with the new Union. In so doing, however, no duties or functions of these bodies were substantially affected.

For the most part, the general provisions of the former telegraph and radiotelegraph conventions were

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(21) See I.R.U., Conference, Documents de la Conférence radio-télégraphique internationale de Madrid (1932), Berne, 1933, Vol. II, p. 140, cited in Codding, op. cit., n. 45, p. 140.

(22) International Telecommunication Convention, Montreux, 12th November 1965, (1967), 18 U.S. T. & O.I.A. 575.

incorporated into the general provisions of the Convention. As in the past, a conference of plenipotentiaries was required to revise the convention, while an administrative conference could be held to revise the service regulations. One change effected by the Convention was to allow private operating companies to participate in an advisory capacity at administrative conferences. Under the terms of earlier conventions, such companies were allowed as advisors only at plenipotentiary conferences.

The articles of Chapter 10, which related to radio in particular, were, for the most part, identical with the corresponding provisions in the 1927 Radiotelegraph Convention. One exception was Article 35 which dealt with the problem of interference:

1. All stations, regardless of their purpose, must, so far as possible, be established and operated in such a manner as not to interfere with the radio services or communications of either the other contracting governments, or the private operating agencies recognized by these contracting governments and of other duly authorized operating agencies which carry on radio communication service.

2. Each contracting government which does not operate the radio facilities itself undertakes to require the private operating agencies recognized by it and the other operating agencies duly authorized for this purpose, to observe the provisions of paragraph 1 above.

Article 7 of the General Radio Regulations dealt with interference in a more particular fashion. Allocation and use of frequencies were outlined, the contracting governments being charged with the responsibility for assigning frequencies for all radio stations capable of causing serious international interference. It was further stipulated that such assignments were to be made pursuant to the international table of allocations drawn up on a service basis.(23) In addition, an international frequency list was to be maintained in order to assist in the choice of new frequency assignments. All new frequency allocations were to be registered with the International Bureau which was to publish a list of all frequencies assigned which might cause international interference. If an assignment by a contracting government was for a frequency not within the bands allocated in the Service Regulations to a specific service, then notification had to be made at least six months, or if a case of urgency three months, in advance of its use. For the most part, the radio frequency allocations for the

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(23) Madrid Convention, op. cit., supra, n. 20, Radio Regulations, Article 15, provides for the international table. For an explanation of the ITU's "service allocation", see supra n. 17 and n. 18.

designated services, contained in these General Radio Regulations were the same as those contained in the regulations annexed to the Washington Radiotelegraph Convention.

Though numerous regional conferences dealing with broadcasting were convened after the 1932 Madrid Conference, the next significant meeting was the Administrative Radio Conference of Cairo in 1938. This conference resulted in the revision of all service regulations annexed to the Madrid Convention.(24) The delegates were concerned with the problems of finding space in the allocation table for the increasing demands for additional frequencies by the ever-growing mobile, fixed and broadcasting services. One of the most far-reaching results of this conference was the adoption of a plan allocating radio channels for inter-continental air routes in the band between 6500 and 23,380 kilocycles. The significance of this allocation lies in the fact that each channel was reserved for a specific aeronautical route and included bands for air services proposed for

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(24) General Radio Regulations and Final Protocol (Cairo Revision 1938) annexed to Madrid Convention 1932, (op. cit., supra, n. 20) 54 Stat. 1417, T.S. No. 948.

the future as well as for those already operative.(25) These allocations were the first ever made in anticipation of a future development. As Codding points out, this represented ". . . a marked contrast to the usual procedure of legalizing existing frequency uses."(26)

In order to diminish still further the possibility of interference while increasing the number of usable frequencies, the Cairo Conference agreed to the establishment of higher technical standards for transmitters via the tolerance and band width tables of the Radio Regulations. It was agreed after considerable negotiation that all old and new transmitters would be obliged to comply with the higher standards laid out in the tables of 1944.(27)

Some changes were made regarding the Radio

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(25) For example, there were bands in the spectrum range between 65000 and 23,380 kc/s set aside for trans-Atlantic air services. This allocation in anticipation of future developments has been noted to be "...the model for the recent allocations for space needs." Francis Lyall, Law and Space Telecommunications, unpublished LL.M. thesis, McGill University, Institute of Air and Space Law, 1965, p. 59.

(26) Codding, op. cit., p. 164; see also Glazer, op. cit., p. 281.

(27) Cairo Revision 1938, Radio Regulations, op. cit., supra, n. 24, Appendix I.

Consultative Committee (CCIR) by the Cairo Conference. This body had previously been charged with the study of technical radio questions; the Cairo Radio Regulations increased its mandate to include the study of operating questions.(28)

PART 4: The Atlantic City Conferences, 1947; Montreux Convention, 1965.

The advent of World War II precluded the holding of the Administrative Telecommunication Conference scheduled in Rome in 1942. During the war, the Union remained dormant with caretaker activities carried on by the Bureau located in Berne.(29) The destruction of all types of telecommunication facilities during the war defies description. For example, of forty-two national broadcasting transmitters operated by the French government in 1939, only four or five were usable after the departure of the German armies.(30) On the other hand, great advances in the science of telecommunication took place during the war. The greatest progress was in the

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(28) Ibid., Article 33.

(29) Glazer, op. cit., p. 281.

(30) Codding, op. cit., p. 181.

field of radio, since radio was an indispensable link between ships and aircraft and because radio is less vulnerable to enemy action than any form of line communication. The most notable wartime development in the field of radio was radar, while broadcasting increased in stature to the point where it became one of the most important of the radio services. As Codding points out, "The war and its repercussions on life in general accentuated the need for emissions concerning public health, imminent danger, rationing, etc. . . . By the end of the hostilities, broadcasting stations were using almost 800 high frequencies."(31)

Such development, together with the political changes resulting from the defeat of Germany, necessitated many changes in the International Telecommunication Convention adopted at Madrid in 1932, and in the Service Regulations revised at Cairo in 1938. As a result, three conferences were held in Atlantic City in 1947: the Telecommunication Conference to revise the Madrid Convention; the Administrative Radio Conference to revise the Cairo Radio Regulations; and the Administrative High Frequency Radio Conference to consider the problems

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(31) Loc. cit.

confronting high frequency broadcasting services. Thus, at the Atlantic City Conferences the International Telecommunication Union was entirely reconstituted. A detailed account of these very important conferences is not within the scope of this dissertation. The following is simply a brief outline of the more significant changes affecting the organization of the Union and the regulation of radio communications.

The Atlantic City Convention[32] for the first time in the history of the Union expressly set out in its preamble the goal of the ITU to ensure the effectiveness of telecommunications while "fully recognizing the sovereign right of each country to regulate its (own) telecommunications."[33] Such a principle had always been implicit in the behaviour of the Union but never before had it been formally set out in any convention.[34]

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(32) International Convention on Telecommunications, Atlantic City, 2nd October 1947. Treaty Series No. 76 (1950) Cmd. 8124, U.K. State Papers,1950-51, Vol. XXXII.

(33) Ibid., Preamble.

(34) "Inasmuch as the ITU, as has been the case with most other international organizations, has never in the past attempted to force any of its members to accept any changes with respect to their internal telecommunications services, the necessity for such

This principle should be kept in mind when considering the aims and purposes of the Union set out in Article 3 of the Atlantic City Convention. This appears as Article 4 of the Montreux Convention of 1965, now presently in force:

(cont'd.)

> a declaration, which might give rise to an evasion of obligations, might not be clear. An explanation can be found in the minutes of the Organization Committee when it was considering the Preamble. The delegate of Belgium, at that time, strongly supported the insertion of this provision because it did, in his opinion, 'involve the independence of the telecommunications of certain countries.' In that respect he pointed out that it had been suggested in the Atlantic City Radio Conference that countries on the same continent should carry out their communications, both national and international, by wire instead of radio so that enough frequencies would be available for intercontinental communications. He felt that the inclusion of the 'sovereign' clause would guard smaller nations against such actions and would in general ensure 'the principle of sovereignty of telecommunications not only within countries, but between countries as well.' After this intervention the delegates agreed to the insertion of the clause in the Preamble." Codding op. cit., p. 247.
> Codding notes that the French delegate originally objected to its inclusion maintaining it to be in contravention of Article 41 of the United Nations Charter (i.e., that on request of the Security Council, United Nations' members must sever postal, telegraphic and telephonic communications with certain countries). He agreed to the inclusion of the sovereignty clause after the Belgian delegate's statement. Presumably an action by the U.N. aimed at severing telecommunication services would involve obligations of states to the U.N. itself and not to the ITU -- there being many members of the ITU not members of the U.N. (loc. cit.).

Article 4: Purposes of the Union

1. The purposes of the Union are:

   (a) to maintain and extend international cooperation for the improvement and rational use of telecommunications of all kinds;

   (b) to promote the development of technical facilities and their most efficient operation with a view to improving the efficiency of telecommunication services, increasing their usefulness and making them, so far as possible, generally available to the public;

   (c) to harmonize the actions of nations in the attainment of those common ends.

2. To this end, the Union shall in particular:

   (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;

   (b) coordinate efforts to eliminate harmful interference between radio stations of different countries and to improve the use made of the radio frequency spectrum;

   (c) foster collaboration among its Members and Associate Members with a view to the establishment of rates at levels as low as possible consistent with an efficient service and taking into account the necessity for maintaining independent financial administration of telecommunication on a sound basis;

   (d) foster the creation, development and improvement of telecommunication equipment and networks in new or developing countries by every means at its disposal, especially its participation in the appropriate programmes of the United Nations;

(e) promote the adoption of measures for ensuring the safety of life through the cooperation of telecommunication services;

(f) undertake studies, make regulations, adopt resolutions, formulate recommendations and opinions, and collect and publish information concerning telecommunication matters for the benefit of all Members and Associate Members.

These statements of principle illustrate the unique position of the ITU as an instrument of international co-operation in matters concerned with telecommunications.

A second important change effected at the Atlantic City Conferences was that the Union agreed to become a specialized agency of the United Nations. This decision was not reached without much debate by the members of the Union. It was feared that such an association would inevitably involve the ITU in political issues -- a fear which had kept it from establishing any formal connection with the League of Nations. Though the ITU's position as a specialized agency of the U.N. is generally conceded to be a desirable one from the point of view of effective organization, the writer can sympathize with those members who opposed associating too closely with the world political organization. "The fear is that, should the political organization

fail, the failure might extend to everything associated with it."(35)

The agreement(36) eventually signed by the two organizations enables the Union to retain its distinctive and separate character. This technical independence combined with general co-ordination with the United Nations has been a feature of the Union's role in allocating frequencies for use in space telecommunications.(37)

The agreement provides inter alia for reciprocal representation, the exchange of information and documents, the mutual right to propose agenda items, the ITU's obligation to assist the U.N., joint services between the two bodies in statistics and for joint personnel services. This last-mentioned item, embodied in Article VIII of the agreement, has proved useful to the Union in that U.N. lawyers can be consulted without the Union having to maintain a legal staff of its own, an obvious necessity

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(35) D. W. Bowett, The Law of International Institutions, London, Stevens, 1963, p. 9.

(36) Agreement between the United Nations and the International Telecommunication Union. Printed as Annex 5 to Atlantic City Convention, 1947, op. cit., supra, n. 32. Also reprinted as Annex B in Codding, op. cit., p. 467 et seq.

(37) Lyall, op. cit., p. 63.

that has been assiduously and for the most part successfully avoided by the ITU.(38) Finally it should be noted that Article XV of the agreement results in the United Nations possessing the same rights as the other full members of the Union for operating telecommunication services. Because of this, the U.N. is the only party to the Telecommunication Convention entitled to rights thereunder which is not a sovereign state or territory.

A third major innovation of the Atlantic City Conferences arose from the recognition by the delegates that one of the greatest defects of the organization(39) (see Appendix A) had been its inability to make decisions between plenipotentiary conferences. A continually functioning organization was thus deemed necessary, especially considering the rapidly changing nature of telecommunications. An administrative council was established by Article 5, paragraphs 10 and 11 of the

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(38) On the Union's aversion to hiring lawyers see: Samuel D. Estep, "International Lawmakers in a Technological World: Space Communications and Nuclear Energy", 22 The George Washington Law Review, pp. 162-180.

(39) Atlantic City Convention 1947, op. cit., supra n. 32, Article 9. See also Appendix A ante for chart of present organizational structure of the ITU.

Atlantic City Convention --

> (1) The Administrative Council shall be responsible for taking all steps to facilitate the implementation by the members and associate members of the provisions of the convention, of the regulations and of the decisions of the Plenipotentiary Conference.
>
> (2) It shall insure the efficient coordination of the work of the Union. In particular the Administrative Council shall --
>
> (a) perform any duties assigned to it by the plenipotentiary conferences;
>
> (b) in the interval between plenipotentiary conferences, be responsible for effecting the coordination with all international organizations . . . and to this end appoint, on the behalf of the Union, one or more representatives to participate in the conferences of such organizations, and when necessary of coordinating committees established in conjunction with those organizations;
>
> (c) appoint the Secretary General and the two Assistant Secretary Generals of the Union . . . supervise administrative functions, . . . review budget . . . arrange for audit . . . arrange for conferences of the Union . . . coordinate the activities of all the other organs of the Union . . .

Thus the old Bureau of the Union was replaced by a General Secretariat under the direction of a Secretary General. This permanent body was responsible to and directed by the Administrative Council, a body of, then, 25 members elected by the plenipotentiary conference from among their numbers.(40) The Conference also unanimously

approved the United States recommendation that the Union's headquarters be moved from Berne to Geneva, Switzerland where it is located today.

A fourth major accomplishment of the Atlantic City Conferences was the establishment of the International Frequency Registration Board (IFRB). This body, along with the General Secretariat, the CCIT,(41) the CCIF,

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(40) The Administrative Council which meets every year for about one month was originally composed of 25 members elected by the Plenipotentiary Conference. The Conference of Plenipotentiaries held in Montreux in 1965 increased the Council's membership from 25 to 29. While this body is superior to the IFRB, it has no authority to exercise "rule-making" functions or even make ministerial changes to the ITU Service Regulations. While the Convention authorizes the Plenipotentiary Conference to delegate powers to the Administrative Council, there is no corresponding provision authorizing a delegation or powers from the ITU Administrative Conferences, the only bodies competent to modify or revise the ITU Radio, Telegraph, and Telephone Regulations. See Glazer, op. cit., p. 306.

(41) CCIT and CCIF were merged by the International Telecommunications Convention negotiated at Buenos Aires in 1952, (1953) 6 U.S. T. & O.I.A. 1213, into one permanent organ identified as the International Telegraph and Telephone Consultative Committee (CCITT). With the formation of this Committee in 1956, the organization of the four permanent organs of the ITU, as they now exist, was completed. The other three permanent organs are: the General Secretariat, the CCIR and the IFRB. The non-permanent organs of the Union are: the Plenipotentiary Conference, the Administrative Conferences, and the Administrative Council. See Montreux Convention 1965, op. cit., supra, n. 22. See also organization layout in Appendix A of this paper.

and the CCIA, was made a permanent organ of the Union by Article 4 of the Atlantic City Convention. The duties of the IFRB are set forth in Article 6:

> (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 regulation, the date, purpose, and technical characteristics of each of these assignments (to domestic users) with a view to insuring formal international recognition therefor.
>
> (b) To furnish advice to members and associate 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.

The Bureau of the Union had, since 1928, been engaged in compiling a master frequency list. However, its function ended there; it had no (discretionary) power whatsoever. If there were conflicting registrations, the countries involved had to work out the problem themselves. The IFRB was designed to improve this system (if it could be called that) for protecting spectrum users from harmful interference. The new Board was to consist of 11 members, (42) nominated by their respective countries

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(42) The IFRB's membership was decreased from 11 to 5 by the Conference of Plenipotentiaries held in Montreux in 1965. The writer speculates that the recent acquisition of a computer by the Board justified this reduction to a more manageable number.

and elected by an ordinary Administrative Radio Conference. The Convention required that Board members be thoroughly qualified by technical training in the field of radio as well as by practical experience in the assignment and utilization of frequencies. Further, Board members, once elected were to act, not as representatives of their respective countries, or of any region, but as custodians of an international public trust.(43)

Very briefly, the system for spectrum management set up by the Atlantic City Conference operates in this fashion: After a bandwidth of the radio spectrum has been allocated by a conference of plenipotentiaries to a particular service, national administrations are at liberty to assign it to individual users such as communications carriers, airlines, etc. Such "national frequency assignment" must then be notified to the IFRB which thereafter conducts a technical examination of the assignment and records it in the Master International Frequency Register.(44) Of course the assignment would not be

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(43) Atlantic City Convention, 1947, op. cit., supra n. 32.

(44) The Bureau's Master Frequency List, which had not been kept up to date, was revised by a Provisional Frequency Board and the IFRB, and, by agreement in 1951, a new International Frequency Register was drawn up. See Codding, op. cit., pp. 250-264.

registered if the IFRB discovered that it does not conform with the service allocations and other provisions of the Convention and Regulations; nor would it be registered if there were a likelihood of it causing harmful interference to an already registered user. If the notification indicates that the proposed frequency assignment will cause interference, the national administration is required upon being so advised by the Board to stop such use. However, the Board's authority ends at this point. In other words, the Board has no real power of enforcement, and compliance with its rulings largely depends upon the self-discipline of the member states.(45)

The Atlantic City Convention formally recognized(46) and strengthened the International Radio Consultative Committee (CCIR) established at the Madrid Conference in 1932. The basic purpose of the Committee remained the same: to study technical and operating

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(45) Atlantic City Convention 1947, op. cit., supra, n. 32, Radio Regulations, Article 11; the current procedure which is essentially the same is laid down in the Montreux Convention, op. cit., supra, n. 22, Radio Regulations, Article 2, Chapter IV.

(46) Atlantic City Convention 1947, op. cit., supra, n. 32, Article 4.

questions relating to radiocommunication and to issue recommendations on them. The CCIR is administered by a fulltime director, elected by the Pleniary Assembly of the CCIR and assisted by a technical secretariate. The Committee is open to all members of the Union and meets in Pleniary Assembly at intervals of about three years to consider specific recommendations submitted by any of its 14-or-so study groups. The Pleniary Assembly is empowered to submit to administrative conferences proposals arising from these recommendations. Such proposals are of an advisory nature, and no ITU member is bound by them just because they are adopted by the CCIR Pleniary Assembly. For them to become legally binding, they must be formally adopted by an administrative radio conference as part of the ITU Radio Regulations.(47) Two of the CCIR study groups are currently

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(47) The formal status accorded CCIR recommendations as described here did not in fact exist until the International Telecommunication Convention (Geneva Revision) 21st December 1959, (1961) 12 U.S. T. & O.I.A. 1761, Article 13, paragraph 181, which provided that "The Plenary Assemblies of the International Consultative Committees are authorized to submit to administrative conferences proposals arising directly from their recommendations or from findings on questions under study." Prior to 1959, then, CCIR recommendations did not have formal status except as valuable background for the use of ITU members in the exercise of their decision-making authority. The counterpart to the above-quoted Article 13 appears as Article 14 (2(1)) of the Montreux Convention 1965, op.cit., supra, n. 22.

engaged in the study of problems relating to space telecommunications.

The Atlantic City Conferences served to bring the operation and structure of the ITU into line with the needs of post-war radio telecommunications. There have been three subsequent meetings of plenipotentiaries each of which resulted in a revision of the International Telecommunication Convention: the Buenos Aires Revision of 1952,(48) the Geneva Revision of 1959,(49) and the Montreux Revision of 1965.(50) However, the form and structure of the ITU have not been substantially changed by these revisions. It remains essentially the same institution as was created by the Atlantic City Conference in 1947. The next scheduled meeting of the plenipotentiaries is to be held at Geneva in 1971.

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(48) Buenos Aires Convention 1952, op. cit., supra, n. 41.

(49) Geneva Revision 1959, op. cit., supra, n. 47.

(50) Montreux Convention 1965, op. cit., supra, n. 22.

CHAPTER II

The ITU and Space Telecommunication

It is hoped that the foregoing provides an adequate picture of the ITU as it existed when the first telecommunication satellite was put into orbit. In this chapter we will leave off the historical development of the ITU and discuss the present role of the Union in space-age communication.

PART 1: The Radio Spectrum

The need for interference-free radio communication in the new fields of communication via satellite and of other space activity became obvious at the very beginning of the space era. Since the allocation of frequencies has been one of the chief functions of the ITU since the early days of radio, it was recognized by 1959 that the ITU was also the competent and proper organization to provide international regulation of the frequencies required by developing communications and space technology.

The need to study the requirements of space telecommunications first received attention in the CCIR when Mr. Andrew G. Haley, then president of the American Rocket Society and of the International Astronautical Federation,

visited the assembly of the CCIR at Warsaw in September of 1956. Here he distributed a paper which pointed to the need for study in the new field.(1) Prior to this assembly, however, in April of 1956, Haley had sent a letter to Hon. Aurelio Marco Andrada, then secretary-general of the ITU, which contained the following five-point plan:

1. The CCIR should study the requirements for radio in space.

2. The IFRB should study the frequencies available to meet the requirements developed by the CCIR.

3. The International Astronautical Federation should send representatives to the sessions of CCIR and IFRB.

4. The ITU should send representatives to IAF meetings including the Rome Congress on Earth Satellites and Space Flight, scheduled for September 1956.

5. After completion of these four steps, the ITU should initiate formal steps to effect radio allocations for use in space.

The secretary-general of the ITU advised the IAF on June 11, 1956, that the Union viewed the matters raised by the IAF as "appropriate for the administration of individual member nations."(2) It is interesting to note this early

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(1) See CCIR Doc. No. 26, June 10, 1960.

(2) See Andrew G. Haley, "Space Age Radio Frequency Allocation," 5 Astronautics and Aeronautics 66 (May, 1966), pp. 66-67.

reluctance of the Union to assume any new fields even of study, much less regulation. Such historical reluctance sheds much light on the present attitude of the ITU to its role in the field of worldwide communications satellites, a subject to be dealt with in subsequent chapters of this dissertation.

Before discussing the steps taken by the ITU towards international regulation of the frequency demands of the space age, it appears advisable to describe in a general layman's manner the nature of the radio frequency spectrum.(3)

Radio communication involves a wireless electrical circuit utilizing the radiation of energy in the form of electromagnetic waves. A system for radio communications between two stations at whatever distance apart comprises three primary elements:

1. A controlled source of emission, that is, a transmitter, including an antenna for radiation;

2. A receiver to intercept and convert the signals into intelligible form;

3. A transfer mechanism by which the energy is propagated from the transmitter to the receiver.

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(3) The following account of the nature of radio and the spectrum has been taken from Wenk, op. cit., and Haley, Space Law and Government, op. cit.

The controlling factor between the three elements is the medium of energy propagation. This medium is a type of electromagnetic energy generally called radio waves. Other types of electromagnetic energy are light waves, X-rays, gamma rays -- all of these display the same essential properties of frequency, velocity, intensity, direction of travel and plane of polarization. However, the most distinguishing characteristic is frequency.

The frequency of electromagnetic energy is the number of cycles per second that the intensity of signal varies when passing successively from what may be considered a positive to a negative phase, in the fashion of a geometric sine wave. The distance occupied by such a cycle is the wavelength.

From the point of view of communications, the radio spectrum is presently considered to cover the frequencies in the range of 10 kilocycles per second to 42,000 megacycles per second. In Appendix C to this dissertation is set out a table of classification in the electromagnetic spectrum. This serves to illustrate a problem of major concern to the ITU -- frequencies available at present for communication purposes are not

unlimited. There is a definite beginning (10 kc/s) and a definite end (presently 42,000 mc/s). Between these two points exist the only frequencies available for radio communication.

The next step is to understand that if two signals are being transmitted on the same frequency and develop equal field strength at the receiving end, the clarity of reception is totally lost; no receiver can discriminate between two such signals. The only way to prevent this "harmful interference" is to control the transmitters themselves by licencing separate frequencies for the emission of signals.

The use of the available frequencies in the radio spectrum is further reduced because "guard bands" must be provided to prevent accidental interference through "overlap". This overlap can be caused by any number of factors including:

1. improper transmission techniques,
2. substandard equipment.

Therefore, while it would first appear that there is an almost infinite spectrum on which any number of stations can operate side by side, the truth is that the radio spectrum is finite in nature. Further, within that finite

frequency spectrum, radio stations for technical reasons cannot even operate side by side. Thus the possible number of individual, non-interfering transmissions is so limited that already today the airways are inalterably crowded.(4)

An excellent description of the nature of the radio spectrum appears in a report of the Joint Technical Advisory Committee of the Institute of Radio Engineers -- Radio Television Manufacturers Association:

> It has become increasingly clear that the spectrum is public domain which must be conserved as carefully as if it were farmland, forest preserves, water power or mineral wealth. It might be added that it is both uniformly distributed and widely prevalent, not just through the earth, but throughout the entire universe. However, unlike many other resources, it cannot be consumed; it can be neither publicly nor privately owned; it cannot be physically confined within jurisdictional boundaries. Yet for effective utilization, it must be skillfully managed, treasured, and delicately allocated as though it were a rare and limited mineral.(5)

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(4) "In one band alone, between 4-10 mc/s, the world total of frequency listings has increased from 1,698 in 1929 to 6,658 in 1939, 21,456 in 1949, and 74,284 in 1959. Yet dominating the picture is the availability of but a single radio spectrum." Staff of the Senate Committee on Aeronautical and Space Sciences, 86th Congress, 2nd Session, Policy Planning for Space Telecommunications, 33 (Comm. Print 1960).

(5) Radio Spectrum Conservation, Joint Technical Advisory Committee, Institute of Radio Engineers - Radio Television Manufacturers' Association, New York, McGraw-Hill, 1952.

It must be obvious, therefore, that the radio frequency spectrum not only ought to be regulated by international law, but must be so regulated if it is to be used by mankind at all.

PART 2: The ITU, the Radio Frequency Spectrum and Space Telecommunication

As we have already seen, the ITU was historically the appropriate international organization to assume responsibility for securing international agreement on the use of the radio frequency spectrum. The basic scheme of international management of that spectrum resulted from the deliberation of the Washington Radiotelegraph Conference of 1927. Under the scheme adopted at that time, the allocation of bands of frequencies to radio communication services(6) became the subject of multilateral agreement, while the assignment of frequencies within band allocations was, as it now is, the exclusive preserve of each member administration.(7) With this basic machinery, the ITU was faced in 1957 with the demand for more frequencies for use in the then new

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(6) See supra, Chapter I, n. 17.

(7) See supra, Chapter I, n. 34.

field of outer space. The need for these new frequencies had to be reconciled with a radio frequency spectrum already "bursting at the seams".(8)

Before discussing the steps taken by the ITU in the field of frequency allocation for space services, it would be well to consider some of the peculiarities of space radio communication in order to appreciate the enormous technical difficulties which faced the Union. As stated above, telecommunication is of central importance to almost all space activities. Without interference-free radio contact, no accurate tracking can be accomplished. Yet because of variation in propagation characteristics, only radio waves of certain length can pass through the atmosphere and ionosphere. Therefore, only selected frequencies within the radio spectrum can be used for communication between space vehicles including satellites and points on earth. Space communications, of course, go far beyond this particular need for frequencies. Frequencies are required for point-to-point communication between terrestrial stations as an adjunct to tracking, for communication between space vehicles, and for transmissions to any part of the world of information received

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(8) Glazer, op. cit., p. 284.

from space vehicles.

The problem of frequency suitability is particularly acute in the field of radio astronomy where reception of emissions from certain elements in space (deuterium, hydrogen and hydroxyl) allows no choice among frequencies. If man is to recover the signals at all, they must be received on the specific frequencies of each element.(9)

The nature of some data messages which can now be received from satellites also creates greater demands than ever on available spectrum space. For example, weather photos require extra-width bands.

It was with these problems of an already overcrowded radio frequency spectrum coupled with the special frequency demands of space telecommunications that the ITU entered the space age.

Soon after the Sputnik launching of October 4,

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(9) The spectrum demands for radio astronomy are discussed at great length by Wenk, op. cit., pp. 61-81. The frequency allocation adopted by the 1963 Geneva Extraordinary Administrative Conference (see Appendix D) illustrates the radio astronomers' problem since this is the only service where bands are set aside for exclusive use.

1957, the ITU began to take action in the field of space telecommunications. In 1958, the Union, after much prodding from governmental and non-governmental organizations, began study programmes under the auspices of the CCIR. That Committee charged two of its existing study groups[10] with the task of formulating recommendations for the protection of frequencies needed in the operation of artificial satellites.

The recommendations of the Committee, as well as recommendations of other interested groups, were acted upon by the delegates to the Administrative Radio Conference held at Geneva in 1959. This conference was held simultaneously with a Plenipotentiary Conference with the result that its Radio Regulations became part of the International Telecommunication Convention of Geneva (1959)[11] which entered into force internationally on January 1, 1961, thereby abrogating and replacing the International Telecommunication Convention of Buenos Aires (1952).[12] The Geneva Convention, like the Montreux

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(10) CCIR Study Group IV (Ionospheric Propagation) and Study Group XI (Television).

(11) Geneva Convention 1959, op. cit., supra, Chapter I, n. 47.

(12) Buenos Aires Convention 1952, op. cit., supra, Chapter I, n. 41.

Convention (1965) which is currently in force, was accompanied by Telegraph Regulations, Telephone Regulations, as well as the Radio Regulations and Additional Radio Regulations. Of course, the Administrative Radio Conference was concerned only with the revision of the Radio Regulation and Additional Radio Regulations.

The Radio Regulations arising from the 1959 Conference contain the first multilateral agreements applicable to outer space activities. Thirteen bands of radio frequencies were allocated under shared channel arrangements to two new services which were identified in Radio Regulations, Article 1, as "space service", a radiocommunication service between space stations, and "earth-space service", a radiocommunication service between earth stations and space stations.(13)

The most important feature of these allocations

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(13) "Space station" and "earth station" are defined, Geneva Convention 1959, op. cit., supra, Chapter I, n. 47, Radio Regulations, Article 1, pp. 72-73:
Space station: "a station in the earth-space service or the space service located on an object which is beyond or intended to go beyond, the major portion of the earth's atmosphere and which is not intended for flight points on the earth's surface."
Earth station: "a station in the earth-space service located either on the earth's surface or on an object which is limited to flight between points on the earth's surface.

is what they did not cover; they were made for the purposes of space research only. Excluded from their use were communication, geographical, navigational and meteorological satellites which could not be deemed "research" vehicles. Thus a vast and important segment of space activity including telecommunication by satellite was not afforded protection from interference.

Furthermore, as is obvious, again the Conference acted only so as to ratify existing use of the spectrum, rather than to provide for current demand and future need. The situations which this attitude had produced were potentially serious ones. For example, before there was proper regulation on the use of radio frequencies in astronautics, 43 space vehicles containing more than 53 radio transmitters had been launched into orbit or sent on information gathering missions.(14)

One exception to the Conference's handling of space allocations was made for the field of radio astronomy. The hydrogen line was given a full allocation, and

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(14) Lincoln P. Bloomfield, "The Prospects for Law and Order", Outer Space Prospects for Man and Society, ed. L. P. Bloomfield, The American Assembly, Columbia University, Englewood Cliffs, N.J., Prentice-Hall, 1962.

footnote action was taken on nine other frequencies.(15) Though this did not precisely correspond to the requests of concerned radio astronomers, the frequencies set aside for their use were close enough not to inhibit the work of these scientists. But the Conference delegates were fully aware that the allocations for radio astronomy were not much more adequate than those for the other new space services. All Union members, therefore, agreed to convene an Extraordinary Administrative Radio Conference (EARC) in 1963 to deal specifically with the allocation

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(15) Wenk, op. cit., p. 81, gives an excellent explanation of the different kinds of action with regard to any particular frequency allocation:

"(1) Inclusion in the radio frequency allocation table of the international radio regulations. Upon ratification this gives the allocation international treaty status and binds each nation to effective compliance.

(2) Inclusion in a footnote to the radio frequency allocation table. This action gives the allocation treaty status, but its strength depends on the wording of the footnote.

(3) Inclusion in a Conference Resolution. This indicates the agreement of the participating nations with the desirability of the allocation, and implies a substantial measure of responsibility for its observance, but does not have the force of a treaty.

(4) Inclusion in a Conference Recommendation. This expresses the agreement of the participating nations that the several local administrations should work towards the allocation or other action concerned."

of radio frequencies for space communications.(16)

Before discussing the 1963 EARC, it should be noted that the 1959 Radio Conference amended the procedures for notification and registration of frequency assignments. The purpose of these changes was to bring the registration procedure into line with the fast-moving world of space telecommunications. By Article 9 of the Radio Regulations, assignments by national administrations were to be made known to the IFRB 90 days before, or within 30 days after, commencement of use of the frequency. The notification is then examined in the usual manner by the IFRB; if satisfactory, it is registered and the member state so informed. However, if it is deemed to be defective in that it infringes a prior notification or is likely to cause harmful interference, it is referred back to the country that made it. At this point either there can be arbitration between the member state making the rejected notification and other member state or states which object to it, or the notifying state can insist upon use of the frequency. If notification is resubmitted for noting, the member state must

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(16) See Geneva Administrative Radio Conference (1959), Recommendation No. 35, reprinted in Wenk, op. cit., p. 82.

declare that the frequency has been used for the previous 60 days without any protest being lodged. An inquiry is held, and if the protest-free 60 days is established, the assignment can be registered.

The EARC of the International Telecommunication Union was held in Geneva from October 7 to November 8, 1963. The Final Acts of the Conference[17] consist of amendments of the Radio Regulations and appendices together with protocol containing declarations, reservations and statements by the various delegations. As no significant changes have since been made in these regulations, etc., they form part of and are attached to the Montreux Convention of 1965[18] which is now in force. These regulations were designed to meet the requirements of space telecommunications for the future, albeit the not-very-distant future. The concept of allocating for future possible users harkens back to the healthy attitude adopted by the Union at the Cairo Conference of 1938,[19]

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(17) The Partial Revision of the Geneva Convention, 1959, Radio Regulations, op. cit., supra, Chapter I, n. 47, made at the EARC is printed in III International Legal Materials, pp. 99 et seq.

(18) Montreux Convention 1965, op. cit., supra, Chapter I, n. 22.

(19) See supra, p. 18.

but it was a refreshing change from more recent attitudes and actions.(20)

Another accomplishment of the Conference was to expand the list of "space service" so that it totalled eight:

communication
navigation
meteorological satellites
space research
radio astronomy
space telemetry
tracking
telecommand

Thus, while only about one per cent of the available spectrum space was allocated to space services in 1959, the 1965 Revision allocated almost 15 per cent to them.(21) A table of radio frequency allocations for space and radio astronomy agreed to at the Conference appears as Appendix D.

The EARC of 1963 at last dealt with the problem of frequency allocation for communication satellites. This area was rife with political overtones. The smaller

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(20) See, for example, supra, p. 45.

(21) See Address of the Secretary General of the ITU to World Plan Committee, Mexico City, 30 October 1967, reprinted in Telecommunications Journal, Vol. 34, No. 11, November 1967, p. 411.

member nations feared that the United States and other leaders in the field of satellite communications would pre-empt all the frequencies allotted by the Conference for this service.(22) Compromise prevailed, however, and what are hoped to be adequate frequencies were allocated to this important new service.(23) The Conference allocated the range of 2,500 to 2,700 mc/s of frequency space to communication satellites on a shared basis with radio services and two 50 mc/s bands on an exclusive basis. Although the United States did not obtain all the allocations it had proposed, a report to Congress from the President early in 1964 indicates that such allocations were at that time believed to be of sufficient quantity and quality to accommodate the requirements projected by the U.S.(24)

Apart from the fears of the smaller countries

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(22) For an account of the debate over communication satellite frequency allotment see "Report of the Chairman of the United States Delegation to the Extraordinary Administrative Radio Conference of the International Telecommunication Union, Geneva, Oct.-Nov. 1963, published in III International Legal Materials, pp. 224-232.

(23) See Appendix D.

(24) Report to the Congress from the President of the United States on United States Aeronautics and Space Activities during 1963, January 27, 1964.

that they would be left out of the new communications developments and as a result that radio frequencies would not be available for their future needs, several other factors of a non-technical nature affected the 1963 Conference. First, it became clear that each of the great powers was primarily concerned with protecting its uses of radio frequencies for military purposes. Second, the technically advanced countries, which have enormous investment in communication equipment and facilities, were concerned with protecting their investment. The equipment, of course, is designed to conform to existing spectrum allocations; a change in frequency allocation could cost millions of dollars. Third, the Conference was concerned with the social and political question of the control of an international satellite communications system, a subject to be dealt with in a subsequent chapter of this dissertation.

During the course of the Conference the role of the IFRB was discussed at length, many members feeling that, as presently constituted, it is inadequate to perform its job of administering the radio regulations. This role of the IFRB is highly controversial and is the subject of much criticism by knowledgeable observers a number of whom feels that the Board's total lack of

enforcement power renders it sterile and ought to be corrected.(25) As indicated above, the IFRB's role is limited; its primary function is to receive notices or proposed users of the radio frequencies. After informing a member country whether or not a proposed use of a frequency is in conformity with existing rules, the IFRB ceases to function with any degree of effectiveness.

The 1963 Conference did make some revisions affecting the procedures of the IFRB. Article 9 and Appendix 1 of the 1959 Radio Regulations were revised and an Article 9A and an Appendix 1A were added.(26) Provision was made for notification and registration of the frequencies shared between earth and space services. CCIR studies indicated that interference could possibly

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(25) See inter alia, Wenk, op. cit., p. 21 where the author envisages the IFRB as a potential international FCC/IRAC, and Ivan A. Vlasic, "The Growth of Space Law 1957-65: Achievements and Issues," Yearbook of Air and Space Law (1965), Montreal, McGill University Press, p. 387, who states: "Considering the vital role of telecommunications in space activities, it is clearly in the common interest to establish appropriate international procedures to protect effectively the users of radio spectrum against interference. This could be achieved, for example, by strengthening the ITU's decision-making authority and by extending the jurisdiction of the IFRB to include the enforcement of the frequency assignments."

(26) Radio Regulations 1963, op.cit., supra, Ch. I, n. 47.

occur between the earth and space services when both operated on what its report referred to as a "defined co-ordination distance". The method of calculating a "co-ordination distance" is set out in recommendation IA of the 1963 Conference. The IFRB was given the task, under certain conditions, of co-ordinating assignments made by member countries in these shared bands. Procedurally, frequencies to be used by a space link should be notified to the IFRB 24 to 6 months before use,(27) while in the case of ground services, notification should be made two years prior to use.(28) Apart from these changes, the procedure is much the same as in the past. Notices are examined by the IFRB and if in conformity with the Convention and the Radio Regulations are registered. If they contravene the regulations, the assignments notified are examined to see whether harmful interference could result from their use. If not, registration proceeds, but if interference is a possibility, the IFRB tries to arrange a compromise. The fact that ground microwave frequencies must now be notified two years before use, while space service assignments

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(27) Loc. cit., Article 9A Section 1.4 (1), paragraph 639.

(28) Ibid., Article 9, Section 1.3 (1), paragraph 491.

need only be notified six months before use does reflect the Union's awareness of the requirements of space technology.

As we have seen, the 1963 EARC accomplished much: it increased by fifteen times the radio frequency allocations for space services; for the first time there were allocations for navigation, meteorological and, most important for our purposes, communication satellites.(29) If it could not solve all the political and social problems inherent in the allotment of frequencies for communications satellites, at least compromise was reached and the fears of the smaller nations somewhat assuaged. Furthermore, although every space service did not get all the frequency allotments that had been requested, the allotments have proved to be at least workable. As one authority has put it: "The 1963 EARC may be considered one of the most important communications conferences ever held."(30)

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(29) As an indication of how tardy these regulations were, it might be pointed out that four complete United States experimental programmes, Echo, Score, Relay and Telstar, were or had been in operation before they were passed.

(30) Richard N. Gardner, "Cooperation in Outer Space", 41 Foreign Affairs 344 (1963), at p. 354.

CHAPTER III

Satellite Telecommunications

Having outlined the history of the ITU and its present role in the regulation of space telecommunications, in this chapter we will examine the present state of telecommunication by satellite. Part 1 will cover briefly the technological development of satellite communication. Naturally, the major developments in this field have been made by the United States and by the Soviet Union. (1) However, material is so scarce on the Soviet programme as to render a meaningful account impossible. Therefore, discussion on this topic will be restricted to the United States.

Part 2 of this chapter will deal with the origins and present state of the American-initiated world-wide satellite communication system known as Intelsat. In Part 3 an attempt will be made to analyse the Soviet proposal for a world-wide system known as Intersputnik.

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(1) Staff of the Senate Committee on Aeronautical and Space Sciences, 89th Cong., 2d Sess., Report on Soviet Space Programs 1962-65, at 327-29, 767-72 (Comm. Print 1966). The report indicates clearly that, as far as the United States government can ascertain, the Soviet Union, in conjunction with its satellite countries, has progressed perhaps not as quickly, but in the same direction as has the American programme.

Part 4 will examine the proposed Canadian scheme, Telesat, as an example of a national satellite system.

PART 1: The Technology of Satellite Telecommunications

To make telecommunication by satellite possible, two threshold technological accomplishments had to be made. The first was to ensure interference-free radio wave communication, in other words, to perform the function of the ITU as set out in Chapter II above. The second was to progress to a technical expertise sufficient to launch a communications satellite into the desired orbit. The first of these factors having been dealt with, we will attempt to sketch the development of launching vehicles before discussing the nature and types of communications satellites.

Fortunately for the development of telecommunication by satellite, the technology of rocketry developed virtually contemporaneously with it. Prior to World War II, significant developments in rocketry occured principally in Germany and in the United States.(2)

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(2) See A History of German Guided Missiles, Benecke and Quick, eds. (1957). In the United States the major activity was at the California Institute of Technology's Rocket Research Project. See "The first Quarter Century of the American Rocket Society", 25 Jet Propulsion 586-93 (1955).

After the War, the United States, beginning with the existing V2 rocket, began an intensive research programme which produced, in 1950, the Redstone rocket. Since the Redstone, the size, complexity and thrust of launch vehicle systems have developed so that in two decades the United States, through its various civil and military agencies, has produced such rockets as the Atlas, the Jupiter, the Thor and the Delta, any one of which has sufficient thrust to place a communications satellite into earth orbit. These and a number of other experimental launch vehicles have culminated in the giant Saturn series of which Saturn V launched Apollo 11 on its successful trip to the moon in July, 1969.

With the progress in ensuring adequate radio frequencies and in developing rockets with sufficient thrust to launch satellites, simultaneously developed the satellite itself. Most writers on the subject agree that Arthur C. Clark, a British author interested in science, first publicized the concept of satellites for communications purposes in an article for Wireless World in 1945.(3) However, the first indication in print of the scientific

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(3) See inter alia, Andrew S. Haley, Space Law and Government, New York, Appleton-Century-Crofts, 1963, p. 8.

feasibility of a communications satellite system appears in an article by Dr. John R. Pierce published in 1955 in the United States.(4) After 1955, the United States's experimental programmes called Echo, Score, Relay, Telstar and Syncom followed in quick succession. Of these, the first active, repeater satellite was Telstar I which relayed transmissions on July 10, 1962 between Europe and North America.(5) The first commercial communications satellite, Intelsat I or Early Bird, was placed in orbit in April of 1965. On the following June 28, it entered commercial operation, providing a direct communications link between Europe and North America.

With this sketch of the historical background, we will turn to a brief description of the three basic types of communications satellites. The first, the passive type, was used in the early stages of satellite communication. The second, the active, is the type

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(4) John R. Pierce, "Orbital Radio Relays", 25 Jet Propulsion 153 (1955).

(5) See House Committee on Science and Astronautics, 88th Cong., 1st Sess., Report on Astronautical and Aeronautical Events of 1962, at 95, 117 (Comm. Print 1963). This report contains an excellent historical sketch of the development of communications satellites in the United States.

currently in use by the commercial communication satellite systems to be discussed later in this chapter. The third type, the broadcasting satellite, which functions in an entirely different fashion from the first two, is on the drawing board and should be ready for use by 1975.

The passive satellite performs a function identical to that of a reflector-type ground relay station.(6) It merely acts as a large radio wave reflector -- a mirror in the sky. It requires a very powerful earth transmitter which bounces a signal off the surface of the satellite, and an earth receiving station with large movable antennae and sensitive equipment to receive the signal. These satellites are extremely reliable as they contain no electronic equipment; furthermore, they can be used by many stations simultaneously, so long as the frequencies are available. However, these advantages are not sufficient to offset the disadvantages of the enormous cost of ground transmitters and receivers and the fact that the satellite's return signal becomes weak at altitudes of over 2,000 miles. As the satellite

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(6) Echo I and Echo II were examples of the passive type. Echo I, a 100-foot metalized balloon launched by NASA, August 1960, ceased to function after approximately three years in orbit. The heavier Echo II had a much longer life.

does not amplify, but merely reflects, signals, it is considered impractical for use except for relatively low volume traffic.

Unlike passive satellites, active satellites contain electronic equipment for receiving radio signals from the earth. They amplify the signal and retransmit it to a ground receiving station. These satellites, then, are analogous to the microwave relay towers seen everywhere across the continent.

There are two types of active satellites; the first is the medium-altitude type. For a commercial system, these satellites are placed in orbit between 5,000 and 10,000 miles above the earth's surface. In order to maintain a continuous global communications system, a minimum of twelve of this type of satellite would be required -- and this number only if each is equipped with electronic devices to enable it to maintain the proper spacing from its neighbours. Without such equipment the satellite is said to be placed in a random orbit. A worldwide network of satellites in random orbit would require a minimum of eighteen satellites. The number of satellites required in these medium-altitude systems is large because, as one satellite disappears

over the horizon, another must come into the range of two communicating ground stations. The number of satellites required for such a global system is an obvious disadvantage. Another disadvantage is that each receiving station must have two complicated and expensive antennae: one to track the disappearing satellite and one to begin communication with the satellite coming into view. A third disadvantage is that these satellites are susceptible to radiation damage at low altitudes. For instance, Telstar I, launched July 10, 1962, ceased operating for this reason after only four and one-half months. The loss of one, or even of several, of the satellites in such a system, from mechanical failure or from radiation damage, will not make the entire system inoperative, but the service will be reduced.

The second type of active satellite is the synchronous or fixed type.(7) This satellite is placed into orbit at an altitude of 22,300 miles, at which its

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(7) Much of the following information is to be found in a paper prepared by P. Adler, "Scychromous Orbit Communications Satellites", Proceedings of the Second National Conference on the Peaceful Uses of Space, Seattle, Washington (May 8-10, 1962), published by the Office of Science and Technical Information, National Aeronautics and Space Administration (NASA) (SP-8, November 1962), pp. 187-91.

speed in orbit equals the speed of the earth's rotation. Placed in orbit over the Equator, the satellite will remain at a fixed point in relation to the earth's surface, just as if there existed a relay tower 22,300 miles high. As such a satellite is always usable from the same point on the earth's surface, it is continuously available for communications. Furthermore, if three satellites are placed in this orbit and spaced at intervals of approximately 120 degrees, they would provide coverage of the entire earth's surface with the exception of the polar regions.

On the negative side, the synchronous satellite is larger and considerably more expensive than the medium-altitude satellite. Initially there was some question as to whether synchronous satellites would be capable of handling telephone communications with an acceptable degree of quality, but these doubts have proven to be ill-founded. The advantages of the synchronous satellite for commercial purposes -- that it requires only three satellites to provide world coverage and that the expensive tracking antennae necessary for the medium-altitude type are not required -- far outweigh the disadvantages. The early experimental synchronous satellites were the Syncom series, the most successful of which was

Syncom III. Launched in August 1964, it transmitted television and radio signals broadcasting the Japanese Olympic Games to North America. Another successful experiment, an operational series known as Intelsat I, led to the choice of synchronous satellites for the communications system of Intelsat, a joint international venture presently comprising 67 members.(8)

Intelsat I, a system composed of three satellites, was equipped with 240 circuits and had a life expectancy of eighteen months. It was followed by Intelsat II with 360 circuits and an estimated lifetime of three years. At least one of the satellites composing Intelsat III has already been placed in orbit; this system has 1,200 circuits and a life expectancy of five years. Leonard H. Marks, the chairman of the United States delegation at the Conference on Definitive Arrangements for Intelsat, announced in an official statement of February 20, 1969 that the Intelsat IV series is presently under construction and that the first satellite will be launched in late 1970 or early 1971. These satellites will have 5,000 circuits each.(9)

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(8) See Part 2 of this chapter.

(9) Department of State, Bulletin, Vol. LX, No. 1551, March 17, 1969, p. 224.

As of June 1969, there are two Intelsat-owned satellites functioning over the Atlantic, two over the Pacific, and one over the Indian Ocean, constituting a single global communications satellite system.(10)

The third basic type of satellite is the direct broadcasting satellite.(11) This type is entirely different from the medium-altitude and synchronous types. As we have seen these two types perform a relay function to a receiving station which strenghtens the signal and rebroadcasts it to home receivers. The direct broadcasting satellite, on the other hand, transmits a signal directly to a home radio or television set. Hence, a direct broadcasting system eliminates the need for a middle point relay and amplification facility, that is, a local radio or television station.

Such satellites are not in use at present, although the technology is available and the prototypes are completed. There is considerable variance in predictions of the exact date, but experts generally agree that such

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(10) Loc. cit.

(11) Much of the following is taken from R. Marsden, ed., Communication Satellite System Technology, (1966), Chapter 4.

a satellite will be available by 1975.(12) The legal implications for the future of this revolutionary means of broadcasting will be discussed in the next chapter of this paper.

PART 2: Intelsat

Anticipating world public opinion, in a statement of "communications satellite policy" issued on July 24, 1961, President John F. Kennedy declared that, through United States leadership, satellite communications should be developed for global benefit at the earliest possible date. At the same time he extended an invitation to all nations of the world to become a part of a communications satellite system to be operated in the interest of world peace and close brotherhood among men.(13)

During the same year the United Nations was active in developing principles to govern international behaviour in outer space. In Resolution 1721,(14) adopted unanimously by the General Assembly on December 21, 1961,

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(12) Loc. cit.

(13) See Communications Satellites, Hearings before the House Committee on Science and Astronautics, 87th Cong., 1st Sess., (1961).

(14) U.N. Doc. A/5100 (1961).

it was declared "the General Assembly (believes) that communications by means of satellites should be available to the nations of the world as soon as possible on a global and non-discriminatory basis . . .". General principles of law which affect communications satellites, and in particular recognizes the possibility of non-governmental activities in outer space, were enumerated in General Assembly Resolution 1962,(15) adopted unanimously on December 13, 1963. In this regard, Resolution 1962 states:

> 1. National activities in outer space, be they conducted by governmental or non-governmental agencies, are the national responsibility of states;
>
> 2. A state is responsible for authorization and continuing supervision of the activities of its non-governmental entities in outer space; and
>
> 3. The ownership of objects launched into outer space is not affected by their passage through outer space.

These early unanimous resolutions by the General Assembly indicate a worldwide desire for the establishment of some sort of international satellite communication system. The approval of the Soviet Union of Resolution 1962 would, on the face of it, indicate no real opposition

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(15) U.N. doc. A/5515 (1963).

to a global system in which private enterprise had a stake -- so long as the state to which the private enterprise belongs accepts the responsibility. This may be the Soviet official position, but unfortunately in practice the U.S.S.R. showed considerable reluctance to join in any scheme involving non-governmental agencies. In this climate and for a number of reasons, the United States decided to take the initiative and begin the groundwork for the establishment of a United States dominated communications satellite system. The United States government concentrated on legislation designed to make this possible.

The Communications Satellite Act of 1962:(16)

The Communications Satellite Act is a perfect example of compromise legislation. Basically there were two opposing points of view as to how the United States might best establish a satellite communications system. On the one hand, it was proposed that such a system be controlled by private enterprise; on the other, it was

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(16) 76 Stat. 419 (1962), 47 U.S.C. 701. Commentary on this Act as adopted can be found in Bernard G. Segal, "Communications Satellites -- Progress and the Road Ahead", 17 Vand. Law Rev. 677 (June, 1964); see also Harvey J. Levin, "Organization and Control of Communications Satellites", 113 U. of Pa. Law Rev. 315 (January, 1965).

proposed that it be state-owned. The resulting legislation is a combination of both points of view. It is beyond the scope of this dissertation to elaborate on the intense political debate and controversy which surrounded the enactment of the Communications Satellite Act of 1962. Suffice it to say that it was a heated and protracted debate. By 1961, private industry in the United States had an enormous stake in satellite technology and had developed considerable competence in the field. The government policy was clear in its determination to maintain control of launch facilities and of the air space used for access to space. The government in the main opposed private industry; hence the compromise.(17)

The policy and purposes of the Act are best stated in the Act itself:

> The Congress hereby declares that it is the policy of the United States to establish, in conjunction and in cooperation with other countries, as expeditiously as practicable a commercial communications satellite system, as part of an improved global communications network, which will be responsive to public needs and national objectives, which will serve the communication needs of the United States and other countries, and which

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(17) For an account of the enactment of this legislation see E. J. Moulton, "Communications Satellites -- the Proposed Communications Satellite Act of 1962", 18 Bus. Law 173 (1962), esp. pp. 174-175; see also Haley, Space Law and Government, op. cit., supra, n. 3, 187-205; and Seagle, op. cit., 677.

will contribute to world peace and understanding.

> The new and expanded telecommunication services are to be made available as promptly as possible and are to be extended to provide global coverage at the earliest practicable date. In effectuating this program, care and attention will be directed toward providing such services to economically less developed countries and areas as well as those more highly developed, toward efficient and economical use of the electro-magnetic frequency spectrum, and toward the reflection of the benefits of this new technology in both quality of services and charges for such services. (18)

The Act declares that the United States will participate in a global system via a quasi-private corporation -- the Communications Satellite Corporation (Comsat).[19] It provides Comsat with the necessary powers to realize the United States's stated objective of attaining at an early date a commercial communications satellite system in conjunction and cooperation with other countries.

Comsat:

The compromise resulted in the creation, on February 1, 1963, of a corporation[20] to be owned one-

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(18) 76 Stat. 419 (1962), 47 U.S.C. 701 (a) & (b).

(19) 76 Stat. 419 (1962), 47 U.S.C. 701 (c).

(20) See Preliminary Prospectus of the Communications Satellite Corporation, reprinted in III International

half by the telephone and telegraph companies (the carriers), and one-half by public stock holders pursuant to Title III of the Communications Satellite Act. Although the corporation's shares are entirely in the hands of private concerns, by the terms of its creation, the corporation is under the control of the Administration or its agencies. In accordance with the Communications Satellite Act, President Kennedy nominated, with the advice and consent of the Senate, thirteen incorporators. They chose two others to serve as Chairman and President. After incorporation, these fifteen became the first Board of Directors of Comsat. The complete presidential control ended with the issuance of the corporation's capital stock -- subsequent Boards of Directors being chosen as follows: three are appointed by the United States President; six are elected by the communications common carriers; six are elected by the other shareholders.(21)

(cont'd.)

Legal Materials 571; and Communications Satellite Incorporators, Hearings before the Senate Committee of Commerce, 88th Cong., 1st Sess., (1963) p. 39.

(21) Of this last group no one shareholder may own more than ten per cent of the shares (five per cent of the total), and foreigners may not own in the aggregate more than twenty per cent of the shares (ten per cent of the total). 76 Stat. 423 (1962), 47 U.S.C. 733 (a).

Besides the presidential power to appoint members of the Board, the President was given broad prerogative powers to "instruct", "aid", "review", and "supervise" the corporation and its activities. (22) Furthermore, the government's participation and regulation is extensive. For example, NASA, which provides launching and associated services, is to "consult and cooperate" with Comsat; (23) and the Federal Communications Commissions (FCC) must authorize, among other things, the issue of stock and the borrowing of money. (24) To say that Comsat, despite its public appearance, is under the control of the federal government of the United States is clearly an understatement.

One authority has said: "Comsat came into existence as a private corporation for profit, but with a responsibility to represent the United States's best interests in an international cooperative venture of undetermined nature." (25) At the same time as the corpora-

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(22) 76 Stat. 421 (1962), 47 U.S.C. 721 (a).

(23) 76 Stat. 421 (1962), 47 U.S.C. 721 (b).

(24) 76 Stat. 419 (1962), 47 U.S.C. 721 (c).

(25) Stephen E. Doyle, "International Organization for Development and Control", 55 Cal. Law Rev. 431 (1967), p. 434.

tion was being established, the State Department was endeavouring to bring into being an international venture of a determined nature. In an attempt to achieve international cooperation for a global satellite communications network, it put out feelers and entered into negotiations with a number of potentially interested nations in all parts of the world. In Geneva, the President's representatives even succeeded in 1963 in negotiating an agreement with their Soviet counterparts for the sharing of communications information which contained provisions for discussions on "the working out with other nations of a project for an experimental global system of space communications . . ."(26) This attempt at cooperation proved, in the event, to be futile. When the United States was ready with Comsat, with technical expertise and having achieved the possibility of broad international cooperation -- to make a workable international satellite communications system, procrastination and reluctance marked the attitude of the Soviet

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(26) For a description of these negotiations see Eagle, op. cit., 690-691; the Agreement is reprinted in Senate Comm. on Aeronautic and Space Sciences, Documents on International Aspects on the Exploration and Use of Outer Space, 1954-1962, S. Doc. No. 18, 88th Cong., ist Sess., 14, at pp. 273-277.

Union. The United States, therefore, moved without her.(27)

Intelsat:

In the summer of 1963, Comsat drew up a statement of proposals for a global system designed for presentation to foreign nations or their designated agencies. These principles were reviewed by the President, the Department of State, the Department of Justice, the Federal Communications Commission, NASA, and other government officials as well as by the American communications carriers. Revisions were made, and the proposal was then placed in the hands of those foreign nations or their telecommunications agencies that the United States expected to be interested in a global satellite communications system. Discussion with these nations took place in late 1963 and early 1964.(28) During February, 1964, representatives of the United States, Canada, Western Europe, Australia and Japan began negotiations in Rome. Together, these countries accounted for more than

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(27) See Segal, op. cit., 691 for a fuller discussion of the reasons for this decision.

(28) See Report of the Communications Satellite Corporation, H. Rep. No. 809, 88th Cong., 1st Sess., pp. 6, 26-27 (1963).

80 per cent of the world's long distance international telephone traffic.(29)

Two inter-related agreements establishing the International Telecommunications Satellite Consortium were drawn up: the Agreement Establishing Interim Arrangements for a Global Commercial Communications Satellite System (the "Interim Agreement"), and the Special Agreement.(30) These were opened for signature and entered into force on August 20, 1964 having been signed by the United States and ten other countries. Thus, Intelsat was created.

The Interim Agreement is intergovernmental and contains organizational principles for the consortium. The Special Agreement is between communications entities -- public, private or hybrid -- designated by the

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(29) See FCC Annual Report for the Fiscal Year 1964, p. 48.

(30) These agreements, together with the Supplementary Agreement on Arbitration, signed June 4, 1965, are cited as 15 U.S.T. 1705, T.I.A.S. 5646. The Interim Agreement and the Special Agreement are reprinted in 30 J.A.L.C. 264 (1964). The Supplementary Agreement on Arbitration quite simply sets out the method of settling disputes between signatories to the Special Agreement.

government signatories of the Interim Agreement.(31) The Special Agreement is concerned with the methods of carrying out the practical aspects of a satellite communications system, that is, the commercial, financial and technical operations.

It was decided at the outset by all the original parties that the Intelsat global satellite system was to be divided into a "space segment" and an "earth segment". In fact, any communications satellite system is composed of three fundamental elements: 1) a space segment comprising the satellites in space and the terrestrial tracking and control facilities necessary to operate them; 2) the earth station segment which serves to transmit and receive radio signals to and from the communications satellites; and 3) the linkage segment comprising the cables, terrestrial relay systems or broadcasting facilities which carry transmissions to the ultimate consumer. It was further decided that both the second and third elements would be owned and operated independently of the

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(31) For example: signing for France was the French government itself; signing for Great Britain was her Postmaster General; signing for the United States was Comsat; signing for Canada was the Canadian Overseas Telecommunications Authority (COTC), a division of the Department of Communications.

consortium, generally by interests in the nation in which they are located. Some degree of control is exercised over the earth station segment in that technical standards to be met by such stations and the rates and conditions for the use of the satellites are to be determined by the ICSC, the governing organ of the consortium.

The specific proposals and goals to which the parties signatory to the Interim Agreement are committed are set out in the Preamble of the Agreement:

> The Governments signatory to this Agreement,
>
> Recalling the principle set forth in Resolution No. 1721 (XVI) of the General Assembly of the United Nations 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;
>
> Desiring to establish a single global commercial communications satellite system as part of an improved global communications network which will provide expanded telecommunications services to all areas of the world and which will contribute to world peace and understanding;
>
> Determined, to this end, to provide, through the most advanced technology available, for the benefit of all nations of the world, the most efficient and economical service possible consistent with the best and most equitable use of the radio spectrum;
>
> Believing that satellite communications should be organized in such a way as to permit all States to have access to the global system and those States so wishing to invest in the system with consequent participation in the design, development, construction (including the provision of equipment),

establishment, maintenance, operation and ownership of the system;

Believing that it is desirable to conclude interim arrangements providing for the establishment of a single global commercial communications satellite system at the earliest practicable date, pending the working out of definitive arrangements for the organization of such a system;

Agree as follows: . . .

The purpose of Intelsat, as set forth in Article I (a) of the Interim Agreement is to

> . . . provide, in accordance with the principles set forth in the Preamble to this Agreement, for the design, development, construction, establishment, maintenance and operation of the space segment of the global commercial communications satellite system to include
>
> (i) an experimental and operational phase in which it is proposed to use one or more satellites to be placed in synchronous orbit in 1965;
>
> (ii) succeeding phases employing satellites of types to be determined with the objective of achieving basic global coverage in the latter part of 1967; and
>
> (iii) such improvements and extensions thereof as the Committee, established by Article IV of this Agreement may decide subject to the provisions of Article VI of this Agreement.

The government of any state which is a member of the International Telecommunication Union is entitled to accede at any time to the Interim Agreement.[32] It

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(32) Interim Agreement, Article XII (a) & (b).

is then entitled to sign the Special Agreement or to designate a communications agency, public or private, to sign it.(33) The true partners in the international joint venture are in fact the signatories of the Special Agreement. It is they who provide the finances for the entire system. Currently there are private and public concerns from 67 nations participating in this venture.

One of the most difficult aspects of the negotiations leading to the establishment of Intelsat involved the proposals by which the ownership of shares in the consortium could be determined. It was decided that the investment quota of each of the partners be in proportion to its use of the system. To ascertain in advance what this might be for each member, it was decided to rely upon estimated long-distance telephone traffic use which would be considered suitable for communication via satellite as projected for the year 1968.(34)

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(33) Ibid., Article XII (a).

(34) The 1968 figures relied upon for use in this formula were developed at the ITU's CCIT-CCIR Plan Committee meeting in Rome, November- December, 1963, and also from data developed at a meeting of traffic experts held in Montreal in April, 1964. See Communications Satellite Corporation, Report to the President and the Congress for the Calendar Year 1966, p. 20, 22 (1967); see also David Johson, "Satellite Communication: the Challenge and the Opportunity for

The quota assigned each member, of course, determines the percentage that it must contribute to the cost of the programme, estimated at $200 million for the duration of the Interim Agreement. The Interim Agreement also specifies that the space segment be owned in undivided shares by the parties to the Special Agreement in proportion to their respective contribution to the cost of the design, development, construction and establishment of the system.(35)

As mentioned above, the governing body of Intelsat is the ICSC, the Interim Communications Satellite Committee,(36) which is responsible for the space segment of the global system. The history of Intelsat, thus far, is evidence that the powers and authority of ICSC, although

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(cont'd.)

International Cooperation", 19 Fed. Com. B.J. at p. 94 (1964-65). On this investment quota basis, the original Comsat share was set at 61 per cent; the European Members' was set at a total of 30.5 per cent; and Australia, Canada and Japan were allotted the remaining 8.5 per cent. In fact, quotas for the original nineteen perspective signatories were set out in an annex to the Interim Agreement. See Interim Agreement, Article IV (f) and Special Agreement. Article 1 (e).

(35) Interim Agreement, Article III.

(36) Ibid., Article IV (A).

set out in rather vague terms, have been sufficient and sufficiently flexible to enable it to fulfil the purpose of the venture.(37)

Two important features of the ICSC, and those which entailed the most prolonged negotiations among the original signatories to the agreements, were the matters of representation on the committee and the distribution of voting power. Regarding representation, the decision was that it should be limited to representatives from each signatory or groups of signatories to the Special Agreement having an investment quota of 1.5 per cent or more.(38) At the present time, there are eighteen members representing 48 of the 67 members of Intelsat.(39) Each member of the ICSC possesses voting power in proportion to the investment quota of the entity, that is, the combined investment quotas of the Intelsat members he

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(37) For the various powers and authorities of the ICSC see the following: Interim Agreement, Articles V (c), (d) & (e), VI, VII, X, XI, XII; Special Agreement, Articles 4, 6, 7, 8, 9, 10, 11, 12, 15; Supplementary Agreement on Arbitration, Articles 3 & 4.

(38) Interim Agreement, Article IV (b). For a fuller discussion on the matters of representation and distribution see Colino, "Intelsat: Doing Business in Outer Space", 6 Columbia Journal of Transnational Law 17 (1967) at pp. 45-47.

(39) Department of State, Bulletin, op. cit., supra n. 9, at p. 225.

represents.(40)

Article VIII of the Interim Agreement establishes the position of Manager of Intelsat and designates Comsat to act in this capacity in the design, development, construction, establishment, operation and maintenance of the space segment. It is submitted that in 1963, there was no other organization in the Western world capable of performing this function. Whether this is the case today will be examined later in this dissertation. The need for a Manager becomes apparent when one considers that the legal status of Intelsat and the ICSC is doubtful for such purposes as negotiating and signing commercial contracts. This is one type of function that Comsat, as Manager, has performed. For example, when ICSC makes the decision that a satellite is necessary, that the monies are available and that a purchase should be made, it so instructs Comsat. Comsat

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(40) Interim Agreement, Article V (a). As new members join the consortium, each existing member suffers a pro-rata reduction of its quota. However, no nation, once seated on the ICSC, can be unseated by a subsequent reduction of its quota to less than 1.5 per cent (ibid., Article XII (c)). The most significant point in this regard is that, using the 1968 traffic figures (see supra n. 34), even if every country in the world joined the consortium, Comsat's quota would still be 50.5 per cent. At present Comsat's quota is 53 per cent.

then selects the manufacturer for the satellite and enters into a contract with him. Comsat, then, has a triple role as the Manager of Intelsat, the designated communications entity for the United States on Intelsat, and a quasi-public corporation operated for profit.

Article IX of the Interim Agreement provides that within one year after the initial global system becomes operational, and in any event not later than January 1, 1969, the ICSC shall render a report to all members of Intelsat concerning definitive arrangements to be established by a new agreement. The Interim Agreement sets out that this report is to present all shades of opinion and should consider whether the Interim Agreement should be continued on a permanent basis, or whether a permanent international organization with a general conference and an international administrative staff should be established.

Article IX further states that the definitive arrangements be consonant with the aims set forth in the Preamble to the Interim Agreement. As was true of the Interim Agreement, any new arrangements must be open to all nations (or their designated agencies) who are members of the ITU. In addition, the new arrangements must safe-

guard the investment made by signatories of the Special Agreement. Finally, such new arrangements should ensure that all parties to them will have an opportunity to contribute to the general policy-making process.

Article IX also stipulates that the governments which are parties to the Interim Agreement will consider the ICSC report at an international conference to be convened by the United States within three months following submission of the report. These governments have undertaken to ensure that the definitive arrangements, hopefully then negotiated, will be established at the earliest practicable date but no later than January 1, 1970. However, Article XV provides that the Interim Agreement will remain in force until it is superceded by new definitive arrangements.

Pursuant to the Interim Agreement, the ICSC has prepared its report.(41) The United States, in its turn, convened the Conference on International Arrangements for the International Telecommunications Satellite Consortium at Washington on February 24, 1969. In calling the meeting, the United States issued notices, not only to the

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(41) At the time of writing, the report of the ICSC is not available to the public.

members of Intelsat, but also to every nation belonging to the United Nations or to the ITU. These notices invited non-members with a serious interest in joining Intelsat to send observers. Fifteen non-Intelsat members agreed to be present; among these were the Soviet Union, Poland, Hungary, Czechoslovakia, Rumania, Yugoslavia, Bulgaria, Mongolia and Afghanistan.

The conference lasted until March 21, 1969. No material is available at the time of writing concerning its accomplishments -- an indication, perhaps, that no definitive arrangements were agreed upon. It will, of course, reconvene in the near future.

The task of formulating acceptable definitive arrangements never appeared to be an easy one. Prior to the conference, it was clear that most, if not all, of the European countries strongly objected to the procurement policies of Comsat, feeling that too much hardware had been bought in the United States and not enough in Europe. At the very least they wanted the ICSC-Comsat structure altered so that the general direction and control of Intelsat will rest with an international secretariat.

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The declared policy of the United States prior to the conference was clearly stated by Leonard H. Marks, Chairman of the United States delegation, when he said:

> The United States takes the position that the only competent agency available to run this system is the Comsat Corporation. No one would dispute the great success that this organization has had in launching satellites, in achieving the highest degree of reliability, in having developed engineering ingenuity in some of the most advanced forms of communication. There is, and I think everybody would agree, no other organization ready anywhere else in the world to take the place of the Comsat Corporation. And we feel that if you are going to have the same kind of an efficient worldwide system that we have so well developed in five years, there must be a continuation of the Comsat Corporation as manager.(42)

PART 3: Intersputnik:

As stated before in this dissertation, detailed and definitive information regarding the communications satellite programme of the Soviet Union is difficult if not impossible to obtain.(43) However, it is generally agreed that the Soviet Union began developing experimental communications satellites at more or less the same time

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(42) Department of State, Bulletin, op. cit., supra n. 9, p. 227.

(43) Some information can be obtained in the following articles: V. Lustiberg, "Satellite Radio Communications in the U.S.S.R.", 33 Telecommunications Journal 425 (December, 1966); also "Towards the Introduction of an International Operational System", 34 Telecommunication Journal 296 (August, 1967).

as did the United States. It had the same advantage as the United States with regard to the cooperation of the ITU in establishing interference-free frequencies for communication satellites. It is well known that the U.S.S.R. was technologically ahead of the United States in rocketry, and there is no reason to doubt that its Molnya series of communication satellites are any less sophisticated than the Intelsat I series. The major purpose of the Molnya system was to relay television programmes within the U.S.S.R. It was also used to set up telephone and telegraph communications.

In 1967, the system was extended to international links. The New York Times of April 17, 1967(44) reported the TASS news agency as saying two days earlier that space experts from the Soviet Union, East Germany, Bulgaria, Cuba, Mongolia, Poland, Rumania, Hungary and Czechoslovakia had worked out a programme of space research which included the development of an international communications satellite system. TASS indicated that these nine countries would cooperate in experiments dealing with outer space problems in general, as well as in the joint launching of satellites and rockets. Thus,

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(44) Cited in Doyle, op. cit., pp. 437 and 438, n. 30.

by agreement with the socialist countries of Eastern Europe, the Russian domestic communications satellite system became a regional system.

The Soviet Union and the East European socialist countries had from the beginning rejected any possibility of participation in the Intelsat programme; and it will be easily realized from the foregoing description of its organization and control, that Intelsat has features totally unacceptable to these countries.(45) However, no alternative plan to Intelsat had ever been suggested.

Aware that in early 1969 a conference must be called to negotiate definitive arrangements for the consortium, the Soviet Union together with seven other socialist countries drafted an agreement for the establishment of a communications satellite system. What in fact was proposed was that their existing regional

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(45) In an interview for a magazine article, a member of the French delegation to Intelsat once asked "If you were the USSR, would you join an organization in which you would have less than 1% voting strength and a private U.S. corporation would have a minimum of 50.6% (sic)?", Katherine Johnsen, "France Backs U.N. Intelsat Control", Aviation Week and Space Technology, February 13, 1967, p. 26.

communication satellite system be extended into a global system. The draft agreement was first presented at the United Nations Conference on Exploration and Peaceful Uses of Outer Space held in Vienna, August 14-27, 1968. The representatives of 74 countries and 13 international organizations including the ITU attended this conference. The United States delegate to the conference described the Soviet proposal as redundant. Having sounded out international opinion at the Vienna conference, the eight socialist states forwarded the draft agreement to the Secretary General of the United Nations; entitled Agreement on the Establishment of an International Communications System Using Artificial Earth Satellites, it was circulated as an official document of the United Nations Committee on the Peaceful Uses of Outer Space.(46)

The draft agreement in its Preamble declares that Intersputnik is created from a desire to develop international cooperation on the basis of respect for the sovereign rights and sovereignty of states. It is submitted that this declaration is directed at the quota

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(46) Establishment of an International Communications System Using Artificial Earth Satellites, U.N. Doc. A/AC. 105/46, 9 August, 1968; the draft agreement is reprinted in 35 Telecommunication Journal 508 (October, 1968).

system of voting in the ICSC -- a system constantly criticized by the Soviet Union. The Preamble also declares that Intersputnik was created from a desire to promote the development of a satellite communications system based on non-interference in the national affairs of member states and to promote mutual assistance and advantage. This directly reflects a fundamental socialist international legal principle -- that socialist states have a duty to assist each other in the interests of the whole socialist community.

Article 1 of the draft agreement indicates that Intersputnik is to be established to ensure cooperation and coordination of effort of the member states in the design, establishment, operation and development of a telecommunications system. Any state which agrees to the principles and conditions of membership and accedes to it may be a member.(47) This provision is interesting when compared with Article 7 (5,d) which indicates that one of the functions of the governing council is to determine the financial and technical conditions for the admission of new members to the organization. Article 9 (5) also speaks of "admission". These two provisions cast some

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(47) Ibid., Article 2.

doubt on whether or not any state can become a member simply by acceding to the agreement.

The Intersputnik communications system would consist of three elements; 1) an outer space complex consisting of satellites and related equipment which would be the property of Intersputnik or would be leased by Intersputnik from its member states; 2) ground control systems also to be owned by Intersputnik or leased from its member states; and 3) a ground complex which would be the property of the state in whose territory it is found.(48) The organization would launch satellites in accordance with bilateral agreements with member states having the necessary means.(49)

Without attempting a detailed analysis of this draft agreement, it may be pointed out that two provisions render the Intersputnik proposal totally unpalatable to many Intelsat members. First, the agreement calls for the establishment of a council to be the governing body of the system.(50) Membership in the council is to be made up of

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(48) Ibid., Article 3.

(49) Ibid., Article 4.

(50) Ibid., Article 6.

one representative of each member of Intersputnik.(51) And each member shall have one vote on the council.(52) A two-thirds vote of the council would be required for the adoption of any decision.(53) As the fund or capital of Intersputnik shall be raised by the contributions of members in amounts proportionate to each member's use of the communications channels,(54) there is no relation between a member's contribution to the fund and his voting power on the council.

The second unacceptable feature is related to the contributions to the fund. Once the amount of this contribution is established, it is to be paid in freely convertible foreign exchange or in transferable roubles (a unit of account whose fixed value bears no relation to the actual value of the rouble).(55) There is no

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(51) Ibid., Article 7 (1).

(52) Ibid., Article 7 (2).

(53) Ibid., Article 7 (6).

(54) Ibid., Article 9 (2).

(55) Ibid., Article 9 (6). The transferable rouble is used mainly in clearing arrangements and its value is fixed by international agreement between the East European socialist countries. See the Accord concernant les règlements multilatéraux en Roubles convertibles et l'organisation de la Banque Internationale de Coopération Economique, 22 octobre 1963.

alternative method of payment provided in this agreement.

The inclusion of such provisions as these would lead the observer to suspect that this draft proposal was put forward more as a propaganda manoeuvre than as a serious plan for the establishment of a truly global satellite communications system. The timing of the presentation of this draft, immediately prior to the conference to review Intelsat's Interim Agreement and when there was considerable discussion among Intelsat's European members concerning their discontent with the extent of Comsat's control, would tend to corroborate this suspicion.

PART 4: Canada's Telesat

Thus far in this chapter we have examined an operative global communications satellite system — Intelsat. We have also briefly dealt with an operational regional communications satellite system -- that of the eight countries who put forward the Intersputnik proposal. In this part we will examine an example of a proposed national domestic communications satellite system.

(cont'd.)

Text appears in Journal du Droit International, 92e Année (1965), No. 3, p. 602.

In July 1967, a task force was appointed by the government of Canada to study and advise on the question of satellite communication in Canada. On the basis of the recommendation of this task force and of other consultations, the government declared its policy in this regard in a White Paper in March of 1968.(56)

In general, the White Paper indicated that a domestic satellite communications system is of vital national importance to the growth, the prosperity and the unity of Canada and that such a system should be a matter of priority. The government proposed that a corporation be organized to own and operate both the satellites and the earth stations of the system. Furthermore, although it was considered that regulatory control of the corporation should be in the hands of the federal government, private participation should be encouraged. The White Paper was clear in stating that a primary objective of the proposed corporation would be the encouragement of Canadian industry to continue its participation in the design and production of space systems. The government expressed its intention that Canada cooperate through the

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(56) A Domestic Satellite Communications System for Canada, Canadian Government White Paper, March 1968, Cat. No. CP 22968, Queen's Printer, Ottawa, Canada.

ITU in the coordination of radio frequencies and orbital positions to be used by the satellites in its system.

In implementation of the aims and goals set out in this White Paper, the government drafted legislation entitled the Telesat Canada Act.(57) At the time of writing, this act has passed through the committee stage and is in the House of Commons awaiting its third and final reading.

The company to be formed under this act is to be called the Telesat Canada Corporation and is to be incorporated under the laws of the Dominion of Canada. Telesat will own and operate the space segment of this domestic satellite system and will be jointly owned in roughly equal shares by the federal government, the communications companies (for example, Bell Telephone and CN-CP Telecommunications) and the public.

It is estimated that the cost of the initial

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(57) Bill C184; 7526 Hansard, April 16, 1969 records the Bill's second reading and the lively if not bitter debate concerning principally the cost, rather than the desirability, of the proposed programme. The Bill, receiving approval in principle, was referred to the Standing Committee on Broadcasting, Films and Assistance to the Arts. By the end of May, 1969, the Committee had finished its work and the Bill was passed back to the Commons.

Canadian satellite project will be in the neighbourhood of $65 million (which does not include an estimated expenditure of $43 million by the Canadian Broadcasting Corporation for ground stations). This money will be used to launch one satellite into a synchronous orbit so that it will cover most, if not all, of Canada.

The announced principal purpose of the venture is to improve communications in the North and to bring live television to isolated northern communities which now receive two-week old television packages in four-hour nightly telecasts. At present, most telephone connections in the North are over high frequency radio links, one of the cheapest forms of communication. At the best of times the quality of the service is marginal; during solar storm activity, telephone communication is often impossible. Furthermore, available frequencies are being used to their utmost capacity, leaving no room for an expansion of service.(58)

It is hoped that Telesat will bind the country

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(58) D. A. Carruthers, "A Canadian Domestic Satellite Communication System", 35 Telecommunication Journal 396 (August, 1968). This article also provides a good account of the technical operations of the proposed system.

together in many other ways. For example, it will be used to bring French language television to isolated French-speaking communities in the West and in the North -- a service which at present is not economically feasible.

Such a domestic communications satellite system in a country of the size of Canada, obviously has many advantages and, although expensive, is highly desirable. Brazil and India, whose size and language structures make their communication problems somewhat akin to those faced by Canada, are in the process of developing domestic communications satellite programmes of their own.

There has been some concern that such domestic programmes will interfere with the operations of Intelsat, or of other global systems which may someday come into being. This question will be discussed in the final chapter of this dissertation.

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CHAPTER IV

Towards International Regulation

Thus far, we have reviewed the history and development of the International Telecommunications Union and examined its present role in the regulation of the radio frequency spectrum, especially with regards to telecommunication by satellite. We have also endeavoured to summarize the activities of states and groups of states in establishing communications satellite systems. In the first part of this concluding chapter, an attempt will be made to outline some of the principal problems beleaguering telecommunications by satellite. In passing, answers to some of the more practical problems will be suggested. Part 2 attempts to indicate that the solution to the broadcast problems can only be found in some form of international regulation.

Part 1: Problem Areas Requiring International Regulation

An Overcrowded Radio Frequency Spectrum:

The problems concerning the spectrum at first appear staggering. As we have seen, it is already overcrowded; yet it is obvious that in the last half of the

twentieth century demands upon the radio frequency spectrum will multiply with ever-increasing momentum. At the national level, the problem is well illustrated by the profusion of applications received every week by such agencies as the FCC in the United States and the CRTC in Canada who issue licences for commercial radio or television stations. International commerce has grown accustomed to telex, to the use of the long-distance telephone, and depends in many instances on data transmission using radio waves. Only an atomic holocaust will stop this unrelenting increase in demand.

However, in the view of this author, the situation is not so desperate as it first appears. There are a number of ways in which the present regulation and use of the radio spectrum can be improved. One obvious improvement, already discussed,(1) would be to increase the power of the IFRB so that it can achieve a disciplined compliance with its rules.

Another is to establish international agreements with regard to the problems of unwanted transmissions from orbiting space vehicles; there is need to stop trans-

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(1) See supra, ch. II, pp. 51-52.

missions from satellites which have outlived their usefulness. This is the sort of problem that the ITU has been traditionally reluctant to tackle, but surely some agreement can be reached requiring that all satellites carrying active radio transmitters have a mechanism to ensure the frequency used will be vacated at the end of the useful life of the satellite. It is submitted that some such agreement could conceivably be achieved by the ITU among its virtually worldwide membership. If successful, the negotiation of such a treaty would represent a complete departure from the tradition of the ITU and would de facto increase the scope of that organization's international authority. We will return to this submission in the conclusions.

Another factor which will undoubtedly contribute to the more efficient use of the radio frequency spectrum is the advance in technology. This will inevitably result in better equipment for transmitting and receiving, and superior equipment means smaller band widths and lessened possibility of harmful, accidental interference.

A fourth method of making better use of what we have is for national administrations to abandon the use of UHF (ultra high frequency) frequencies for commercial

television broadcasting. There is no reason why the VHF (very high frequency) allocations of twelve channels cannot adequately fill the needs of domestic television, particularly since satellite relays will permit nation-wide and worldwide television broadcasting via small ground distribution stations.(2)

The UHF frequencies are also used by many national administrations for a variety of services apart from television, most if not all of which could be operated equally well by cable. As early as 1947 at the Atlantic City Conferences there was strong support for a proposal to include in the Convention or its Regulations provisions to the effect that countries on the same continent use cable for telephone and telegraph communications, thereby releasing frequencies for inter-continental communications. The idea was dismissed, however, there being massive opposition to such a rule, and a declaration of non-interference in sovereign rights was included in the Preamble to the Convention.(3) Such a declaration is not sacrosanct. It could be deleted or altered so as to enable the ITU to

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(2) Haley, Space Age Radio Frequency Allocations, op. cit., p. 126.

(3) See supra, ch. 1, p. 21, n. 32.

incorporate in its treaties provisions requiring the use of land lines in specified areas and for specified purposes.

Finally, the greatest hope for the future of the radio frequency spectrum possibly lies in the use of laser waves for radio communications. A laser produces a narrow beam of light which is monochromatic (of a single sharply defined colour or wavelength) and coherent (with all its light waves in a regional order). Lasers were theoretically predicted in 1958, and have already been the subject of much scientific experimentation. The first operating laser was built in 1960 by Dr. T. H. Maiman of the Hughes Aircraft Company. Since then the beams have been used to flash light beams to the moon and measure their reflections, to drill diamonds, and in eye surgery.

However, it is in the field of communications that lasers may well prove to have their most outstanding application. A light beam from a laser may be modulated by means of radio, television or telephone signals. At the receiving end, a demodulator of the light beam would reproduce the original signal. As the capacity of a communication carrier is directly

proportional to its frequency and as the light waves have a very much higher frequency than conventional radio signals, it is possible for a laser beam to carry a fantastic number of communication messages. "In fact a single laser-produced light beam has the theoretical ability to carry all the information transmitted by all the telephone lines in the world operating at the same time."(4)

The laser suffers from all of the disadvantages of light in that it is impeded by clouds, water vapour, or fog. However, this problem can be overcome by piping the beam through an evacuated pipe containing no atmospheric hindrances. To the layman, this revolutionary method of telecommunication has a Jules Verne flavour, but in fact the Canadian Minister of Communications recently indicated in a speech to the House of Commons that the use of piped lasers is under consideration for the future by his department.(5) Because in space there

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(4) "From Semaphore to Satellite", 32 Telecommunication Journal (March, 1965).

(5) From a speech delivered by the Minister of Communications, Eric Kierans to the Canadian House of Commons on the subject of the Ministry of Communications, reprinted in The Montreal Gazette, March 15, 1969, p. 8, col. 1.

is a perfect vacuum which allows light to travel unimpeded, the use of the laser in communication between space craft in space is already technically possible; no doubt it will be tried within the very near future. For our purpose then, the laser beam, if proven successful for telecommunication purposes, will more than any other single development alleviate the already overcrowded radio frequency spectrum.

A Proliferation of Global Satellite Systems:

As we have seen in chapter III, there are already in existence a global communications satellite system (Intelsat) and a regional communications satellite system (the group proposing Intersputnik). There is no doubt that the number of systems, be they global, or regional or national, will increase. We have mentioned the aspirations of Brazil and India and the immediate plans of Canada. France has yearned for a national satellite for some time, and has been inhibited only by its participation in ESRO and ELDO (a thoroughly unsuccessful pair of joint ventures). Every system requires its own orbiting satellites -- the medium-altitude systems needing as many as eighteen for one commercial system. Apart from the commercial systems which have been our

only concern in this dissertation, there exists a multiplicity of military, meteorological, weather and other information gathering satellites to say nothing of space garbage -- dead satellites, experimental materials and the like.

It is generally agreed that commercial communications satellites are best served by vehicles in synchronous orbit. While few in number compared to the medium-altitude type satellites, these satellites have special requirements regarding altitude and position which adds to the crowding problem. There are a limited number of positions which will serve the densely populated regions of the world. Furthermore a fixed distance must be maintained between these satellites to avoid interference -- a problem compounded by the fact that all communication satellites are required under the current ITU Radio Regulations to operate in the same range of the spectrum.(6)

It is not an alarmist suggestion that the time is foreseeable when there is no more room in space. An

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(6) For a discussion of this see Seventh Annual Report by the ITU to the UN Committee on the Peaceful Uses of Outer Space, reprinted in full 35 Telecommunication Journal 359 (August 1968), at p. 361.

excellent example of the seriousness of the present situation is the situation of the proposed Telesat Canada satellite. A recent newspaper article stated that the Deputy Minister of Communications emphasized the need for haste in launching the Canadian communications satellite while there is still room in its most advantageous position: "If Canada hesitates, it might find all the parking places booked."(7)

A second and more important result of the proliferation of communications satellite systems is that such systems could result in an intensification of the ideological differences that already exist in the world. We may well have to face the existence of an Intelsat global communications satellite system, an anti-Intelsat global communications satellite system dominated by the U.S.S.R. and a plethora of smaller national or regional systems. Such a situation would not be in accordance with the declared aims of the ITU, the United Nations or the United States, each one of whom has

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(7) John Doig, "This Canadian Satellite Could Bind the Nation", Montreal Star, June 7, 1969, p. 11, cols. 1 & 2. The first Canadian communications satellite is to be placed in a synchronous orbit above the equator roughly in line with the city of Winnipeg - the article states that "there is room for approximately eight satellites in that line in space.

declared itself strongly in favour of a single global system. The result might well be a cold war in telecommunications.

The trend towards proliferation will undoubtedly result in the costly duplication of facilities and will unnecessarily increase the strain on the overcrowded radio frequency spectrum. Practically, however, it is difficult to imagine how some form of international regulatory body given control over this aspect of communications could overcome or mitigate the temptation for nations to indulge their desire for national prestige, security, autonomy and pride. In any case, it is doubtful that the technicians of the ITU and the economists of the world can alter the course of events on their own.

The prospect of an Intelsat member participating in another communications satellite system raises some interesting legal points. The Preamble to the Interim Agreement of Intelsat[8] commits the signatories to a "single" global system. In the course of the negotiations leading to this agreement, the United States moved that a similar provision be included in Article I. As

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(8) See supra, pp. 76-77.

the United States proposed it, Article I would have required every government formally to agree not to participate in any commercial communications satellite system other than the single Intelsat system. France and some other European countries considered this inclusion unpalatable; in the interests of concluding the negotiations and with the assurance of France and these other countries that they were committed to the concept of a single global system, the United States agreed to withdraw its demand, and the words of the Preamble were not repeated in the text.(9)

The United States also insisted upon limiting the rights of members to use the inventions, technical data and information obtained from the Intelsat programme. The Preamble to the Interim Agreement together with Article 10 (f) of the Special Agreement would indicate that no such information may be applied in the operation of any system considered to be in competition with the space segment of Intelsat.(10)

With this background, one can appreciate some

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(9) Colino, op. cit., supra, ch. III, n. 38, at p. 40.

(10) Ibid., p. 52.

of the hurdles that Telesat Canada must overcome vis-à-vis its relationship with Intelsat. It is submitted, however, that the crux of the "prohibition" is to be found in the word "competition". The Canadian government (COTC) is under a legal obligation as a signatory of the Interim and Special Agreements only to ensure that Telesat Canada Corporation does not establish a communications satellite system designed to compete with the Intelsat system. Telesat is designed only to satisfy the unique national communications needs of Canada; it is submitted, therefore that its establishment is consistant with the concept of the Intelsat joint venture. This, however, would not be the case were a member of Intelsat to join another global communications satellite system which could be considered in competition with Intelsat.

Direct Broadcasting Satellites:

As we have seen,(11) the direct broadcasting satellite does not require an earth station to receive and transmit its messages; rather, it broadcasts material directly to the home receiver. It is technically

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(11) See supra, ch. III, p. 64.

impossible at the present time to limit the coverage of a direct broadcasting satellite to the frontiers of any one of the nations of the world.

For some time, far-sighted lawyers, sociologists and political scientists have been concerned by the staggering legal, political and cultural implications of this type of broadcasting.(12) At the very least, and with the most noble of intentions, this type of broadcasting could result in what the Canadian delegate to the last UNESCO General Conference called "invasion of cultural privacy". With a slight shift in motives, it could constitute "cultural colonialism".(13) Its worst manifestation would be its use for thrusting upon unwilling nations a barrage of the political propaganda of two competing systems -- a frightening development which would constitute both cause and effect of an intensification of the cold war. Moreover, there is nothing practical that could be done by the victims

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(12) See inter alia, Doyle, op. cit., supra, ch. III, n.25 ; Glazer, op. cit., supra, ch. I, n. 4; Haley, op. cit., supra, ch.II , n. 2 ; Jenks, op. cit., ch. II , n. 4 ; Lord Ritchie Calder, "Brainwashing may soon echo from Space", The Montreal Star, June 21, 1969, p. 19, cols. 2-5.

(13) Calder, op. cit.

in such a situation.(14)

In practical terms these satellites create two major areas which will require equitable and effective international regulation. The first is purely technical in nature and involves such things as radio frequency allocation and standards for compatibility. If such satellites are to be operated on a commercial basis, agreements on rates and charges must be agreed upon. In addition, there will have to be agreements regarding the ownership and operation of internationally-shared facilities. The second and more testy area will concern the form and content of broadcasts from the space facilities. As one authority puts it:(15)

> Given the nature of national interests -- economic, political, cultural and religious -- a great deal of mutual understanding and patience will be required to attain agreement on programming to be beamed from satellites. And if agreement in these areas cannot be reached, nations will turn from cooperative ventures to self-help.

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(14) Jamming has been found to be psychologically unwise and ineffective; the victims in such a situation being the smaller nations, economic reprisals are not feasible; domestic legislation requiring the use of antennae unsuitable for direct broadcast frequencies would require gestapo-like search procedures for enforcement; diplomatic reaction in such a desperate situation would be a weak weapon indeed.

(15) Doyle, op. cit., p. 448.

As is so often the case, because these satellites are not yet operational, not even preliminary steps have been taken to solve any of these problems. Even conservative predictions indicate that direct broadcasting satellites will be operational within the next five to eight years. The time for the establishment of international regularion is now. As Lord Ritchie Calder has said:(16)

> When the first (direct broadcasting satellites) get into position, it will already be too late. Before that time, we must secure international conventions to prevent "cultural colonialism." I am glad that at UNESCO, Canada took a strong stand on this and that we could persuade others of the imminent dangers. Such conventions would bind governments and their nationals to see that there shall be no cultural aggression through broadcasting satellites. Better still, they should be internationally owned and administered.

PART 2: Proposals

Every one of the three problem areas discussed in part 1 of this chapter requires some sort of international legal regulation. That being the case, some form of international institution or body must be empowered to formulate and enforce these regulations. It is also

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(16) Calder, op. cit.

logical to assume that the best of all possible solutions would be for this to be a single organization. If this submission is accepted, then either an existing organization must be revised or a new organization created to perform such a function. One essential ingredient is that the membership of such an organization comprise most if not all of the nations of the world; a second is the organization must have power to enforce the decisions and regulations made by its members.

The international regulation of the use of the overcrowded radio frequency spectrum is unquestionably the task of the ITU. This has been true since the advent of radio, and it seems unnecessary to alter this international regulatory function, particularly since it has been performed with reasonable effectiveness. The principal deficiency in the management function of the ITU has been the lack of enforcement power of the IFRB; but its inability to impose sanctions has not resulted in crises because the members of the Union have realized that not only is it their legal obligation under international law to abide by the treaties and the regulations of the ITU, it is also in their own best interests to abide by them.

As we have seen, regulation and coordination is required for the existing communications satellite systems and for those systems which will undoubtedly be established in the future. Aware of this requirement, many delegates to the United Nations Conference on the Exploration and Peaceful Uses of Outer Space held in Vienna in the summer of 1968 advocated that the United Nations set up a specialized agency to deal with space problems.(17) Some felt that the terms of reference of the U.N. Committee on the Peaceful Uses of Outer Space should be enlarged, and it is conceivable that what they had in mind was to enable that body to create an agency to deal with all aspects of space problems. There was, however, among some delegates a feeling that, while undoubtedly the United Nations would be the appropriate body to cope with the regulation of general space problems, the ITU should be used as the United Nations specialized agency designated to control and regulate telecommunications by satellite.

It is the opinion of many that the proliferation of systems could be controlled if not eliminated by

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(17) Report in 35 Telecommunication Journal 438 (September, 1968); see also ibid., 506 (October, 1968).

the establishment of an operating organization which the proponents of the Intersputnik scheme as well as the members of Intelsat would join. France, one of the members of Intelsat having expressed an interest in Intersputnik, has unofficially announced that it put forward a proposal at the recent Conference on Definitive Arrangements for Intelsat to the effect that the management structure, that is the ICSC-Comsat control, would be supplanted possibly by a United Nations agency, and that the voting structure on the management level should be altered so that each member has one vote.(18) Presumably, this sort of scheme, were it to be implemented, would attract the entire socialist block and in so doing would establish a single global communications satellite system. It has also been suggested that a new specialized agency of the United Nations supervise or regulate this single global system; it would be patterned after the ITU and would perform the same functions in the area of satellite communications that the ITU now performs in other types of communications. Without critically analysing this proposal, the writer would point out that it seems superfluous to designate another United Nations

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(18) K. Johnsen, op. cit., supra, ch. III, n. 45.

specialized agency to perform the same function that the ITU can and does perform in related fields.

As far as the one-vote-one-country concept is concerned, this is abhorent to most of the nations of the Western world when associated with a commercial venture like Intelsat. Furthermore, for a United Nations agency to take over Intelsat, the shares of the member states would have to be purchased on the open market and at that market price.(19) Clearly, the United Nations would not be prepared to do this.

As far as Intelsat is concerned, the make-up and structure of the ICSC may well be altered in the definitive agreement, and the quota system of voting may be changed, but for the present and for the foreseeable future, there will be a system of weighted voting on the executive council, and Comsat will remain the Manager of the consortium.(20) Thus, the socialist block, the proponents of Intersputnik, will still find the Intelsat management

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(19) The Interim Agreement contains a provision that states that the investment of the signatories to the special agreement must be protected. It is expressly provided also that this is one of the provisions that cannot be altered in drawing up a definitive agreement.

(20) See supra, ch. III, p. 69 et seq.

structure unacceptable.

Thus, however desirable a single global system might be, it is not realistic to expect its establishment. Reason dictates that we will have to deal with at least two major communications satellite systems and with a number of small national or regional systems. The very least that must be done is to establish an international body to regulate these systems -- one with sufficient enforcement power to effectively back up its control decisions.

The future problems which will result from the use of direct broadcasting satellites will also require international direction, control and regulation. At present no radio frequency bands are provided for direct broadcasting from satellites; standards will have to be fixed for the direct broadcasting satellite services sharing bands with terrestrial broadcasting services; questions involving the power output required for these satellites must be resolved; standards must be set for home receivers suitable for these transmissions. The direct broadcasting satellite, like any other satellite, occupies orbital space, and regulation will be required in order to prevent overcrowding. The most testy problems

of all those posed by direct broadcasting satellites are in that of the control of programming and content.

Presumably the ITU will be recognized as competent to handle the technical aspects of this new method of communication, including international agreement on the space occupied in the radio frequency spectrum. It has been suggested by some, including Lord Ritchie Calder quoted above,[21] that the programming and content of direct broadcasts by satellite be controlled by the negotiation of a convention or treaty. Possibly the problems of overcrowding in space could be handled by yet another international convention. This appears to the writer to be a picture of chaos; from a proliferation of satellite systems to a proliferation of treaties.

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(21) See supra, n. 12.

CONCLUSION

It is submitted that the ITU is the most appropriate international organization to take on the regulatory functions described in this dissertation. This is not to say that, as presently structured, the ITU is legally capable of performing these tasks. As has been pointed out, there is a traditional reluctance in the administration and among the members of the Union to become involved in any controversy that is not "technical" in nature. The rationale for this reluctance, and perhaps it has been a valid one, has been that in becoming involved in political or sociological controversy, it risks losing its ability to deal effectively with the technical problems of telecommunications. It is submitted that now is the time when the ITU must take that risk.

Even within the framework of the Convention (Montreux, 1965, currently in force) and its annexed Regulations, it is possible for the Union to develop legally binding prohibitive rules.(22) The unwritten rule by which the Union has operated in the past is that

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(22) The following is developed fully in Glazer, op. cit., pp. 299-304.

technical competence alone marks the bounderies of its jurisdiction. In the past, however, the ITU in exercising "technical competence" has in fact prohibited actions; in other words, it has created positive international law. An example is found in Article 7 of the Radio Regulations which states: "The establishment and use of broadcasting stations (sound broadcasting and television broadcasting stations) on board ships, aircraft or any other floating or airborne objects outside national territories is prohibited." Glazer points out that this article was not simply an attempt to remedy a situation in response to a complaint, (for instance, of harmful interference), but rather represents a decision on the part of the Union that seaborne and airborne broadcasting beyond national territories is "contrary to the orderly use of the radio frequency spectrum and may result in chaotic conditions."(23) This, then, is an example of the ITU as a lawmaker. And it has performed its lawmaking without any alteration or addition to its existing structure.

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(23) Doc. No. 647-E of November 25, 1959, Administrative Radio Conference (Geneva 1959). See also Doc. No. 661-E of November 26, 1959, at 2, as cited in Glazer, op. cit., p. 302, n. 113

The administration and membership of the ITU ought to seriously consider enlarging the scope of that organization. With imagination and courage the traditional delimination of the ITU's competence can be altered, not dramatically and all in one step, but little by little.

In a resolution passed at the Montreux Conference in the autumn of 1965, it was agreed in principle that the traditional ITU conventions be replaced by a constitutional charter. It was not specified as to what, if any, substantial differences there might be between the traditional convention and this new charter. However, the twenty-first session of the Administrative Council, which met in Geneva in May of 1966, appointed a study group with a mandate to draft a constitutional charter to be considered by all of the members at the next plenipotentiary conference in 1971.

It is submitted that this is an ideal time for the administration of the ITU to suggest to its membership that its powers be expanded so that it has more authority to cope with the regulatory problems in the field of satellite telecommunications. At the very least, any new charter must avoid endorsing the traditional limitations

of the organization, and must leave the road open for the Union to take advantage of any situation providing it with an opportunity to broaden the lawmaking function it has fulfilled on an ad hoc basis in the past. The present author is under no illusions; this is undoubtedly wishful thinking. However, it is not beyond the realms of possibility: the machinery exists and is functioning; however stringent the limitations it has placed on its own lawmaking function, the Union has already set some precedents.

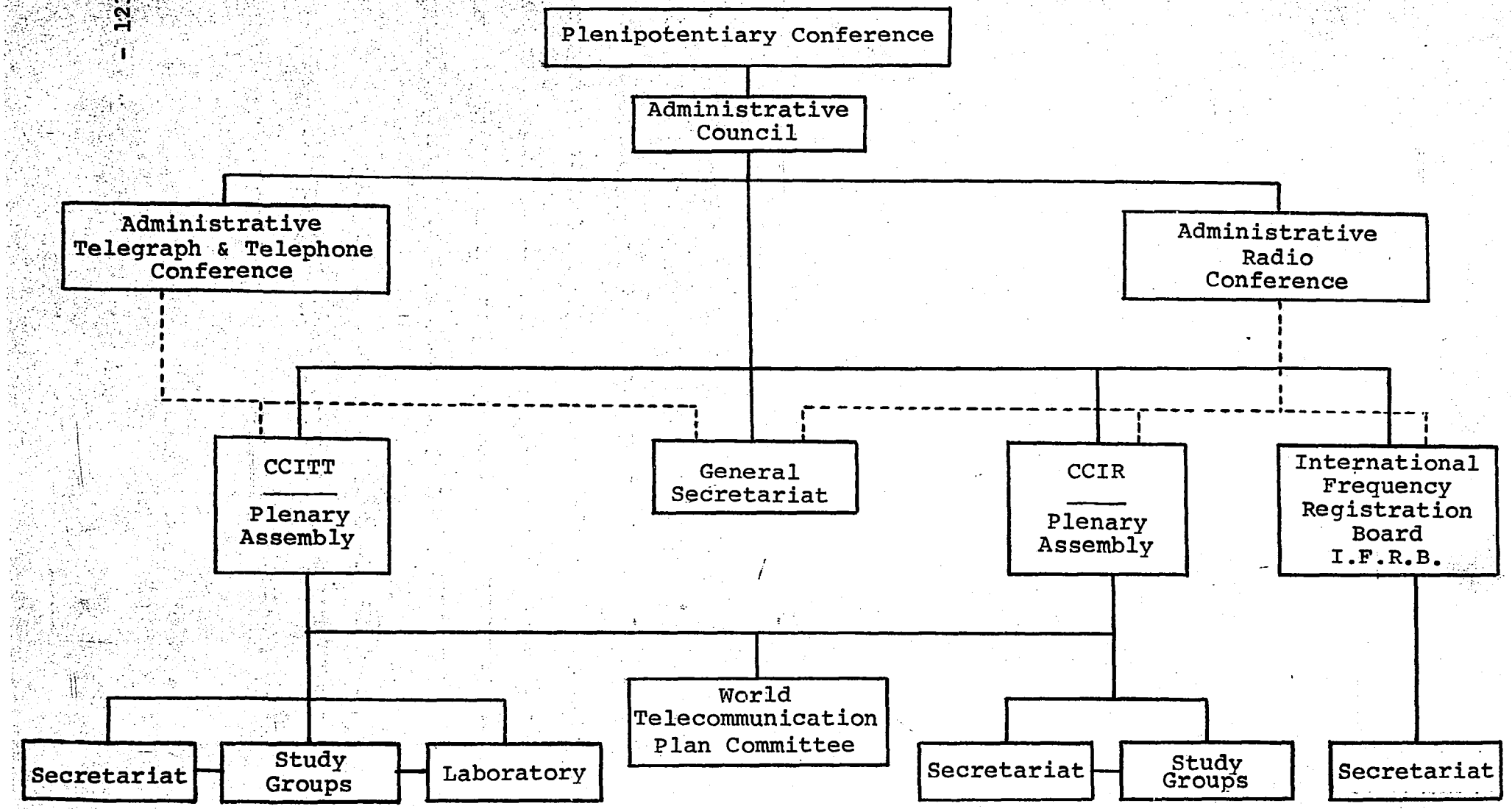
One factor holding the ITU back from enlarging the scope of its competence has been the attitude of its administration. This, as has been pointed out, is mainly composed of technicians who depend on other organizations for legal and political advice when the need arises. Is it any wonder that it has been extremely cautious in extending the scope of its authority beyond its traditional limitations and into fields in which the individuals involved have no competence? It may be hoped, at this point, that the politicians, lawyers and social scientists of countries belonging to the ITU will see the need for a broadening of the attitudes of the organization in general and of its administration in particular.

As an important step towards that end the administration should be revitalized and equipped with members trained in disciplines other than technological ones.

It is submitted that the need for international regulation of telecommunications by satellite is clear. It is further suggested that this regulatory function would be best performed by a single international organization. The ITU, with increased and broadened authority, could be turned into an organization competent to manage and regulate global communications satellite activity.

APPENDIX A

Organization of the International Telecommunication Union



APPENDIX B

Extensions of Radio Spectrum covered by I.T.U. Regulations.

Year	Meeting	Part of Spectrum covered by Regulations
1906	Berlin Radio Conference	500 Kc/s and 1000 Kc/s
1912	London Radio Conference	150 Kc/s to 1000 Kc/s
1922	Washington Radio Conference	10 Kc/s to 23,000 Kc/s
1932	Madrid Radio Conference	10 Kc/s to 60,000 Kc/s
1938	Cairo Radio Conference	10 Kc/s to 200 Mc/s
1947	Atlantic City Conference	10 Kc/s to 10,500 Mc/s
1959	Geneva Conference	10 Kc/s to 40,000 Mc/s
1965	Montreux Conference	10 Kc/s to 42,000 Mc/s

APPENDIX C

Classifications in the Electromagnetic Spectrum

Class of Radiation	Sub-Class	Frequency Range	Wavelength	Description
Radio Communications	Very low frequency	10-30 Kc/s	30,000-10,000 m	Long Wave
	Low frequency	30-300 Kc/s	10,000- 1,000 m	
	Medium frequency	300-3000 Kc/s	1000-100 m	Ordinary Broad-
	High frequency	3-30 Mc/s	100-10 m	casting
	Very high frequency	30-300 Mc/s	1000-100 cm	F.M.-T.V.
	Ultra high frequency	300-3000 Mc/s	100-10 cm	
	Super high frequency	3000-30,000 Mc/s	10-1 cm	Radar
	Extremely high frequency	30,000-300,000 Mc/s	1 cm	
Infra-red				Heat
Visible light	red colour			Visible light
	violet colour			Visible light
Ultra violet				
Gamma radiation	X-rays			
	Gamma			
	Cosmic rays or			
	Photos			

From the point of view of communications the radio spectrum is presently considered to cover the continuum of frequencies in the range of 10 Kc/s to 42,000 Mc/s.

FREQUENCY ALLOCATIONS ADOPTED BY 963 GENEVA EARC

Frequency bands	Service	Frequency bands	Service
15 762-15 768 kc/s	Space Research (shared)	4400-4700 Mc/s	Communication-Satellites (Satellite-to-Earth) (shared)
18 030-18 036 kc/s	Space Research (shared)		
30.005-30.010 Mc/s	Space Research & Space (Satellite identification) (shared)	4990-5000 Mc/s	Radio Astronomy (shared in Regions 1 & 3, exclusive in 2)
37.75-38.25 Mc/s	Radio Astronomy (shared)	5250-5255 Mc/s	Space Research (shared)
73-74.6 Mc/s	Radio Astronomy (exclusive)	5670-5725 Mc/s	Space Research (Deep space) (shared)
136-137 Mc/s	Space Research (Telemetering & tracking) (shared in Regions 1 & 3, exclusive in 2)	5725-5850 Mc/s	Communication-Satellites (Earth-to-satellite) (only in Region 1 & shared)
137-138 Mc/s	Meteorological-Satellite, Space Research (Telemetering & tracking, Space) (Telemetering & tracking) (shared)	5850-5925 Mc/s	Communication-Satellites (Earth-to-satellite) (only in Regions 1 & 3 and shared)
143.6-143.65 Mc/s	Space Research (Telemetering & tracking) (shared)	5925-6425 Mc/s	Communication-Satellites (Earth-to-satellite) (shared in all Regions)
149.9-150.05 Mc/s	Radionavigation-Satellites (exclusive)	7250-7300 Mc/s	Communication-Satellites (Satellite-to-Earth) (exclusive)
267-273 Mc/s	Space (Telemetering) (shared)	7300-7750 Mc/s	Communication-Satellites (shared)
399.9-400.05 Mc/s	Radionavigation-Satellites (exclusive)		
400.05-401 Mc/s	Meteorological-Satellites (Maintenance telemetering)	7900-7975 Mc/s	Communication-Satellites (Earth-to-satellite) (shared)
	Space Research (Telemetering & tracking) (shared)	7975-8025 Mc/s	Communication-Satellites (Earth-to-satellites) (exclusive)
401-402 Mc/s	Space (Telemetering) (shared)		
460-470 Mc/s	Meteorological-Satellites (shared)	8025-8400 Mc/s	Communication-Satellites (Earth-to-satellites) (shared)
1400-1427 Mc/s	Radio Astronomy (exclusive)	8400-8500 Mc/s	Space Research (shared in Regions 1 & 3, exclusive in Region 2)
1427-1429 Mc/s	Space (Telecommand) (shared)	10.68-10.7 Gc/s	Radio Astronomy (exclusive)
1525-1535 Mc/s	Space (Telemetering) (shared)	14.3-14.4 Gc/s	Radionavigation-Satellites (exclusive)
1535-1540 Mc/s	Space (Telemetering) (exclusive)	15.25-15.35 Gc/s	Space Research (exclusive)
1660-1670 Mc/s	Meteorological-Satellites (shared)	15.35-15.4 Gc/s	Radio Astronomy (exclusive)
1664.4-1668.4 Mc/s	Radio Astronomy (shared)	19.3-19.4 Gc/s	Radio Astronomy (exclusive)
1690-1700 Mc/s	Meteorological-Satellites (shared)	31-31.3 Gc/s	Space Research (shared)
1700-1710 Mc/s	Space Research (Telemetering & tracking) (shared)	31.3-31.5 Gc/s	Radio Astronomy (exclusive)
1770-1790 Mc/s	Meteorological-Satellites (shared)	31.5-31.8 Gc/s	Space Research (shared in Regions 1 & 3, exclusive in Region 2)
2290-2300 Mc/s	Space Research (Telemetering & tracking in deep space) (shared)	31.8-32.3 Gc/s	Space Research (shared)
2690-2700 Mc/s	Radio Astronomy (exclusive)	33-33.4 Gc/s	Radio Astronomy (only in Region 1 and shared)
3400-4200 Mc/s	Communication-Satellites (Satellite-to-Earth) (shared)	34.2-35.2 Gc/s	Space Research (shared)

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