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INTRODUCTION

Communication satellites in geostationary orbit have the marvelous ability to permit information exchange across very large distances. These satellites can accomplish this feat because they are high enough above the earth's surface to be in the "line-of-sight" of microwave transmitters and receivers many thousands of miles apart.[1] Although communication satellites were first used to relay information between continents, by the end of the 1970s they were being used increasingly to transmit information within large countries. This more recent usage, known as "domestic satellite service," is an attractive substitute for lengthy terrestrial microwave or cable networks.[2]

The growth of domestic satellite ("domsat") service has begun to cause scarcity problems in the geostationary orbit at the microwave frequency bands employed for sending information to and from communications satellites.[3] These problems arise because communications satellite transmissions directed at the same portion of the earth's surface will interfere with each other, and thereby lose their information content, unless the satellites are spaced some distance apart. The requisite satellite spacing is the function of many technical factors, but, with existing technology, is generally about three degrees.[4] The total geostationary orbit in which satellites are placed encircles the earth's equator at an altitude of six earth radii.

Certain portions of the geostationary orbit are, however, more in de-

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mand than others, a factor which aggravates scarcity problems.[5] For example, it is necessary to associate orbital positions with the longitudes of the portion of the world receiving domsat service. Failure to do so would result either in the earth itself blocking the line-of-sight to the satellite or in the satellite signal arriving at too low an angle of elevation for relayed signals to be adequately received. Hence, geostationary orbit scarcity problems may become especially severe at European and African longitudes, where over half the world's geopolitical entities are found; in the Western Hemisphere, where demand for domsat communications service appears especially great; and at the Indian Ocean basin longitudes, where satellites must be placed to serve the large Eurasian countries.[6]

In recognition of the potential impact of geostationary orbit scarcity on proliferation of domsat communications service, the International Telecommunications Union (ITU) passed a resolution at its 1979 World Administrative Radio Conference (WARC '79) which called for the convocation of a special world conference "to guarantee in practice for all countries equitable access to the geostationary-satellite orbit and the frequency bands allocated to the space services."[7] This conference is commonly referred to as the "Space WARC" and will meet in July 1985.[8] A recent memorandum prepared jointly by the Department of State, the National Telecommunications and Information Administration (NTIA) and the Federal Communications Commission (FCC) refers to the Space WARC as "by far the most important and comprehensive conference ever to affect space telecommunications."[9]

Several international orbit/spectrum management mechanisms have been proposed for consideration at the 1985 Space WARC.[10] Each of them ostensibly "guarantees in practice equitable access to the geostationary-satellite orbit and the frequency bands allocated to the space services."[11] This article provides a comparative legal assessment under United States and international law of these various approaches to international management of the "orbit/spectrum resource."[12]

COMPARATIVE LEGAL ASSESSMENT

Legal Criteria

Analysis of United States and international law concerning geostationary satellite communications reveals two fundamental legal doctrines. These doctrines may be used as legal criteria for evaluating the various approaches to international management of the orbit/spectrum which may be considered at the 1985 Space WARC. The first legal doctrine, normally referred to as "open entry" policy, encompasses the legal principles and rules which are relevant to satellite communications service within the

United States. The second legal doctrine, referred to as "equitable access" policy, encompasses the international legal principles and rules adhered to by the United States which are relevant to satellite communications service outside the United States. Hence "open entry" and "equitable access" are the legal criteria for evaluating various approaches to international management of the orbit/spectrum.

Open Entry

Open entry may be defined as the legal basis for satisfying United States domestic satellite communications requirements. Its statutory foundation has been identified by the FCC as Section 1 of the Communications Act of 1934, which mandates the availability:

> to all people of the United States [of] a rapid, efficient, nationwide, and worldwide wire and radio communication service with adequate facilities at reasonable charges.[13]

The open entry doctrine has been developed principally in FCC decisions,[14] but has been affirmed by the Federal courts.[15] These decisions reveal the following chain of reasoning as the justification for open entry:

1. Insufficient information precludes accurate administrative determination of changing requirements for domestic satellite communications service.[16]
2. A competitive market is able, through price signals, to satisfy changing requirements for domestic satellite communications service.[17]
3. A domsat market can be competitive only if new entry is assured and if existing entrants have an opportunity to increase their market share.[18]
4. New entry and growth in the domsat market is possible only in the absence of extended administrative delays.[19]
5. New entry and growth in the domsat market can be assured only to the extent that orbit/spectrum assignments remain available.[20]
6. Continued availability of orbit/spectrum assignments, and minimal administrative delays, may require that technical efficiency be mandated.[21]

Hence, to the extent that an international approach to orbit/spectrum management provides for continued availability of requested satellite assignments without inhibitive administrative delay, it will allow the U.S. to maintain a competitive domestic satellite communications market. This competitive market, in turn, is necessary as a matter of United States law

for the satisfaction of domestic satellite communications requirements.[22] Continued availability of requested satellite assignments, therefore, is the essence of the open entry criteria.

In practice, currently requested satellite assignments may endanger the continued availability of subsequently requested assignments. In such a case, the open entry doctrine will compromise currently requested satellite assignments in order to ensure continued availability of assignments for new entry into the domsat market, because the competitiveness of the domsat market is more sensitive to entry opportunity than to the particular technical nature of the requested entry opportunity. For this reason, domestic satellite law permits administratively mandated efficiency, such as reduced orbital spacing or minimum satellite communication capacity, but only to the extent necessary to guarantee new (including growth of existing systems) entry opportunities.[23]

Thus, for purposes of legally evaluating Space WARC proposals, the open entry criteria is generally an increasing function of continued availability to the United States of requested satellite assignments. However, at that point in time when requested satellite assignments jeopardize availability of future assignments, the open entry criteria becomes an increasing function of the United States' ability to mandate greater technical efficiency with minimal impact upon requested satellite assignments.

Equitable Access

Equitable access may be defined as the international legal basis for satisfying worldwide satellite communications requirements. Just as open entry policy relies upon entrepreneurial initiative to satisfy United States satellite communications requirements,[24] the equitable access doctrine relies upon sovereign initiative to satisfy worldwide satellite communications requirements.

The equitable access doctrine finds legal expression in several treaties binding upon the United States. Article 33 of the ITU Convention[25] mandates efficient use of orbit/spectrum "so that countries or groups of countries may have equitable access. . . ." The purposes of the ITU, stated in article 4 of the Convention, include international cooperative efforts toward the "creation, development and improvement" of telecommunications systems, "notably those using space techniques"—a mandate wholly consistent with equitable access to the orbit/spectrum.[26]

Equitable access to the orbit/spectrum is also assured under the Outer Space Treaty of 1967, which holds space to "be the province of all mankind" and open for "use by all States without discrimination of any kind. . . ."[27] Certain equatorial countries have argued that special legal principles apply to that portion of outer space occupied by geostationary satellites.[28] These claims are not, however, binding upon other states and are deemed

by America's leading space law authorities to be without international legal support.[29]

The equitable access doctrine is also expressed in the INTELSAT Agreement, article II of which calls for the establishment of a global satellite system "[w]ith full regard for the principles" of universal access and the "most equitable use of the radio frequency spectrum and of orbital space."[30] A similar commitment to the equitable access doctrine may be found in the INMARSAT Convention.[31]

The equitable access doctrine, therefore, mandates that opportunities must exist for all countries to satisfy their requirements for satellite communications service. The determination of these requirements, and the method of satisfying them, is left to the "sovereign initiative" of each country. As noted earlier, the United States exercises its sovereign initiative by allowing marketplace forces to determine and satisfy domsat requirements.[32]

To the extent, therefore, that an international approach to orbit/spectrum management provides for continued availability of internationally requested satellite assignments, it allows all countries an opportunity to satisfy their own satellite communications requirements. This assurance of sovereign initiative with respect to satellite communications systems, in turn, is required as a matter of international law for the satisfaction of worldwide orbit/spectrum requirements.[33] Continued international availability of requested satellite assignments, therefore, is the essence of the equitable access criteria.

As in the domestic arena, however, it is necessary to consider the point in time when currently requested satellite assignments endanger the continued availability of subsequently requested assignments. This is, of course, the central issue of the Space WARC.[34] The equitable access doctrine will compromise currently requested and used satellite assignments in order to ensure continued assignment availability.[35] The ITU's technical requirements,[36] coordination procedures,[37] and broadcast satellite service plan[38] each constrain the latitude of existing and/or prospective satellite systems so that continued assignment availability is assured. The equitable access doctrine operates in this manner because the efficacy of satisfying worldwide domsat requirements via sovereign initiative depends more on assurance of entry opportunity than on the particular technical nature of each request.

As with the open entry doctrine, the equitable access doctrine constrains the latitude of current orbit/spectrum utilization only to the extent necessary to assure continued access opportunities. This is because, aside from that point in time when opportunities for universal sharing of the orbit/spectrum become problematic, equitable access is a simple increasing function of the availability of requested satellite assignments. Any constraint

upon currently requested and used satellite systems in excess of that needed to assure continued assignment availability would constitute a net decrement of sovereign initiative and, thereby, only undermine the equitable access doctrine. In short, equitable access means all requests for orbit/spectrum must be satisfied, subject to the condition that the magnitude of requests will be compromised to the extent necessary to ensure an ability to satisfy future requests without inhibitive administrative delay.

Summary of Legal Criteria for Evaluating International Orbit/Spectrum Management Approaches

For convenience, the preceding descriptions of fundamental United States and international legal criteria for the evaluation of approaches to orbit/spectrum management are summarized below.

a) Open Entry Criteria:
   (i) An increasing function of availability to the United States of requested satellite assignments, for all times when requested and used satellite assignments do not preclude new entry into the domsat market.
   (ii) An increasing function of United States' ability to mandate the greatest amount of technical efficiency in use of the orbit/spectrum for the least amount of constraint upon domsat system, for all times when currently requested and used satellite assignments preclude new entry into the domsat market.

b) Equitable Access Criteria
   (i) An increasing function of availability to all countries and groups of countries of requested satellite assignments, for all times when currently requested and used satellite assignments do not impair future availability of satellite assignments.
   (ii) An increasing function of global ability to ensure future availability of satellite assignments with the least constraint upon currently requested and used satellite assignments, for all times when currently requested and used satellite assignments endanger the continued availability of subsequently requested assignments.

The most striking fact arising from this comparison is that the controlling legal doctrines under both United States and international law are *structurally identical.* [39] In both cases, the fundamental mandate is that there be continued availability of requested satellite assignments. Also, for both doctrines, the fundamental mandate is qualified when currently requested and used satellite assignments begin to impair the availability of future satellite assignments. Moreover, at such times when future assignment

availability appears problematic, both doctrines mandate that the *nature* of requested satellite assignments be modified. Finally, both doctrines require that administrative modifications of the nature of satellite assignments be no greater than is necessary to assure continued availability of future satellite assignments. Such structural consistency between United States and international law is very gratifying.

This structural consistency is an especially interesting finding because the two doctrines arose from very different assumptions. Open entry, it will be recalled, is necessary to effectuate a competitive market in domestic satellite communications service within the United States. A competitive market relies critically upon continuous possibilities for the exercise of entrepreneurial initiative. Equitable access, by contrast, is needed to ensure the rights of all countries to utilize a resource, the geostationary orbit, which is "the province of all mankind." Universal utilization of a *res communes* depends critically upon continuous possibilities for the exercise of sovereign initiative. Hence, while the open entry and equitable access doctrines have unique origins, they generate a common legal mandate: adequate provision for satellite initiatives, entrepreneurial or sovereign, must always exist.[40]

Application of Legal Criteria to Space WARC Orbit/Spectrum Management Options

Given this exposition of the controlling legal doctrines, this article next examines a wide array of proposals for global management of the orbit/spectrum resource. These proposals have been suggested as approaches the Space WARC may adopt to "guarantee in practice, for all countries, equitable access to the geostationary orbit and frequency bands allocated to space services."[41] The purpose of the analysis is to assess the relative consistency of the proposals with the open entry and equitable access doctrines, and thereby provide advice to United States and international policymakers as to preferred approaches. Each approach to international orbit/spectrum management is first described in terms of its basic characteristics.[42] Following the description comes legal analyses in terms of open entry (U.S. law) and equitable access (international law) criteria.[43]

Separate legal analyses in terms of open entry and equitable access are required, despite the structural identity of the two doctrines, because legal analysis consists of *applying* doctrine to real world situations. The two real world situations of concern in this article are, respectively, satisfaction of the domestic satellite communications requirements of the United States and of all countries. With regard to United States requirements, it is the open entry doctrine which states the controlling legal rules. With regard to the simultaneous satisfaction of all countries' requirements, it is the

equitable access doctrine which provides legal guidance. As will be seen below, while the structure of legal analysis is the same for both United States and worldwide requirements, the various orbit/spectrum management options have differential consistency with open entry and equitable access doctrines.

Detailed Allotment Plans (Long Term)

Description

This type of orbit/spectrum management option involves a "Plan" which sets out firm, long-term allotment of frequencies or channels, associated orbital locations, and service areas to each and every ITU Administration. The Plan would also establish technical implementation and operational parameters or parameter ranges associated with the use of these allotments. New requirements would be accommodated only if they did not cause unacceptable interference to those networks established by the Plan. In essence, this approach entails deciding how many satellite assignments are possible with existing technology and then apportioning these assignments among countries for a long period of time. This approach was employed for the broadcast satellite service downlink in ITU Regions 1 and 3 in 1977. In that case each country received approximately four satellite assignments per time zone within its borders for a period of twenty years.[44]

Legal Evaluation in Terms of Open Entry Criterion

The ability of detailed allotment (long term) plans to satisfy the open entry criterion depends upon whether United States allotments are (1) sufficient in number and (2) broad enough in technical specification to accommodate all FCC applications for domsat systems. The need to provide long term assignments for all countries, however, necessitates well-defined technical specifications and a ceiling on the number of United States allotments.

It is not possible to predict whether the *number* of United States allotments will be sufficient to meet the requests of domsat applicants. As the number of minimum allotments per country increases, though, and as the number of countries receiving minimum allotments increases, it becomes increasingly likely that the United States may find itself with an insufficient number of allotments to satisfy entrepreneurial requests.

It is fairly probable, however, that the tight specification of technical parameters inherent in a long-term, *a priori* plan will make it difficult, if not impossible, for the FCC to satisfy requests for domsat authority which are inconsistent with the technical parameters specified in the Plan. For example, wideband, high-power flux density approaches to satellite communications, such as contiguous or scanning spot beam systems, may be

impossible to accommodate within a plan designed for conventional domsats.[45]

At that point in time when currently requested and used assignments preclude new assignments, the open entry criterion varies directly with the FCC's ability to mandate technical efficiency and thereby permit new domsat entry (including growth of existing systems). The tightly specified interference parameters of a long-term plan, however, sharply constrain the ability of ITU administrations to squeeze unplanned systems within a planned allotment.

Legal Evaluation in Terms of Equitable Access Criterion

A long-term, detailed allotment plan will satisfy equitable access criteria to the extent it can provide the number and nature of satellite assignments requested worldwide. The ability to provide the *number* of requested satellite assignments is very uncertain in light of unknown global demand for the orbit/spectrum. However, insofar as very improbable users of the orbit/spectrum for domsat requirements receive a minimum number of allotments, there will generally be fewer allotments left for countries which are more likely to implement domsat systems. A long-term, detailed allotment plan is unlikely to be able to satisfy the *nature* of requested assignments which depart significantly from those provided for in the Plan.

At that point in time when currently requested and used satellite assignments endanger the continued availability of subsequently requested assignments, a long-term, detailed allotment plan does not offer any dependable mechanism for ensuring future availability of satellite assignments. While a plan revision is possible, existing satellite systems and vacant but vested allotments will make it difficult to engineer greater orbit/spectrum efficiency.

Periodically Revised Detailed Allotment Plan

Description

This approach is identical to the long-term, detailed allotment plan except that conferences would be convened periodically, every three to five years, to revise the technical parameters and regulatory procedures for the plan and to accommodate new requirements. At each conference it would be understood that all of the existing networks and all of the new or modified requirements would be accommodated. During the interval between conferences, new requirements would be accommodated to the extent that they did not cause unacceptable interference to networks in the plan.[46]

Legal Evaluation in Terms of Open Entry Criterion

A periodically-revised, detailed allotment plan is better able to accommodate the *number* of requested United States domsat systems than a long-term plan because the former accommodates new requirements periodically through plan revisions. Since, however, a percentage of the resource remains inaccessible due to universal distribution of orbit/spectrum allotments, it remains possible that some number of an administration's requirements may not be accommodated despite interim technological advances.

It is fairly probable that a periodically revised detailed allotment plan will not accommodate the *nature* of all requested assignments, because new requirements are accommodated only to the extent that they do not cause unacceptable interference with networks in the plan. Thus, system compromise will be necessary even with respect to the "paper" satellite networks which have not been implemented.[47] These technical compromises will be less severe, however, than under a long-term plan, as evolving technology can be taken into account at periodic conferences which revise the plan.

As with a long-term plan, periodically revised plans offer little opportunity for the United States to create additional access opportunities within United States allotments. If the periodic revisions allow greater independence between national allotments, however, the United States could gain additional latitude to mandate greater technical efficiency in national systems.

Equitable Access Criterion

A periodically revised plan would offer an improved ability to accommodate both the number and nature of internationally requested satellite assignments over that offered by long-term plans. However, it remains probable that interference parameters of the plan, even as revised, will place limits on the number and nature of satellite assignments in excess of those which would exist without a plan, particularly in those portions of the world where smaller countries enjoy little geographical isolation from neighboring countries.

The ability to take technological advances into account at three to five year intervals improves significantly the theoretical possibility of global action to increase the number of satellite networks which can be accommodated. However, the need to cause no interference to existing networks under the plan mitigates the extent to which the plan can be made more efficient.

Detailed Allotment Plan with Future Requirements Reserve

Description

This option is identical in concept to the previous two types of detailed allotment plans except that not all of the technologically feasible satellite assignments would be allotted to countries at the initial planning conference. Instead, some fraction of the technologically feasible satellite assignments would be held by the ITU in a "future requirements reserve." Conferences to revise the plan would still be held periodically, probably on the order of every ten years. If a country depleted its allotment of satellite assignments before the next scheduled conference it could satisfy its requirements from the "future requirements reserve." Also, at periodically reconvened conferences new technological advances could be taken into account to increase the number of satellite assignments allotted to countries and to replenish the "future requirements reserve."[48]

Open Entry and Equitable Access

The analysis of the long-term and periodically revised, detailed allotment plan is generally applicable to this type of plan as well. To the extent that the reserve is created by reducing the size of initial national allotments, but not floor allotments, below the level for other detailed allotment plans, countries will be more likely to find themselves, over time, unable to obtain requested satellite assignments under the Plan.[49] They can then, however, access the reserve and compensate for any shortfall of orbit/spectrum. Based on this scenario, it cannot be said with any certainty whether a requirements reserve offers either the United States or any other country a greater ability to secure satellite assignments than the other detailed allotment methods.

If the reserve is created, though, by reducing the floor allotment to all countries below that which would exist for other detailed allotment plans, then both the United States and other countries would experience some increase in their ability to secure requested satellite assignments. This is due to a diminution in the extent to which allotments are distributed, and could be accomplished as well without a reserve.

Guaranteed Access by Multilateral Coordination

Description

This approach is fundamentally different from the previous three "planning" approaches whereby the entire orbit/spectrum resource is, at a single point in time, distributed among all countries regardless of their need for any satellite communications service. Under the multilateral coordination approach, there would be no advance distribution of satellite assignments to all countries. Instead, when a country wished to launch a new satellite

system, it would follow existing procedures stated in article 11 of the ITU Radio Regulations. These Regulations provide that advance notification be given to all countries of a new satellite system. If the new satellite system would cause harmful interference to an existing satellite system of another country or group of countries, the new satellite system could not receive "international recognition," which carries with it certain valuable legal rights, until the potential for interference were eliminated. It is this situation which many countries fear will block their access to the geostationary orbit.[50]

The multilateral coordination approach addresses this problem by requiring that the new satellite system be accommodated at a special meeting of the countries or groups of countries which are responsible for the satellite systems involved. There has been no articulation of exactly *how* the new satellite system would be accommodated. This method could, however, involve forced relocation of the existing satellites which would suffer interference from the new satellite system.

Legal Analysis in Terms of Open Entry Criterion

Multilateral coordination is highly consistent with United States open entry policy because a high probability exists that both the number and nature of requested domsat assignments will be available. Since no planning is involved, the entire orbit/spectrum resource, less that portion in actual use or subject to near-term coordination, is potentially available to the United States.

When inability to satisfy a new non-United States orbit/spectrum requirement necessitates a special multilateral coordination meeting, orbit/spectrum availability to the United States would not be significantly impaired. This is so because (1) the geographical isolation of the United States limits significantly the number of meetings for which its attendance would be necessary; (2) the meetings would not deplete orbit/spectrum availability since they would deal only with the actual requirements of administrations prepared to orbit satellite systems (as opposed to the need to provide for theoretical requirements of all administrations under planning); and (3) the meetings would be able to accommodate new requirements in light of evolving technology, thereby further minimizing the drain on orbit/spectrum availability. For that point in time when currently requested and used domsat assignments do appear to preclude new domestic entry, the FCC will retain broad latitude to mandate increased technical efficiency under the multilateral coordination approach.

Legal Evaluation in Terms of Equitable Access Criterion

The multilateral coordination approach does not fare as well under equitable access criteria as it does under open access because, for most countries

or groups of countries, dedicated domsat systems will be initiated only after several developed country satellite systems are in orbit. This implies a much higher probability of need to resort to special multilateral coordination meetings than will be experienced by earlier developers of the orbit/spectrum.

The need to resort to special multilateral coordination meetings is, itself, a compromise of satellite assignment availability and, therefore, a denigration of the equitable access doctrine. More importantly, however, is the fact that the special multilateral coordination meetings would probably not yield the level of satellite assignment availability developing countries want except under the equitable access doctrine. While this method states that "a means would be found to accommodate the new requirement," the means will necessitate compromise of the new requirement in proportion to the extent that the desired transmission parameters conflict with previously coordinated and registered systems. This compromise will clearly become greater over time, particularly for countries which enjoy little geographical isolation. Furthermore, the time and expense needed to participate in special multilateral coordination meetings is likely to be viewed by latecomers to orbit/spectrum exploitation as a significant impediment to satellite assignment availability.

With regard to that point in time when international availability of satellite assignment does, in fact, become problematic, the special multilateral coordination meeting would be the key tool by which future availability of satellite assignment is assured. To be consistent with the equitable access doctrine, this tool must yield the greatest amount of satellite assignment availability for the least constraint upon existing assignments. Because the special meetings may take into account evolving technology and are coordinative in nature, they yield new assignment availability with minimal impact on existing satellite systems. As discussed earlier, however, the nature and, to a lesser extent, the number of new assignments effected at special meetings may very well fall short of that expected by latecomers to the orbit/spectrum resource.

Periodic Revision of Coordination Procedures

Description

This approach is similar to that of multilateral coordination insofar as it does not contemplate an *a priori* allotment of the orbit/spectrum to all countries. The distinctive feature of this approach is that it contemplates constant and possibly major revisions to the basic procedures stated in article 11 of the Radio Regulations which specify the manner in which new satellite systems can be placed into orbit without causing interference to existing satellite systems.[51] These coordination procedures may be revised

in a minor manner, to simply reduce their considerable complexity, or they might conceivably be so significantly revised as to, for example, require satellites of developed countries to incur all modifications necessary to avoid interference with new satellite systems of developing countries.

Legal Analysis in Terms of Open Entry Criterion

Periodic revision of coordination procedures to enhance orbit/spectrum efficiency is wholly consistent with the United States policy of open entry. The kernel of open entry is satellite assignment availability; by improving the coordination process and by increasing the technical efficiency of orbit/spectrum systems, the United States has its best possible assurance of adequate satellite assignments to meet domestic requirements. This method also leaves the FCC broad latitude to create new domsat entry opportunities via domestic technical efficiency regulations more stringent than those mandated by the ITU.

It is possible that continuous international revision of coordination procedures and baseline transmission characteristics may introduce so much uncertainty that the FCC domsat authorization process will not operate expeditiously. It is also possible that coordination procedures may be revised in such a manner that existing satellite networks may have to incur greater modifications than is now necessary. For example, failure to effect timely coordination with a planned satellite system could possibly be deemed a waiver by the administration representing registered systems of claims of harmful interference from the planned system. The uncertainty introduced by periodic revision of coordination procedures and technical parameters may, therefore, significantly undermine open entry policies.

Legal Evaluation in Terms of Equitable Access Criterion

The analysis of the multilateral coordination method is largely applicable here as well. The key difference is that, under this method, administrations throughout the world must rely wholly upon revisions to the coordination procedures and ITU technical parameters, instead of special multilateral coordination meetings, as a source of new satellite assignment availability.

If the coordination procedures are revised to place significant bargaining power in the hands of latecomers to orbit/spectrum development, then developing countries will probably rate this method high under equitable access criteria. But the likelihood of such a revision being made is very uncertain. If, on the other hand, the revisions essentially leave the coordination procedures as they are but heighten the technical requirements placed on satellite networks, this method will probably be viewed as detracting from orbit/spectrum availability for the same reasons stated in the discussion of multilateral coordination.

ITU efforts under this method to mandate greater satellite assignment

availability will probably be rather slow and of uncertain impact. Tighter technical constraints may be resisted by developing countries as inconsistent with their satellite development plans and capabilities.

Resource Pool Planning

Description

This method involves the creation of a resource pool consisting of blocks of the spectrum associated with a portion of the orbital arc. This resource pool would be managed by an international entity, such as the ITU. When a country plans to orbit a new communications satellite system it forwards its service requirements to the pool manager. The pool manager provides for the requested service requirements from the resource pool and "packs" the requested assignments of various countries in a manner which causes the least depletion of the pool.[52]

Legal Evaluation in Terms of Open Entry Criterion

Resource pool planning should allow the United States a maximum number of requested satellite assignments because no artificial ceiling is placed on resource availability as under formal plans, where resource units are predistributed to all administrations. Resource pool planning will probably not allow, however, maximum United States latitude in the nature of requested satellite assignments. The nature of satellite assignments, including at least orbital location, and probably other design parameters as well, would be subject to the discretion (which may be appropriately circumscribed) of the pool "manager." The managing entity "packs" requested assignments within the pool in a manner which causes the least depletion of the pool and the least, if any, impact on existing assignments. The constraints imposed on system architecture as a result of the packing process probably exceed those which result from the existing technical coordination process of article 11 of the ITU Radio Regulations. However, these constraints may not be significant for the United States due to its geographical isolation. Furthermore, the increment in ability to accommodate new satellite systems through efficient resource pool management largely offsets any impairment of satellite design flexibility. As noted earlier, the open entry policy is more sensitive to the *existence* of entry opportunity than it is to the *particular* nature of requested entry opportunities.

Resource pool planning would have an uncertain effect on the FCC's ability to mandate greater orbit/spectrum efficiency. The FCC would remain free to set orbit/spectrum efficiency standards and to submit only those requested assignments to the pool manager which comply with such standards (thereby facilitating the manager's chores). On the other hand,

the pool manager may pack the resource in such a manner as to limit significantly the utility of FCC actions aimed at achieving greater orbit/spectrum efficiency. Once again, however, the geographical isolation of the United States is a factor that should allow the FCC significant flexibility.

Legal Evaluation in Terms of Equitable Access Criterion

Resource pool planning should be able to accommodate the number of internationally requested satellite assignments with less time delay and administrative expense than would be involved for latecomers under coordination procedure-based methods. The need to pack newly requested satellite assignments with minimal disruption to existing networks, minimal depletion of remaining resource units, and with regard to evolving technology, however, implies that latecomers to the orbit/spectrum resource may face significant design constraints. These constraints, if they amount to obstacles to domsat deployment, undermine the equitable access doctrine.

The ability of the international regime to mandate greater entry opportunity at times and places of orbit/spectrum congestion is highly dependent on the powers given to the pool manager. The need to accommodate already packed networks, however, militates against any significant ITU ability to create new access opportunities.

Institutional Provision or Planning

Description

This method contemplates international institutional provision of satellite service as a supplement to separate domsat systems.[53] Institutional provision of domsat service is an orbit/spectrum management approach because guaranteed access to the institutional system would serve as a substitute for the need to reserve fractions of orbit/spectrum for all countries. This approach contemplates the ability of existing, or perhaps modified, coordination procedures to manage adequately the orbit/spectrum once the requirements of international latecomers are guaranteed by international or regional operating institutions.[54] Article III(e) of the INTELSAT Agreement gives INTELSAT, the largest existing international institution providing intercontinental, transborder and domestic satellite service, the authority to provide such institutional access:

> INTELSAT may, on request and under appropriate terms and conditions, provide satellites or associated facilities separate from the INTELSAT space segment for:
> (i) domestic public telecommunications service in territories under the jurisdiction of one or more Parties;

(ii) international public telecommunications services between or among territories under the jurisdiction of two or more Parties;
(iii) specialized telecommunications services, other than for military purposes;
provided that the efficient and economic operation of the INTELSAT space segment is not unfavorably affected in any way.[55]

Legal Evaluation in Terms of Open Entry Criterion

This approach gives the United States the maximum availability of requested satellite assignments in terms of both number and technical nature. No artificial ceiling would exist on the number of allotments available to the United States (as exists under planning approaches) and coordination procedures permit maximum flexibility in accommodating different types of satellite systems.

It may be argued that the proliferation of institutional systems will complicate coordination and thereby reduce the availability of satellite assignments to the United States. The geographical isolation of the United States, however, minimizes this problem significantly. Furthermore, the United States would be coordinating with real systems in real time, and can therefore take advantage of technological innovations to reduce coordination problems. Also, under this approach the FCC would retain maximum flexibility to mandate greater efficiency in United States use of the orbit/spectrum should new entry opportunities become problematic.

Legal Evaluation in Terms of Equitable Access Criterion

Institutional provision of domsat service, supplementary to sovereign networks, would also provide the maximum availability of satellite assignments worldwide. For small countries, access is guaranteed to the institutional system.[56] Access would be much greater under either long or short-term formal plans, where the small country is guaranteed only certain interference-free transmission parameters and actual satellite service remains unlikely. Access would also be greater than under pure coordination procedure-based approaches, where latecomers can face significant coordinative hurdles in registering their space systems. With institutional provision of domsat service, coordination will be shared among all administrations participating in the institutional arrangement.

Developing countries that do not wish to participate in an institutional arrangement to provide domsat service (probably the larger states such as India) may feel that this method does not adequately assure future satellite assignment availability. India has already complained of coordination difficulties with INTELSAT and the Soviet Union.[57] Hence, some uncer-

tainty remains as to how well institutional provision of international domsat service effectuates the equitable access doctrine.

As to international efforts toward mandating greater access opportunity at times of orbit/spectrum crowding, the institutional provision approach appears preferable to other approaches because global satellite system decision-making is concentrated in entities which are cognizant and appreciative of technological advances. Nevertheless, with many systems already on orbit in need of protection, any significant enhancement of orbit/spectrum availability will be a gradual process.

JURIMETRIC SYNTHESIS

In this section, the article synthesizes, with the aid of symbolic functional notation, the legal and technical considerations explained earlier. The fundamental decision of the Space WARC is of an allotment nature: that is, in what way should the orbit/spectrum be associated with particular countries? Let this decision be denoted D_a. The allotment decision, D_a, is a function of, *i.e.*, it depends upon, consistency with policies which require continual availability of requested satellite assignments. Letting p represent this common mandate of open entry and equitable access, it may then be said that $D_a = f(p)$.

Now p itself may be represented as the difference between satellite assignment supply and satellite assignment demand. Both the supply of and demand for satellite assignments are functions of time. Letting t represent time, $R_d(t)$ represent the rate of satellite assignment demand and $R_s(t)$ represent the rate of satellite assignment supply, it may be stated that $p = f(t) = R_s(t) - R_d(t)$. Clearly if for a particular allotment option $R_d(t)$ exceeded $R_s(t)$, then p would assume a negative value and such an allotment decision would not be made.

Let it be assumed that $R_d(t)$ is independent of the approach to orbit/spectrum management. The rate of supply of satellite assignments, $R_s(t)$, depends in addition on the number of satellite allotments a management approach, M, provides, and on technological innovations, I. Consider first only the categories of planning methods (represented with a subscripted p) and coordination methods (represented with a subscripted c). For planning methods, $R_{sp} = M_p + I_p$, and for coordination procedure methods, $R_{sc} = M_c + I_c$. But it is universally agreed that $I_p < I_c$ because plans cannot take into account technological innovations which do not yet exist.[58] Hence $R_{sp} > R_{sc}$ only if $M_p > M_c + (I_c - I_p)$. But, to the contrary, $M_p < M_c$ because, in a plan, the total number of allotments is of a magnitude determined by the need to provide interference protection to satellite systems which do not now and may never exist: *i.e.*, the portion of the "floor allotments"

provided to all countries which will not be utilized.[59] Whereas in a coordination procedure approach, M_c, the allotments are of a magnitude determined only by the need to provide interference protection to existing or imminently deployed satellite systems. Since the number of all real satellite systems is much less than the number of all real plus hypothetical satellite systems, M_c is always greater than M_p. Thus $R_{sc} > R_{sp}$ and $R_s - R_d$ must be greater for coordination methods than planning methods. Based on these considerations, the Space WARC decision $D_a = f(p)$ should be to rely upon coordination procedures.

Now it is appropriate to consider particular variations of planning method approaches whereby the plan is revised in one way or another at periodic intervals.[60] The effect of periodic revision is to provide I_p with a value which approaches I_c in the limit when periodic revisions become continuous. However, since the periodically revised planning methods do not alter the universal allotment of the orbit/spectrum which characterizes all planning methods, M_p remains less than M_c. That is, notwithstanding changes in technology which increase the overall availability of satellite assignments, the need to protect the hypothetical assignments of countries without any need for satellite service will always result in fewer available assignments than if protection need be afforded only to real systems. Hence, while periodically revised plans enjoy a $R_s(t)$ value higher than that of long-term plans, due solely to a limit condition at which $I_p = I_c$, the R_{sp} remains less than R_{sc} because M_p remains less than M_c. Therefore, even continuously revised plans have a lower $R_s - R_d$ value than do coordination methods of orbit/spectrum management. The Space WARC decision, D_a, should thus continue to favor the latter approach.

Finally, consider the perspective of a country whose $R_d(t)$ will never exceed the $R_{sp}(t)$. For such a country, there may be no perceived advantage in a coordination procedure approach to orbit/spectrum management. However, such a country may perceive ancillary benefits of a non-legal nature in a planning method approach, its legal requirements being met by the condition that $R_{sp}(t) > R_d(t)$. These ancillary benefits may include geopolitical gains in relations with Western industrialized states, economic gains from leasing its allotment of unused orbit/spectrum and transfer of expenses incurred obtaining satellite assignments from the country itself, presumably at an early stage of industrialization, to the ITU and its Consultative Committee on International Radio (CCIR), where the costs (including significant computing resources) of preparing plans are borne by the world community.

If countries described in the preceding paragraph represent a large majority of all states, and given that all states have equal standing under international law, such states may be able to foist the orbit/spectrum management model which meets their interests upon the world communi-

ty. If that model entails planning, such a result would appear to be legally unacceptable to states for whom $R_{sp}(t) < R_d(t)$.[61] In this event, a dilemma would be reached.

Taking now the perspective of the United States as a country for whom $R_{sp}(t) < R_d(t)$, there are at least three ways out of this dilemma. First, the United States may change its domestic laws to restrict $R_d(t)$. Second, the United States may maintain its domestic legal policies and refuse to ratify any Space WARC treaty that mandates planning. And third, the United States may promote a coordination procedure approach which also addresses the eco-geopolitical bases upon which support for planning rests. The first and second approaches appear costly to United States domestic and international interests, respectively. The third approach would be met by the "Institutional Provision" method of orbit/spectrum management. While the United States might incur costs in facilitating the establishment of global domestic satellite communications service, much if not most of these expenses would be passed on to the United States satellite communications industry.[62] Given a choice between a partnership with the United States and other countries in a global domsat system, and its accompanying advantage of near-term access to advanced satellite communications technology, or foresaking the same if support is given for a planning method, it appears likely that orbit/spectrum management based on planning would be unable to muster majority support at the Space WARC.[63]

It must be recalled that lawmaking is a consensual activity.[64] As the universe of entities from whom consensus is required grows more diverse, the substance of any consensus achieved invariably becomes more diffuse.[65] Ambiguity must supplant specificity if divergent interests are to find common ground.

The jurimetric synthesis has shown that the common and universally agreed upon mandate of the open entry and equitable access doctrines may be met only by coordination procedure approaches for countries whose rate of growth in satellite assignment demand exceeds the rate of growth in satellite assignment supply under orbit/spectrum planning. However, there are a majority of countries for whom the rate of growth in satellite assignment demand is less than the rate of growth in satellite assignment supply available through an orbit/spectrum plan. These countries are not indifferent to the orbit/spectrum management approach because they can benefit geopolitically and economically from the planning methods.

For a worldwide consensus to be achieved, the minority of technologically advanced states must either restrain satellite system growth or must offer the less technologically developed states economic and geopolitical benefits which exceed those associated with universal, *a priori* distribution of the orbit/spectrum resource. The argument of this article is that the first option is antithetical to United States policy, but that the second option

is met by a worldwide partnership in domestic satellite communications service, facilitated with United States financial and technical assistance.

CONCLUSION

The foregoing comparative legal assessment of international orbit/spectrum management approaches reveals substantial diversity in the consistency of these approaches with both United States and international law. While the underlying principles of United States and international satellite law, "open entry" and "equitable access," respectively, have been shown to be structurally identical, they may yield different results when applied to concrete orbit/spectrum management proposals. These disparate results must, however, be expected, since analysis under United States law considers only the requirements of a single, technologically advanced country, whereas analysis under international law must consider the varying needs of over 150 countries with a wide spectrum of technological and economic infrastructures.

From a systems perspective, the ideal orbit/spectrum management approach is one which is consonant with both United States and international legal principles. Based on the foregoing analysis, the "Institutional Provision" approach appears to satisfy the criteria of both "open entry" and "equitable access" to a greater degree than do any of the alternative approaches. It is therefore suggested that from the combined viewpoint of both United States and international interests in global domestic satellite communications service, the 1985 Space WARC should pursue the Institutional Provision approach as the best means of "guaranteeing in practice for all countries equitable access to the geostationary-satellite orbit and frequency bands allocated to the space services."[66]

NOTES

[1] *See generally* D. JANSKY 4 M. JERVCHIM, COMMUNICATION SATELLITES IN THE GEOSTATIONARY ORBIT (1983); J. MARTIN, COMMUNICATIONS SATELLITE SYSTEMS (1978).

[2] *See generally* D. JANSKY, WORLD ATLAS OF SATELLITES (1983). When this article was written, the U.S. had four domestic satellite communications systems in place: Western Union's Westar, RCA Americom's Satcom, Comsat General's Comstar and Satellite Business System's digital Ku-Band network. Permission has been granted for the construction of new fixed satellite systems by American Telephone & Telegraph, GTE Satellite, Hughes Aircraft Company, Spacecom, and Southern Pacific Communications. Permission has also been granted to other firms to construct the initial phase of eight separate broadcast satellite systems. Applications are pending for permission to construct an additional six satellite systems by still

other firms. Each of these satellite systems is capable of providing satellite communications service to neighboring countries as well.

Total worldwide demand for non-broadcast satellite communications service has been estimated at 10,530 36 MHz equivalent transponders by the year 2000. Each 36 MHz transponder is capable of conveying from one to four channels of television programming, or approximately one thousand telephone circuits, depending on the technology employed. Typical satellite configurations have evolved from 12 transponders in the 1970s to 24 transponders in the 1980s. If 24 transponder satellites remain typical through the 1990s, then estimated worldwide demand for non-broadcast satellite service will support over 200 geostationary satellites by the year 2000. *See* Second Notice of Inquiry—Space WARC, Gen. Dkt. No. 80-741, at § 14 (F.C.C. 17714, 1982) [hereinafter cited as *Notice of Inquiry—Space WARC*].

[3] *See*, Levin, *Orbit and Spectrum Resource Strategies: Third World Demands*, TELECOM. POL'Y, June 1981, at 102. When assessing the future use of the geostationary orbit, broadcast satellite service and defense communications satellites must also be considered. However, because broadcast and defense satellites operate at different frequency bands from non-broadcast satellites, they are considered separately for purposes of analyzing orbit/spectrum scarcity.

[4] Licensing Space Stations in the Domestic Fixed-Satellite Service, Notice of Inquiry and Proposed Rulemaking, 46 Fed. Reg. 57,067 (1981) (to be codified at 47 C.F.R. pt.25) [hereinafter cited as Licensing of Space Stations].

[5] *See* Hill, *Corporate Star Wars: Domsats Battle for the Geostationary Orbit*, SATELLITE COM., Aug. 1980, at 12.

[6] The U.K., Sweden, France, West Germany, Austria, Luxemburg, Austria, Switzerland, and Italy are each planning one or more fixed or broadcast satellite systems in addition to a common user Eutelsat system. Nigeria has expressed interest in its own satellite system, while the West African Post & Telegraph Union is studying a common user satellite system. The Soviet Union has five separate domestic civil satellite communications systems. India, Japan and Indonesia each have two satellites in orbit.

[7] ITU, WORLD ADMINISTRATIVE RADIO CONFERENCE (1979), *reprinted in* President's Message to Congress Transmitting the Radio Regulations (Geneva, 1979) and Final Protocol, Sen. Treaty Doc. No. 97-21, 97th Cong., 1st Sess. 74-75 (1981) [hereinafter cited as WARC-79].

[8] *See* ITU, FINAL ACTS OF THE PLENIPOTENTIARY CONFERENCE (1982) [hereinafter cited as WARC-82].

[9] Dep't of State, Memorandum on the National Preparatory Program (1982).

[10] *See, e.g., Notice of Inquiry-Space WARC, supra* note 2.

[11] *See* WARC-79 *supra* note 7. The entire text of Resolution 3 reads as follows:

considering

a) that the geostationary-satellite orbit and the radio frequency spectrum are limited natural resources and are utilized by space services;

b) That there is a need for equitable access to, and efficient and economical use of, these resources by all countries as provided for in Article 33 of the International Telecommunication Convention (Malaga-Torremolinos, 1978) and Resolution 2;

c) That the utilization of radio frequencies and the geostationary-satellite orbit by individual countries and groups of countries can take place at various points in time, based on their requirements and the availability of the resources at their disposal;

d) That there are growing requirements all over the world for orbital position and frequency assignments for the space services;

e) That in the use of the geostationary-satellite orbit for space services, attention should be given to the relevant technical aspects concerning the special geographical situation of particular countries;

resolves

1. That a world administrative radio conference shall be convened not later than 1984 to guarantee in practice for all countries equitable access to the geostationary-satellite orbit and the frequency bands allocated to space services;
2. That this conference shall be held in two sessions;
3. That the first session shall:
   - 3.1 Decide which space service and frequency bands should be planned;
   - 3.2 Establish the principles, technical parameters and criteria for planning, including those for orbit and frequency assignments of the space services and frequency bands identified as per para. 3.1, taking into account the relevant technical aspects concerning the special geographical situation of particular countries; and provide guidelines for associated regulatory procedures;
   - 3.3 Establish guidelines for regulatory procedures in respect to services and frequency bands not covered by para. 3.2;
   - 3.4 Consider other possible approaches that could meet the objective of resolve 1;
4. That the second session shall be held not sooner than twelve months and not later than eighteen months after the first session and implement the decisions taken at the first session;

invites

1. The International Radio Consultative Committee to carry out preparatory studies and provide the first session of the conference with technical information concerning principles, criteria and technical parameters including those required for planning space services;
2. The International Frequency Registration Board to prepare a report on the operation of the procedures of Articles 11 and 13 including information about difficulties which may be reported to the IFRB by administrations in gaining access to suitable orbital locations and frequencies, and to circulate this report to administrations at least one year before the first session of the conference;
3. The IFRB to carry out technical preparations for the conference in accordance with the provisions of the Radio Regulations;
4. The administrations to examine all aspects of the matter with a view to submitting proposals to the conference, and to cooperate actively in the above-mentioned work of the CCIR and IFRB;
5. The Administrative Council to take all necessary steps for the convening of the conference in accordance with this Resolution.

The dates for the first and second sessions were subsequently postponed to July, 1985 and September, 1987 respectively. *See* WARC-82, *supra* note 8.

12 *See generally* Rothblatt, *The Impact of International Satellite Communications Law Upon Access to the Geostationary Orbit and the Electromagnetic Spectrum*, 16 TEX. INT'L L.J. 207 (1981) (examination of various space WARC options).

13 47 U.S.C. § 151 (1976); *see also* Orbit Deployment Plan-Domestic Satellite, 84 F.C.C.2d 584, 602 (1981) [hereinafter cited as *Orbit Deployment Plan*].

14 *See, e.g., Orbit Deployment Plan*, 84 F.C.C.2d 584, Domestic Communications-Satellite Facilities, 35 F.C.C.2d 844 (1972).

15 *See, e.g.*, United States v. F.C.C., 652 F.2d 72 (D.C. Cir. 1980); Network Project v. F.C.C., 511 F.2d 786, 797 (D.C. Cir. 1975).

16 *Orbit Deployment Plan*, 84 F.C.C.2d at 600, 602.

17 *Id.*

18 *Id.* at 601.

19 *Id.* at 602 ("Having decided on a competitive, open entry policy for the domestic satellite market, we were concerned that a domestic satellite operator be able to implement its system promptly without needless and protracted administrative delays . . ."); *see also* U.S. v. FCC, 652 F.2d at 95-96.

20 *Orbit Deployment Plan,* 84 F.C.C.2d at 601 ("The development of a competitive market structure . . . depends on the Commission's ability to accommodate a sufficiently large number of satellites in suitable orbital locations.").

21 *Id.* at 596 ("applicants are therefore put on notice that they may subsequently be required to cease operation of twelve 36 MHz transponder satellites from independent orbital locations if an insufficient number of orbital locations are available to accommodate higher technology (capacity) satellites . . .").

22 *See generally* NATIONAL TELECOMMUNICATIONS AND INFORMATION ADMINISTRATION REPORT (1981) (discussion of competitive market policies, trade issues, and telecommunications and information policies).

23 *See* Licensing of Space Stations, *supra* note 4.

24 *See supra* notes 16-23 and accompanying text.

25 International Telecommunication Convention, October 25, 1973, art. 33, 28 U.S.T. 2495, 2529-30, T.I.A.S. No. 8572; *see also* Licensing of Space Stations, *supra* note 4 (would amend arts. 33, 34 of the Convention, adding as relevant considerations the geographical situation of individual countries and special needs of developing countries).

26 *See* International Telecommunication Convention, arts. 4(c), (e), 28 U.S.T. at 2512, 2513; *see also* G. CODDING & A. RUTKOWSKI, THE ITU IN A CHANGING WORLD (1982), D. LEIVE, INTERNATIONAL TELECOMMUNICATIONS AND INTERNATIONAL LAW (1970).

27 Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, opened for signature Jan. 27, 1967, Art. I, 18 U.S.T. 2410, 2412-13, T.I.A.S. No. 6347, 610 U.N.T.S. 205 [hereinafter cited as Outer Space Treaty]. *See generally* C. CHRISTOL, THE MODERN INTERNATIONAL LAW OF OUTER SPACE at 12-58 (1982) (definitive legal analysis of the Outer Space Treaty); Galloway, *The History and Development of Space Law: International Law and United States Law,* 7 ANNALS OF AIR AND SPACE L. 295 (1982) (cogent summary of the evolution of space law).

28 *See* The Bogota Declaration (Dec. 3, 1976), *reprinted in* 6 J. SPACE L. 193 (1978). Geostationary satellites lie in the plane of the earth's equator, directly above the equatorial states. Those states have argued that the geostationary orbit is an integral part of their territory because the equatorial plane is a gravitational phenomenon caused by the earth.

29 *See, e.g.,* Gorove, *Geostationary Orbit: Issues of Law and Policy,* 73 AM. J. INT'L L. 444, 447 (1979).

30 Agreement Relating to the International Telecommunications Satellite Organization "INTELSAT", Aug. 20, 1971, preamble & art. II, 23 U.S.T. 3813, 3814, 3818, T.I.A.S. No. 7532, [hereinafter cited as INTELSAT Agreement]; *see also* R. COLINO, THE INTELSAT DEFINITIVE ARRANGEMENTS: USHERING IN A NEW ERA IN SATELLITE TELECOMMUNICATIONS (1973).

31 Convention on the International Maritime Satellite Organization "INMARSAT," Sept. 3, 1976, art. 7, 34 U.S.T. 1, 5, T.I.A.S. No. 9605; *see also* Jasentuliyana, *The Establishment of an International Maritime Satellite System,* 2 ANNALS OF AIR & SPACE L. 323, 327 (1977).

32 *See* Address by Brigadier General Martin Menter (U.S.A.F. Ret.), A.B.A. Institute on Aviation Litigation and Space Law (May 28, 1982) (assessment of U.S. policy with regard to space industrialization activities).

33 *But cf.* Paper Presented by Harvey Levin, 95th Mtg. of the American Economic Ass'n (Dec. 29, 1982) (contrasting regional and global strategies in orbit spectrum management).

34 *See Notice of Inquiry-Space WARC, supra* note 2.

35 The international legal order mandates this result because universal sharing of orbit/spectrum, the premise of equitable access, is more sensitive to the existence of access oppor-

tunity than to the particular technical nature of requested access opportunities. *See* Levin, *The Political Economy of Orbit Spectrum Leasing*, this volume.

[36] *See* WARC-79, *supra* note 7, at RR 428A ("all technical means available shall be used to reduce, to the maximum extent practicable, the radiation over the territory of other countries. . . .").

[37] *See id.* at 156-57. Briefly, coordination involves the publication of a proposed satellite system's technical parameters, a subsequent exchange of prescribed information among ITU administrations whose communications services may cause mutual interference and, if necessary, negotiations to alter the technical or operational characteristics of some or all systems to eliminate interference. *See also* Colino, *International Cooperation Between Satellite Systems: An Overview of Current Practices and Future Prospects*, 5 J. SPACE L. 65, 89-90 (1977).

[38] *See* WARC-79, *supra* note 7, at App. 29A. Richard Butler, the Secretary-General of the ITU, has noted that the plan incorporates "a collection of all the technical parameters necessary for the purpose of ensuring the optimum use of available resources." Butler, *World Administrative Radio Conference for Planning Broadcasting-Satellite Service*, 5 J. SPACE L. 93, 98 (1977). Under this plan, specific countries are assigned the frequencies and orbital positions they may use for satellite broadcasting. The assignments derive from dividing the bandwidth into many channels of lesser, more practical bandwidths; associating each group of channels with an orbital position; and granting states the right to specific channels at specific orbital positions. Most countries receive four channels, although depending on size, population and foreseeable communication needs, some states are granted as many as sixty-five (the U.S.S.R.) and as few as two (Brunei). *See* Mili, *World Administrative Radio Conference for the Planning of the Broadcasting-Satellite Service in Frequency Bands 11.7-12.2 GHz (in Regions 2 and 3) and 11.7-12.5 GHz (in Region 1)*, in PROCEEDINGS OF THE TWENTIETH COLLOQUIUM ON THE LAW OF OUTER SPACE 346 (1978); *see also* Johnsen, *Service Date for Fixed Satellite Pressed*, AVIATION WEEK & SPACE TECHNOLOGY, Sept. 10, 1979, at 75. The plan was implemented for Regions 1 and 3. (Region 1 covers Europe, Africa, the Soviet Union, Turkey, and the Mongolian People's Republic; Region 3 covers Asia, Oceania, Australia and New Zealand).

The decision to extend the assignment plan to Region 2 (covering the western hemisphere) was postponed, largely owing to American resistance. The matter will be decided at the 1983 regional conference. *See* ITU, FINAL ACTS OF THE WARC FOR THE PLANNING OF THE BROADCASTING-SATELLITE SERVICE Res. H (1977). The goal of that conference is to "draw up a detailed plan for the orbit spectrum resource [which] provide[s] for the detailed assignment of the orbital positions and frequency channels available, ensuring that the broadcasting-satellite service requirements of the various administrations are met in an equitable manner satisfactory to all the countries concerned." The plan should guarantee each state four channels. Above this minimum, the special characteristics of the state (*e.g.*, size, time zones, language differences) will be taken into account. *Id.* at Res. HH.

[39] *See* Rothblatt, *Satellite Communication and Spectrum Allocation*, 76 AM. J. INT'L L. 56 (1982) (analysis of the principle of maximum channel dispersion—which underlies most communications law and policy and could therefore explain the structural identity of open entry and equitable access doctrines).

[40] The principle of channel dispersion is achieved in practice by providing opportunities for new initiatives in satellite communications. *Id.* at 58-65; *see also* Paper Presented by Stephen Gorove, Hague Academy of International Law (Nov. 15, 1982) (discussing the utilization of space in light of the concept of the common heritage of mankind).

[41] WARC-79, *supra* note 7, at 74-75.

[42] The author is indebted to Mr. Michael Jeruchim, Vice President at General Electric Co., for his comparative assessment of orbit/spectrum management options. *See* Public Docket File No. 80-741 (F.C.C. 17714, 1983) (prepared for the FCC's Space WARC Advisory Subcommittee).

43 *Notice of Inquiry-Space WARC, supra* note 2 (Comments of Comsat); ITU, CCIR Working Paper 4/1, Doc. No. 4/286-E at ch. 6 (1981)(method 1) [hereinafter cited as CCIR Working Paper].

44 *See supra* note 38.

45 *See, e.g.*, Burgess & Schmidt, *Satellite Constellations Using Multiple-Beam Satellites with Onboard-Switched IDMA*, in SATELLITE COMMUNICATIONS: FUTURE SYSTEMS 468 (D. Jarret ed. 1976); Yeh & Reudnik, *The Organization and Synchronization of a Switched Spot-Beam System*, in DIGITAL SATELLITE COMMUNICATIONS 191 (D. Staelin ed. 1978).

46 CCIR Working Paper, *supra* note 43 (method 2).

47 *See supra* notes 37 & 38.

48 CCIR Working Paper, *supra* note 43 (method 3).

49 All plans proposed to date specify a floor, or minimum allotment for each state. *See, e.g., supra* note 38; *see also* Rutkowski, *The 1979 World Administrative Radio Conference: The ITU in a Changing World*, 13 INT'L LAW. 289, 316, 324 (1979)(allotment results of 1974 Maritime Conference and allotment results of 1977 Broadcasting Satellite Conference).

50 CCIR Working Paper, *supra* note 43 (method 4).

51 *Id.* (method 5).

52 *Notice of Inquiry-Space WARC, supra* note 2 (comments of Comsat).

53 *See* M. McDOUGAL, H. LASSWELL & I. VLASIC, LAW AND PUBLIC ORDER IN SPACE (1963) (review of other international space venture concepts).

54 *See* Rothblatt, *International Cooperation in Regulating 12 GHz Band Geostationary Satellite Communications: Technology, Geopolitics and the Common Heritage of Mankind*, in PROCEEDINGS OF THE TWENTY-THIRD COLLOQUIUM ON THE LAW OF OUTER SPACE 189, 193 (1980).

55 *See* INTELSAT Agreement, *supra* note 30, at art. III(e), 23 U.S.T. 3820.

56 *See* J. PELTON, GLOBAL TALK 291-97 (1981) (lists and describes those smaller states which are in the process of acceding to the INTELSAT system for domsat service, or which plan to in the near future).

57 *See* Robinson, *Regulating International Airwaves: The 1979 WARC*, 21 VA. J. INT'L L. 1, 45 n.139 (1980); Rutkowski, *Six Ad-Hoc Two: The Third World Speaks Its Mind*, SATELLITE COMMUNICATIONS, Mar. 1980, at 17. *See* Jackson, *The Orbit/Spectrum Resource: Market Allocation of International Property*, TELECOM. POL'Y, Sept. 1978, at 179; Levin, this volume.

58 Robinson, *supra* note 57, at 4; *see also* Rothblatt, *ITU Regulation of Satellite Communications*, 18 STAN. J. INT'L L. 1, 15 n.72 (1982)(quotes position of Indian delegate to WARC-1979).

59 *See supra* note 38.

60 *See supra* notes 46-51 and accompanying text.

61 *See supra* notes 13-23 and accompanying text.

62 *See Notice of Inquiry-Space WARC, supra* note 2, at para. 15 ("The export potential for American technology and equipment represents a significant U.S. interest that could be affected at the Space WARC. It is in the U.S. interest to advocate geostationary-satellite orbit resource management mechanisms that allow innovative [U.S.] equipment and services to be readily introduced into a growing domestic and international market.").

63 *See id.* at para. 18 ("U.S. interests also include our relationships with other Administrations. These relationships affect our ability to achieve the U.S. objectives for the [Space WARC] conference and to advance U.S. telecommunication markets worldwide. It is, therefore, in the U.S. interest to develop proposals that also satisfy other Administrations' telecommunications requirements.").

64 *See* Galloway, *Consensus Decisionmaking By The United Nations Committee on the Peaceful Uses of Outer Space*, 7 J. SPACE L. 3 (1979).

65 *See* CHRISTOL, *supra* note 27, at 12-49, 246-360, 435-521 & 547-755 (excellent and well-researched examples).

[66] *See* WARC-79, *supra* note 7, at Res. 3. The relevant portions of the resolution are reprinted *supra* note 11.