A LOST CONNECTION: GEOSTATIONARY SATELLITE NETWORKS AND THE INTERNATIONAL TELECOMMUNICATION UNION

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ABSTRACT

Over the past forty years, communications and broadcasting via geostationary satellite systems have become integral and valued parts of the global information infrastructure. International communications and data distribution from orbit, however, have been hobbled by regulatory mechanisms administered under the auspices of the International Telecommunication Union. The author examines the current regime and the problems confronting the industry, discusses potential solutions, and proposes that the present method for allocating frequencies and orbital positions for geostationary satellite networks can be substantially enhanced through an auction process and the addition of select regulatory changes.

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I. INTRODUCTION

For most of its history, space activity has been the province of government. From the earliest practical experiments with rockets, the high frontier has been perceived as a forum for advancing a wide variety of national goals. It was, and in many cases still is, a means for promoting patriotic fervor,[1] enhancing prestige abroad,[2] advancing technology,[3] projecting force over great distances,[4] improving security both militarily[5] and through international cooperation,[6] and promoting the general welfare through public services such as weather forecasting[7] and geological surveying.[8] While the potential for commercial activity involving outer space

1. Karl Leib, *International Competition and Ideology in U.S. Space Policy*, *at* http://csf.colorado.edu/isa/isn/24-3/1560_5leib.htm (last visited Oct. 18, 2000).

2. *Id.*

3. *Id.*

4. Walter A. McDougall, *The Heavens and the Earth: A Political History of the Space Age*, *in* OUTER SPACE: PROBLEMS OF LAW AND POLICY 3 (Glenn Reynolds & Robert Merges eds., 2d ed. 1997).

5. Reconnaissance by orbital spacecraft had been suggested by 1946. DOUGLAS AIRCRAFT CO., REPORT NO. SM11827, PRELIMINARY DESIGN OF AN EXPERIMENTAL WORLD-CIRCLING SPACESHIP (1946).

6. *See* Leib, *supra* note 1; *see also* VERNON VAN DYKE, PRIDE AND POWER: THE RATIONALE OF THE SPACE PROGRAM 7 (1964).

7. The RAND Corporation recognized shortly after World War II that space represented an ideal vantage point for weather observation platforms. McDougall, *supra* note 4, at 4. The first weather satellite was launched fourteen years later. ELI GINZBERG ET AL., ECONOMIC IMPACT OF LARGE PUBLIC PROGRAMS: THE NASA EXPERIENCE 115 (1976).

8. GINZBERG ET AL., *supra* note 7, at 189-90.

was recognized relatively early on,[9] and there were occasionally dramatic successes,[10] commercial investments represented only a tiny portion of total space expenditures. Even this sliver devoted to commercial enterprise involved substantial government participation, with the state assuming the role of sole proprietor, service provider, or partner.[11]

The world is a far different place today. The modern global economy has come to depend upon the rapid manipulation and transfer of substantial amounts of information. The systems that facilitate this information economy have grown dramatically in both size and importance. The field of space communications is no exception. In the United States alone, commercial space revenues reached 7.1 billion dollars in 1999.[12] Commercial space activity, primarily voice and data relay and broadcasting, once constituted a minuscule fraction of all space spending. It presently comprises the majority of global annual space expenditures.[13] Growth in commercial space launches is expected to increase an additional fifteen percent this year.[14]

Although the technological and financial environments facing space communications have changed dramatically over the decades, the International Telecommunication Union ("ITU"), the organization responsible for managing all aspects of the activity among the community of nations, has remained a constant fixture. Formed in response to the regulatory chal-

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9. *See* Wiesner Committee, *Report to the President-Elect of the Ad Hoc Committee on Space*, *at* http://www.hq.nasa.gov/office/pao/History/report61.html (last visited Nov. 12, 2000).

10. The first operational communications satellite, Syncom 3, was used to broadcast the 1964 Summer Olympic games from Tokyo. Boeing Satellite Systems, Inc., *Syncom—The World's First Geosynchronous Communications Satellite*, *at* http://www.hughespace.com/factsheets/376/syncom/syncom.html (last visited Nov. 12, 2000).

11. *See* Communications Satellite Act of 1962, 47 U.S.C. §§ 701-744 (1994). Though the U.S. government held no ownership interest in the entity to be known as the Communications Satellite Corporation, it did have substantial representation on the corporation's board and retained extensive regulatory authority over the industry. *See* DELBERT D. SMITH, COMMUNICATION VIA SATELLITE: A VISION IN RETROSPECT 108-11 (1976).

12. David H. Napier, *1999 Year-end Review and 2000 Forecast—An Analysis*, *at* http://www.aia-aerospace.org/departments/stats/yrendr99.html (last visited Oct. 18, 2000).

13. Kenneth C. Brill, *Remarks to the International Space Business Assembly*, *at* http://www.reston.com/nasa/state/11.02.99.isba.brill.html (last visited Oct. 18, 2000).

14. ASSOCIATE ADMINISTRATOR FOR COMMERCIAL SPACE TRANSPORTATION AND THE COMMERCIAL SPACE TRANSPORTATION ADVISORY COMMITTEE, FEDERAL AVIATION ADMINISTRATION, COMMERCIAL SPACE TRANSPORTATION FORECASTS 2 (2000) [hereinafter 2000 COMMERCIAL SPACE TRANSPORTATION FORECAST].

lenges of nineteenth century technologies, the ITU has been hard pressed of late to adapt its procedures to the new challenges posed by rapid growth in the telecommunications industry. Its present approach to regulation has hindered development of communications systems and engendered unnecessary friction among the community of nations.

Part II of this Article recounts the physical and technological parameters of the outer space environment with regard to satellite communication. Part III details the history and structure of the ITU and the process employed by the organization for regulating geostationary satellite networks. Part IV examines the current international legal and policy regime affecting geostationary communications with a view towards its efficiency, equity, and effect on international relations. Lastly, Part V discusses the enhancement of the regulatory process through the application of a variety of mechanisms, including market-based allocation via auctions, regulatory reforms, and new approaches to dispute resolution.

II. PHYSICAL AND TECHNICAL PARAMETERS AFFECTING SATELLITE COMMUNICATION

A. The Geostationary Orbit

It was October 1945. World War II had ended a mere two months before and the possibilities of the technologies spawned by the conflict were very much on the mind of an officer in the British Royal Air Force, Arthur C. Clarke. In a seminal article for *Wireless World*,[15] Clarke recognized that the then nascent technology of the space age could make use of Kepler's laws of planetary motion to supply cost-effective communications across the globe.[16]

The principle is ingenious in its application. The force of gravity exerted by one object on another decreases with the square of the distance between them.[17] Any object will orbit a more massive body, such as a

15. Arthur C. Clarke, *Extra Terrestrial Relays: Can Rocket Stations Give World Wide Radio Coverage?*, WIRELESS WORLD, Oct. 1945, *reprinted in* LAUNCHSPACE, Jan.-Feb. 1999, at 305, 305-08.

16. Kepler's Laws state: (1) each planet in the solar system travels in an ellipse with the sun at one focus of the ellipse; (2) the line between the sun and any planetary body sweeps over equal areas in equal time intervals; and (3) the ratio of the cube of the semimajor axis to the square of the period of a planet's revolution is the same for each planet. *See generally* JOHANNES KEPLER, NEW ASTRONOMY (1609); JOHANNES KEPLER, THE HARMONY OF WORLDS (1619).

17. *See* ISAAC NEWTON, MATHEMATICAL PRINCIPLES OF NATURAL PHILOSOPHY (1686).

planet, when the centrifugal force generated by its velocity exactly balances the force of gravity.[18] Given the marked reduction of gravitational effects with distance, an object in orbit around the Earth needs significantly less speed to maintain a higher orbit than a lower one.

For example, the International Space Station typically orbits at 250 miles above the surface[19] and makes one complete orbit approximately every ninety minutes.[20] In contrast, a satellite placed in an orbit 22,300 miles above the Earth will take precisely one day to complete a single circuit. Such an object is considered to be geosynchronous.[21] If a spacecraft is placed in this 22,300 mile orbit directly above the Earth's equator, the satellite's orbit is not merely synchronized with the Earth's rotation but will appear from the surface to be stationary. For this reason, this specific orbit is commonly known as the "geostationary orbit."[22] The illustration shows the relative position and coverage of a geostationary craft in orbit around the Earth:[23]

18. *See id.*

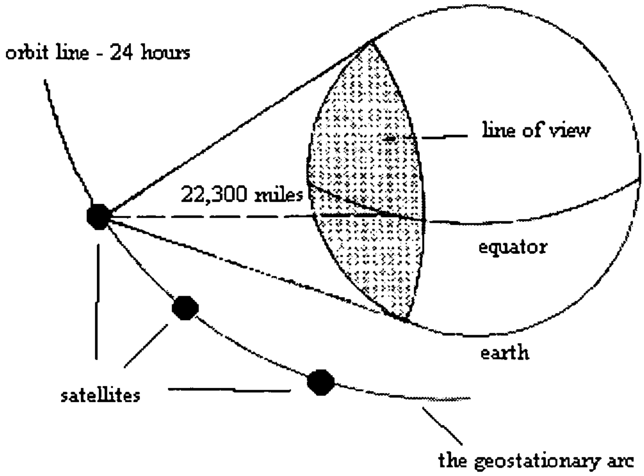
19. The orbit of the International Space Station actually varies by fifty miles, ranging from a maximum altitude of 275 miles to a minimum of roughly 225 miles as the spacecraft's orbit decays over time. *See* Jeff Hunt et al., *International Space Station, at* http://www2.satellite.eu.org/sat/vsohp/iss.html (last visited Oct. 18, 2000).

20. National Aeronautics & Space Administration, *International Space Station, at* http://www.hq.nasa.gov/osf/funstuff/stationoverview/npage1.html (last visited Oct. 18, 2000).

21. INTERNATIONAL TELECOMMUNICATION UNION, ITU RADIO REGULATIONS 1998 [hereinafter RADIO REGULATIONS], *reprinted in* 2 SPACE LAW: BASIC LEGAL DOCUMENTS, at C.IV.2.1 (Karl-Heinz Böckstiegel & Marietta Benkö eds., 1999) [hereinafter SPACE LAW].

22. A geostationary orbit is distinguished from a merely geosynchronous orbit. Any orbit of 22,300 miles in height, regardless of its inclination to the equator is considered geosynchronous given its twenty-four hour period, but as a general rule, only a satellite with an inclination of zero degrees can be considered geostationary. Any inclination placed on the satellite's orbit will give the appearance of the satellite alternately traveling northward and southward across the sky. All geostationary orbits are geosynchronous, but not all geosynchronous orbits are geostationary. For a formal definition of "geostationary orbit," see *id.*

23. Molly Macauley & Paul R. Portney, *Property Rights in Orbit: Slicing the Geostationary Pie*, REGULATION, July/Aug. 1984, at 15. Reprinted with permission.



A geostationary satellite has an unparalleled view. Each craft has unobstructed access to as much as forty percent of the Earth's surface.[24] In addition to permitting cost-effective communications across vast distances, geostationary satellites have proven ideal for the distribution of broadcast signals to large regions. They are also convenient platforms for various types of remote sensing. For example, weather forecasting is heavily reliant on geostationary assets and military early warning craft make use of the orbit.[25] As of 1997, there were nearly one thousand craft conducting activities in geostationary orbit.[26]

24. Martin A. Rothblatt, *Satellite Communications and Spectrum Allocations*, 76 AM. J. INT'L L. 56 (1982). The maximum area of visibility for a geostationary satellite is the area of a circle with its center at the equator directly below the satellite and having a radius of 9,050 kilometers. This maximum area is restricted somewhat by the ability of Earth stations at the margins of the visible area to receive transmissions from the orbiting satellite due to the extremely low angle of placement of the receiving antenna. Inclement weather over the receiving stations can further reduce the maximum useful service area of a satellite system. *See* MILTON L. SMITH, INTERNATIONAL REGULATION OF SATELLITE COMMUNICATION 9 (1990).

25. *See* Joseph T. Page, *Early Warning Overview*, *at* http://www.zianet.com/jpage/spysats/earlywarning/overview.html (last visited Oct. 18, 2000).

26. ITU data indicate that 998 satellites were registered as of September, 1997. International Telecommunication Union, *Satellite Systems—From VSAT to GMPCS*, *at* http://www.itu.int/plweb-cgi/fastweb?getdoc+view1+www+15667+20++geostationary%20position (last visited Oct. 18, 2000).

B. Limitations on the Use of Geostationary Orbit

A variety of factors hinder the continued use of the geostationary orbit. In particular, the medium is restricted by (1) the physical nature of the geostationary orbit, (2) the industry's technological capabilities, (3) the realities of the telecommunication marketplace, and (4) regulatory limitations imposed by the international community.

The confluence of physical attributes that make the geostationary orbit so desirable are confined to an extremely small volume, particularly in comparison to other regions of near-Earth space. In order to maintain synchronicity with the Earth's rotation, there is little room for discrepancies between a satellite's actual position and the theoretical ideal as small variances will eventually produce significant drift if left uncorrected.[27] Most geostationary satellites rarely stray beyond a thirty kilometer band that encompasses the nominal altitude of the geostationary position.[28] Although satellites are permitted some measure of drift in other dimensions, the hazard of such drift makes multiple placement within the same area of space untenable.[29] Consequently, for the purposes of most policy discussions, the geostationary orbit can be considered a one-dimensional line describing a great circle around the planet.[30]

This scarcity of useful volume is exacerbated by other physical and market realities. For example, each satellite in geostationary orbit is usually kept in its position within an accuracy of approximately one-tenth of one degree.[31] Absent any other limitations on the availability of orbital positions, a maximum of 1,800 satellites could be placed without posing a navigational hazard to others.[32]

However, this theoretical maximum grossly overestimates the possible number of useful positions. Not all satellite positions are created equal; only a subset of those available slots are well-suited for communications.

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27. *See* T. S. Kelso, *Basics of the Geostationary Orbit*, *at* http://www.celestrak.com/columns/v04n07/ (last visited Oct. 18, 2000).

28. *See* LARRY MARTINEZ, COMMUNICATION SATELLITES: POWER POLITICS IN SPACE 56 (1985).

29. Kelso, *supra* note 27.

30. SMITH, *supra* note 24, at 6. The determination of whether a satellite is geostationary or geosynchronous is one of degree rather than of strict definition. Changing approaches and capabilities with regard to satellite stationkeeping constantly alter the perception of the limits of the geostationary orbit. The determination of whether or not a spacecraft operates within the geostationary zone can have significant consequences due to the general signal priority given to geostationary transmissions over signals emanating from non-geostationary craft. *Id.* at 57.

31. *Id.*

32. *Id.*

For example, the distance between the North American and European coasts is so great that only a relatively tiny portion of the orbital arc can be used for the purpose of acting as a transatlantic relay.[33] The Pacific and Indian Oceans pose similar, if slightly less serious, limitations.[34] Likewise, orbital positions having broad coverage of continental regions are more desirable than those that can access only smaller portions of those land masses.

Despite being one of the most cost-effective means for communicating and distributing information over large areas, a satellite system is, by any measure, extremely expensive. All other variables being equal, a satellite capable of simultaneously viewing the east and west coasts of the United States, for example, will be more valuable than one in an orbit from which only a portion of the United States is visible. A single craft with the broadest geographic and population coverage can maximize its potential user base and thereby distribute its capital costs across a larger number of potential clients.

The arrangement of satellites along the geostationary orbit reflects the impact of these physical and financial realities. Systems tend to cluster along small arcs above oceans and continents. Still, though physical proximity is an important factor, it is not the predominant element limiting the availability of positions for communications satellites in geostationary orbit.

Interference is an even more serious concern. Almost from the very beginning, interference has been a thorny issue for radio communication.[35] The problem is basically a matter of frequency.[36] If two different transmissions are made in the same geographic area at the same frequency, they will interfere with each other, thereby leading to deterioration or even loss of the signals.[37] In order to operate in an environment with a large number

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33. The available arc for placement of a geostationary relay over the Atlantic Ocean is a mere one and a half degrees. *See id.* at 10.

34. The available orbital arc for these areas is three degrees. *See id.*

35. *See* International Telecommunication Union, *Sharing the Spectrum: A Matter of International Negotiations*, *at* http://www.itu.int/newsarchive/press/WRC97/Sharing-the-spectrum.html (last visited Nov. 2, 2000).

36. "Frequency" is the term used to describe the number of times an electromagnetic wave cycles per second. A single cycle in one second is called a hertz (Hz); one thousand cycles in the same period of time is termed a kilohertz (KHz); one million cycles a second is referred to as a megahertz (MHz); and one billion hertz is a gigahertz (GHz).

37. *See* Roscoe M. Moore, *Business-Driven Negotiations for Satellite System Coordination: Reforming the International Telecommunication Union to Increase Commercially Oriented Negotiations over Scarce Frequency Spectrum*, 65 J. AIR L. & COM. 51, 56 (1999).

of users, communications systems are forced to use different frequencies to avoid this interference. Unfortunately this does not solve the problem, as demand far outstrips the available supply of useful frequencies.

Some of the interference problem is purely a matter of physics. Certain frequencies simply cannot easily penetrate the layers of the Earth's atmosphere or magnetic field, making them available for some forms of terrestrial communications, but unsuitable for use in a space-based relay system.[38] Other frequencies have been set aside despite their technical availability for use in communications because they are ideally suited for conducting astronomical research.[39] Moreover, unlike many other services which, due to their limited power and geographic coverage can reallocate the same frequency in other regions, geostationary communications has, by the very nature of its broad coverage and high power, limited opportunity for reuse.

The most significant restriction on frequency availability, however, comes not from the laws of physics, but rather from the laws of competition. The demand for communications services continues to expand at a remarkable rate.[40] All manner of terrestrial communications and broadcast services take up wide swaths of the spectrum. Space-based services unrelated to geostationary communications consume still more.[41] Mobile satellite services have recently made inroads into frequencies previously set aside for geosynchronous systems.[42] Competition for the allocation of frequencies among the various uses is always intense and limits the ability of services to expand greatly through the acquisition of additional spectra.

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38. Frederick O. Maia, *The Remarkable Radio Wave*, *at* http://www.lerc.nasa.gov/WWW/MAEL/ag/agprop2.htm (last visited Nov. 13, 2000).

39. NATIONAL RESEARCH COUNCIL, VIEWS OF THE COMMITTEE ON RADIO FREQUENCIES CONCERNING FREQUENCY ALLOCATIONS FOR THE PASSIVE SERVICES AT THE 1992 WORLD ADMINISTRATIVE RADIO CONFERENCE, http://www.nationalacademies.org/bpa/corf/view1195.html (last visited Nov. 13, 2000).

40. *See* Trevor Barr, *The Communications Revolution: Paradoxes of Growth*, *at* http://www2.apii.or.kr/cc/document/hrd/english/hrd_sympo_1_2.html (last visited Nov. 2, 2000).

41. The L Band, with a frequency range of one to two GHz, is reserved for mobile satellite services. The S Band, using the two to four GHz range, is employed for satellite based navigation systems. The X Band is employed for military communications and has been allotted the frequencies from eight to twelve GHz. *See* Donald J. Dichmann & Troy A. Thrash, *The GEO-LEO Connection*, LAUNCHSPACE, Feb.-Mar. 1998, at 31.

42. *See* International Telecommunication Union, *World Radiocommunication Conference 2000: The Main Results*, *at* http://www.itu.int/plweb-cgi/fastweb?getdoc+view1+www+28911+3++geostationary%20satellite%20frequencies (last visited Oct. 13, 2000).

The fixed communication satellite services are limited to three frequency bands—the C band, Ku band, and Ka band.[43] The C Band has been in use the longest for satellite services.[44] The greatest benefit to users of the C band is cost. The technology for producing C Band systems is mature and equipment costs are relatively low. On the other hand, the wavelength of the C Band signals is so long that large antennas are needed to receive the signal. The Ku band was opened to satellite communications in response to the increasing clutter found within the C band. Systems operate at a somewhat higher frequency, allowing for significantly smaller receiving antennas that have proven quite popular for use in direct broadcast systems. The Ka band has only relatively recently been employed for communications services. There are two principal advantages to using this band. First, because it has not been previously made available, the frequencies in this band are relatively clear.[45] Second, the higher frequencies allow for more information to be transmitted at any one time.[46] All other variables remaining constant, the Ku and Ka bands are more efficient at transmitting information.[47] This can be extremely valuable given the constant market demand for greater bandwidth and the high initial capital costs for manufacturing and launching space-based communication platforms.[48]

At present, 164 satellites operate in the C band, 416 in the Ku band and 12 in the Ka band.[49] Despite the physical, institutional, and market limitations of geostationary satellite systems, demand for them continues to grow. The International Telecommunication Union anticipates that the number of geostationary craft will nearly double by September, 2003.[50]

43. Dichmann & Thrash, *supra* note 41, at 31.

44. SMITH, *supra* note 24, at 8.

45. Dichmann & Thrash, *supra* note 41, at 31.

46. *Id.*

47. Each wave cycle is capable of transmitting a discrete unit of information. Consequently, the more cycles which can be transmitted in a set length of time, the more information that wavelength can carry during that time. Since higher frequencies are measured in greater numbers of cycles per second, they can transmit more information than lower frequencies. MARTINEZ, *supra* note 28, at 62.

48. Construction and launch of a single geostationary craft can approach one billion dollars. Saleem Bhatti, Lecture Notes for M.Sc. Data Communication Networks and Distributed Systems D51—Basic Communications and Networks, *at* http://www.cs.ucl.ac.uk/staff/S.Bhatti/D51-notes/node24.html (last visited Nov. 13, 2000).

49. Arifin Nugroho, *Geostationary Orbit Optimization in the Future Space Commercialization*, *at* http://www.indosat.net.id/elektro/assi03a.html (last visited Oct. 18, 2000).

50. International Telecommunication Union, *supra* note 26.

Moreover, those satellites launched today tend to be larger and employ far more transponders than past communications satellites.[51] The U.S. Department of Transportation anticipates further satellite mass increases throughout the next decade.[52] The highly variable capabilities of the three frequency bands and the concomitant variations in economic value are poorly managed under the current regulatory system, and absent change, demand for frequencies and geostationary locations will continue to outstrip supply.

III. THE INTERNATIONAL TELECOMMUNICATION UNION

The organization responsible for international administration of geosynchronous orbital slots and frequencies for all satellite communications is the International Telecommunication Union. With its beginnings in the middle of the nineteenth century, the ITU is the oldest international organization still in existence.[53] As with other institutions of such long provenance, the current structure and policies of the ITU have evolved over time but nevertheless remain strongly influenced by its history.

A. History of the ITU

The ITU owes it birth to the development of the telegraph.[54] The telegraph, first introduced in England in 1837 and the United States in 1844, was quickly recognized as a revolution in communications.[55] Ten years after its introduction in the United States, most European nations had established their own telegraph networks.[56] Unfortunately, while the various domestic telegraphic systems operated efficiently within their own borders, international messages encountered difficulties due to differences in standards across national telegraphic networks. A telegraph message sent to a neighboring state had to be transmitted to the border, transcribed,

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51. 2000 COMMERCIAL SPACE TRANSPORTATION FORECAST, *supra* note 14, at 11.

52. *Id.*

53. Although a plethora of bilateral and multilateral agreements concerning international mail carriage predate the telegraph agreements, the international organization presently known as the Universal Postal Union was not established until the 1874 Congress of Berne. Fred H. Cate, *Global Information Policymaking and Domestic Law*, 1 IND. J. GLOBAL LEGAL STUD. 467, 469 (1994).

54. George A. Codding, Jr., *The International Telecommunication Union: 130 Years of Telecommunications Regulation*, 23 DENV. J. INT'L L. & POL'Y 501, 502 (1995).

55. David Paull Nickles, *Telegraph Diplomats: The United States' Relations with France in 1848 and 1870*, *at* http://muse.jhu.edu/demo/tech/40.1nickles.html (last visited Nov. 10, 2000).

56. *See* JAMES G. SAVAGE, THE POLITICS OF INTERNATIONAL TELECOMMUNICATIONS REGULATION 28 (1989).

physically carried across the frontier, and then transmitted to its final destination via the receiving state's system.[57]

Efforts by individual governments to eliminate the time and expense created by this inefficient process resulted in a series of bilateral and multilateral agreements. These accords sought to standardize telegraph systems and codes among the signatories and encourage the linking of national systems.[58] Though not the first of these agreements, the convention that formed the Western European Telegraph Union was the template from which the ITU would emerge.[59]

The ITU can trace its official existence to the International Telegraph Convention of 1865.[60] The International Telegraph Union, as the organization was then called, was in many ways merely a geographic expansion of earlier accords.[61] Ten years later, the organization, now consisting of twenty-four state Members and two-thirds as many officially recognized private entities,[62] established a revision process based on relatively low-level administrative conferences that continue to this day.[63] A decade after that, regulatory oversight of the nascent telephone system was given to the body,[64] though telephone standards were not seriously integrated into the ITU until the London Telegraph Conference of 1903.[65]

The first efforts at regulating wireless radio services were made during that same year.[66] The Berlin Preliminary Conference ("Preliminary Conference") was called in response to conflicts among competing technologies that resulted in potential safety hazards and inconsistent service.[67] Interestingly, despite the use of the telegraph-derived Morse code as the preferred method of transmission, the radio was not regulated under the auspices of the existing International Telegraph Union. Instead, the Preliminary Conference established a new organization called the Radio-telegraph

57. *Id.*

58. *See* FRANCIS LYALL, LAW & SPACE TELECOMMUNICATIONS 397 n.6 (1989).

59. *See* Telegraph Convention, Sept. 1, 1858, 119 Consol. T.S. 461.

60. International Telegraph Convention, May 17, 1865, 130 Consol. T.S. 198.

61. *See* LYALL, *supra* note 58, at 313.

62. SAVAGE, *supra* note 56, at 30.

63. International Telegraph Convention and Regulations, July 22, 1875, 148 Consol. T.S. 416.

64. Regulations in Execution of the International Telegraph Convention of July 22, 1875, Sept. 17, 1885, 165 Consol. T.S. 212.

65. *See, e.g.*, Regulations Annexed to the Revised International Telegraph Convention, July 10, 1903, 193 Consol. T.S. 327.

66. *See* The Final Protocol to the Preliminary Conference at Berlin on Wireless Telegraphy, Oct. 14, 1903, 194 Consol. T.S. 46.

67. *See* LYALL, *supra* note 58, at 314.

Union ("RTU") to administer the technology.[68] Though a separate entity, the RTU mirrored the organizational structure of the International Telegraph Union.[69]

The new radio medium presented many of the same issues that affected the fixed wire services. The Preliminary Conference established the objective of interoperability of equipment and considered the issue of taxation.[70] The challenge posed by interference, however, differed markedly from past issues faced by negotiators. The limits of the early technology severely constrained the utility of early transmitters. Consequently, there was a desperate need to impose restrictions upon the use of frequencies and the power output of transmitters to minimize interference.[71] Efforts were even made to limit the nature of the communications so as to ensure clear signals for higher priority messages.[72]

Although the RTU used the ITU's administrative support to help maintain its own operations,[73] and the two organizations shared similar structures, the two agencies remained separate entities throughout the first quarter of the twentieth century. By the 1920s, however, the possibility of achieving economies of scale was not lost on the Members of the RTU.[74] The coincidental meeting of both groups in Madrid in 1932[75] proved to be the perfect opportunity to merge them. The joint meetings resulting from the accessibility of representatives produced a single instrument which settled on the basic principles attributable to the technologies administered by the two groups.[76]

The first major conference after World War II made major strides toward shaping the ITU into an organization resembling its current form.[77] The Members agreed to pursue status as a specialized agency of the

68. *See id.*

69. *See id.*

70. *See id.* at 315.

71. *See id.*

72. *See id.*

73. *See id.* at 319.

74. The radiocommunications conference held in Washington, D.C. in 1927 produced a resolution suggesting that the state Members explore the possibility of merging the two organizations. *Id.*

75. *Id.*

76. Telecommunication Convention, General Radio Regulations, Additional Radio Regulations, Additional Protocol (European), Telegraph Regulations and Telephone Regulations, Dec. 9, 1932, 151 L.N.T.S. 4.

77. *See generally* International Convention on Telecommunications, Oct. 2, 1947, 63 Stat. 1399, 30 U.N.T.S. 316.

United Nations, an overture that was quickly accepted.[78] Also, the International Frequency Registration Board, the Administrative Council, and the Secretariat were established.[79] Lastly, the consultative committees, previously employed on an intermittent basis, were granted permanent status.[80]

Although the organization continued to evolve over the next forty years, the basic structure of the ITU remained largely unchanged. It was not until the 1989 Plenipotentiary Conference in Nice, France that the process of structural reform began, principally in response to perceptions that the organization was slow to manage the pace of technological change and the spread of information services throughout the globe.[81] Though some alterations were made immediately at the Nice Conference, it was through the work of the High Level Committee appointed at the conference that major changes to the organization of the ITU were proposed.[82] The changes suggested by the High Level Committee took effect in 1994, following their adoption at the December 1992 Additional Plenipotentiary Conference.[83] Although some relatively minor amendments have been made to the major instruments of the organization since 1992, the ITU remains largely the same today.

B. The Structure of the ITU

From its humble beginnings 135 years ago, the ITU has grown into an immense organization with a voting membership that very nearly mirrors that of its parent organization, the United Nations. The ITU's financing is derived from voluntary contributions of its member states. These contributions can be made by a Member at any one of twenty-two recommended levels, which vary from a maximum suggested contribution of forty times the standard unit[84] to a minimum level equal to one-sixteenth the standard

78. The ITU became a specialized agency of the United Nations on October 15, 1947. International Telecommunication Union, *ITU History*, *at* http://www.itu.int/itudoc/about/itu/history/history.txt (last visited Nov. 2, 2000).

79. *Id.*

80. *Id.*

81. Francis Lyall, *Communications Regulation: The Role of the International Telecommunication Union*, *at* http://elj.warwick.ac.uk/jilt/commsreg/97_3lyal/ (last visited Nov. 2, 2000).

82. *Id.*

83. *See* Lyall, *supra* note 81.

84. The Convention leaves open the possibility that Members might wish to make a contribution in excess of the maximum suggested level. Convention to the International Telecommunication Union (Geneva, 1992), art. 33(1)(1), S. TREATY DOC. 104-34, 1996 B.T.S. 24 [hereinafter ITU Convention], *reprinted in* SPACE LAW, *supra* note 21.

contribution unit.[85] As with all agencies of the United Nations, the principle of "one state, one vote" applies to the ITU.[86]

The present incarnation of the ITU is composed of several basic elements that shape the global telecommunications regime. The Plenipotentiary Conference is the preeminent organizational event for the ITU. Held once every four years,[87] the conference is intended to set the general policies for the ITU,[88] approve constitutional changes,[89] establish a budget (including a cap on expenditures) for the organization,[90] craft employment policies,[91] and elect various Members and officers of the organization. During the period between conferences, the ITU Council acts as a proxy for those powers delegated to it by the Plenipotentiary Conference.[92]

The substantive work of the organization is conducted under the auspices of three sector units. The Radiocommunication Sector is tasked with the responsibility of managing the frequency spectrum, as well as the positions of geostationary satellites.[93] As its name implies, the Telecommunication Standardization Sector is responsible for questions concerning standardization of communication technologies, operations, and tariffs.[94] The third group, the Telecommunication Development Sector, is responsible for coordinating the responsibilities of the ITU as a specialized agency of the United Nations.[95] It also administers development projects funded by other organizations, conducts research into issues affecting telecommunications in developing countries[96] and otherwise promotes and organizes

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85. *Id.*

86. "[E]ach Member shall have one vote at all Plenipotentiary Conferences, all world conferences and all radiocommunication assemblies and study group meetings and, if it is a Member of the Council, all sessions of that Council. At regional conferences, only the Members of the region concerned shall have the right to vote." Constitution of the International Telecommunication Union (Geneva, 1992), art. 3(2)(b), S. TREATY DOC. 104-34, 1996 B.T.S. 24 [hereinafter ITU Constitution], *reprinted in* SPACE LAW, *supra* note 21.

87. *Id.* art. 8(1).

88. *Id.* art 8(2)(a).

89. *Id.* art. 8(2)(i).

90. *Id.* art. 8(2)(c).

91. *Id.* art. 8(2)(d).

92. *Id.* art. 10(3).

93. *Id.* art. 12.

94. *Id.* art. 17.

95. *Id.* art. 21(1)(1).

96. Unlike the other two sectors, the role of the Telecommunications Development Sector in the conduct of studies is minimized by Article 17(1) of the Convention:

> Telecommunication development study groups shall deal with specific telecommunication questions of general interest to developing countries .... Such study groups shall be limited in number and created for a

telecommunication cooperation and aid activities in the developing world.[97] All three sectors coordinate their respective responsibilities in an effort to minimize overlap of their efforts. Finally, the General Secretariat is the administrative support body for the ITU as a whole.[98]

Despite the process of simplification that has continued throughout the past decade, the regulatory sources of authority for the ITU remain fairly complex. The organization's primary instrument is the Constitution of the International Telecommunications Union. The ITU's Constitution is a part of the recent reform efforts being undertaken by the organization. Adopted in 1992 and amended two years later, the Constitution did not enter into force until 1996.[99] Prior to the introduction of this instrument, all basic operating principles were set out in convention form. The constitutional model was a response to concerns that the basic tenets of the ITU were repeatedly being subjected to revision at each major conference.[100] The omnipresent threat of revision made reliance upon basic rules fraught with risk and undermined the authority of the organization.

The Constitution addressed the problem by including those provisions of greatest import to the ITU in a stable instrument. The Constitution sets forth the core principles of the ITU,[101] the criteria for membership,[102] basic organizational structure,[103] voting rights and procedures,[104] basic financial arrangements,[105] and a dispute resolution policy.[106] Notably, the Constitution limits the ability of the ITU membership to alter the agree-

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> limited period of time, subject to the availability of resources, shall have specific terms of reference on questions and matters of priority to developing countries and shall be task oriented.

ITU Convention, *supra* note 84, art. 17(1).

97. *Id.* art. 21.

98. *Id.* art. 11.

99. Modest changes were made to the Constitution by the 1998 Plenipotentiary Conference in Minneapolis. The changes have only recently entered into force. *See* Instrument Amending the Constitution of the International Telecommunication Union (Geneva, 1992) (as amended by the 1994 Plenipotentiary Conference), *at* http://www.itu.int/itu-2000/2003/final-e.htm (last visited Nov. 15 2000) (amendments adopted by the 1998 Plenipotentiary Conference).

100. Gregory C. Staple, *Current Development: The New World Satellite Order: A Report From Geneva*, 80 AM. J. INT'L L. 699, 720 (1986).

101. ITU Constitution, *supra* note 86, art. 1.

102. *Id.* art. 2.

103. *Id.* arts. 7-32.

104. *Id.* art. 3.

105. *Id.* art. 28.

106. *Id.* art. 56.

ment[107] by requiring a two-thirds majority of the delegations able to vote at a Plenipotentiary Conference for passage of any amendment.[108]

The Convention of the International Telecommunications Union is second only to the Constitution in authority.[109] While the Constitution defines the roles of the various organs of the ITU, the Convention sets forth the procedures for the organization's operation. The Convention addresses the details of running the ITU such as defining election procedures and terms of service for ITU officers both under normal and extraordinary circumstances,[110] and describing the particular duties of the various sectors.[111] The Convention is significantly easier to amend than the Constitution. A simple majority of voting Members is all that is required in order to ratify a change to the Convention.[112]

Administrative regulations are the particular substantive operative guidelines for ensuring the smooth functioning of telecommunication systems around the world. Development and amendment of these regulations take place through world and regional conferences hosted by the various sectors.[113] The provisions of both the Constitution and the Convention take precedence over resolutions and other regulatory actions taken at these conferences.[114]

C. The Allocation of Electromagnetic Spectrum and Geostationary Positions

It is important to note that the ITU process does not, strictly speaking, allocate the frequencies or orbital positions that it registers. Authority to place a satellite into orbit and employ frequencies for its use rests with each sovereign state. The ITU acts as an efficiency-enhancing resource through which sovereign states attempt to avoid potential usage conflicts and as a convenient forum for resolving disputes that arise. Nevertheless, the economic incentives perpetuated by the process as well as the legal preferences accorded to successful applicants have a significant impact on the development and operation of geostationary systems.

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107. Lyall, *supra* note 81.
108. ITU Constitution, *supra* note 86, art. 55(4).
109. *Id.* art. 4(4).
110. ITU Convention, *supra* note 84, art. 2.
111. *Id.* arts. 7-18.
112. *Id.* art. 42(4).
113. *Id.* arts. 13, 18, 22.
114. ITU Constitution, *supra* note 86, art. 4(4).

Under the Radio Regulations of the ITU, when a satellite operator[115] wishes to develop a communications satellite system, it obtains the cooperation of a state Member who informs the Radiocommunication Bureau of its intention to assign a particular set of frequencies and a geostationary position to this operator.[116] Upon receipt of the Member's notification, the application is reviewed against the Table of Allocations to ensure that the frequencies employed by the proposed system have been allocated for the type of service contemplated.[117] In addition, notice of the application is sent to the appropriate state Members and the applicant's proposed frequencies are compared with the Master International Frequency Register to ensure that they have not already been designated for use in the same region by another operator.[118] If no difficulties are discovered during the review process, the ITU adds the operator's notification to the frequency register.[119]

This procedure serves two functions. First, the process encourages the development of new systems. By establishing frequency ranges for particular types of service and providing a centralized registry of specific users, developers of communication services can reduce the risks associated with construction of such systems. With the guidelines established by the ITU and information made available through its frequency register, a developer can plan and construct its systems more efficiently and with a view towards potential interference problems. Second, the system improves the quality of service and increases the likelihood of continued transmission clarity for existing users by providing a means through which prospective operators can avoid conflicts with preexisting systems. Current users are afforded a degree of protection against interference without resort to enforcement mechanisms. Perhaps more importantly, preliminary acceptance by the ITU bestows significant priority against potential users of the same spectrum.[120] Though some obligation to accommodate remains when conflicts between early and later registrants arise, early registration affords a measure of legitimacy that supports the first registrant's

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115. The identity of a satellite operator could be a corporation or other private body, the state Member itself or an international entity such as the International Telecommunications Satellite Organization.

116. Francis Lyall, *Paralysis By Phantom: Problems of the ITU Filing Procedures*, *in* INTERNATIONAL INSTITUTE OF SPACE LAW OF THE INTERNATIONAL ASTRONAUTICAL FEDERATION, PROCEEDINGS OF THE THIRTY-NINTH COLLOQUIUM ON THE LAW OF OUTER SPACE 188 (1996).

117. *Id.*

118. *Id.*

119. *Id.*

120. *See* RADIO REGULATIONS, *supra* note 21.

negotiating position.[121] Because the notification process affords preferential treatment to early registrants, it is often characterized as "first come, first served."[122]

Once an orbital position and frequencies have been registered, the registration remains in effect until the operator-defined system life expectancy has expired, or until the ITU is notified that the frequency and orbital position are no longer in use by the registrant. Once a satellite relay system has been registered successfully, it rarely terminates prior to complete failure of the spacecraft because of the substantial overhead investment in equipment and launch. Additionally, marginal benefits can still be derived from orbiting equipment decades out of date.[123] At least some of the growth in satellite mass and initial cost can be attributed to increasing the stationkeeping capacity of the craft and incorporation of additional communications redundancy. These additional measures might be economically impractical but for the possibility of losing legal rights that might be terminated with the loss of a satellite signal.

When multiple-satellite networks are involved, failure of a single satellite does not in itself invalidate registration because the operator is afforded time to replace the failed unit. Generally, most communications networks are sufficiently robust that a spare spacecraft is maintained in orbit in order to ensure relatively rapid resumption of service.[124] In other instances, it is not unheard of for an operator to purchase a replacement from craft already in orbit.[125] In fact, the allocation by the ITU to multisatellite systems could conceivably be almost perpetual, despite ITU resolutions declaring that permanent occupancy of geostationary orbital positions is not permitted.[126] The longevity of these regulatory rights is typically due to the sturdy nature of the communications networks, the ability of operators to transfer space assets to other entities without restriction, even after bankruptcy, the tendency of operators to define extremely long

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121. Lyall, *supra* note 116, at 189.

122. Staple, *supra* note 100, at 701; *see also* Henry Wong, Comment, *2001: A Space Legislation Odyssey—A Proposed Model for Reforming the Intergovernmental Satellite Organizations*, 48 AM. U. L. REV. 547, 558 (1998).

123. Theresa Foley, *Filling Parking Spots 22,000 Miles High*, N.Y. TIMES, Nov. 13, 2000, at C4.

124. Brian J. McIntosh, *In Orbit Back Up Services*, *in* ABOUT, *at* http://telecomindustry.about.com/industry/telecomindustry/library/weekly/aa051400.htm (last visited Nov. 14, 2000).

125. Foley, *supra* note 123.

126. *See Report Of The Special Committee To The Director Of The Radiocommunication Bureau*, ITU Doc. SC97-214 (Rev.1)-E, at 4 (1997) [hereinafter *Report of the Special Committee*].

operating periods for their networks,[127] and operator efforts to make multiple applications for the same position and frequencies for later time periods.

When disputes arise, they are managed on an ad hoc basis. The parties can resort to any of a wide variety of techniques, including negotiation, settlement in accordance with non-ITU dispute resolution agreements that may be binding on the parties, or any other mechanism agreed upon by the parties.[128] In addition, Article 56(2) of the Constitution[129] provides for the parties to enter into binding arbitration in accordance with procedures set forth in Article 41 of the Convention in the event that no other mechanism is found to be mutually acceptable. Although it would appear from Article 56(2) that any single party to the dispute may request binding arbitration,[130] unilateral recourse to binding arbitration in accordance with the Convention's procedures is available only for those disputes in which both parties have adopted the Optional Protocol on the Compulsory Settlement of Disputes Relating to the Constitution of the International Telecommunication Union, to the Convention of the International Telecommunication Union, and to the Administrative Regulations.[131] The Optional Protocol sets out alternative procedures available in the event that the noncooperating party fails to fulfill its obligation to appoint an arbitrator within three months from receipt of the notice of arbitration.[132]

IV. EVALUATING ITU REGULATIONS

A. Methods of Evaluation

Before a determination of the efficacy of the existing legal regime for administering international fixed communication services can be made, it

127. Satellite systems have in the past been described in filings as having operating lifetimes of as long as fifty years. *Report to the Special Committee of the Radiocommunication Study Groups*, ITU Doc. SC97-21-1E, at 16 (1996).

128. ITU Constitution, *supra* note 86, art. 56(1).

129. *Id.* at 56(2).

130. Article 56(2) states in pertinent part: "[a]ny Member State party to a dispute may have recourse to arbitration in accordance with the procedure defined in the Convention." *Id.*

131. Optional Protocol on the Compulsory Settlement of Disputes Relating to the Constitution of the International Telecommunication Union, to the Convention of the International Telecommunication Union, and the Administrative Regulations (Geneva, 1992), S. TREATY DOC. 104-34, 1996 B.T.S. 24 [hereinafter Optional Protocol], *reprinted* in SPACE LAW, *supra* note 21. Roughly half of the ITU membership are signatories to the Optional Protocol.

132. *Id.* art. 1.

is essential to understand the criteria used for evaluating such a regime. The ITU's own constitutional goals are a useful starting point from which three general objectives emerge.[133] These objectives are the rapid and effective development of telecommunication services, the fair and broad distribution of these services, and the achievement of these first two goals in a manner beneficial to international relations as a whole.

1. Efficiency

As a general proposition, the substantive development objectives are best served if they are implemented through as efficient a regulatory regime as possible. Ronald Coase, in his groundbreaking article, *The Problem of Social Cost*,[134] argued that an outcome will be optimally efficient regardless of the initial placement of rights by a regulatory structure if transaction costs among the parties are nonexistent. Parties will then bargain among themselves until the most efficient allocation of rights is reached.

The process of allocating rights for orbital positions and frequencies in an international context, however, is not free of transaction costs. These costs can be found in the inefficiencies of the regulatory process itself, in transaction costs encountered by the parties dealing with the regulatory process, and in the costs encountered by developers as a result of flawed substantive rules that present undue barriers to efficient bargaining among interested members of society.

Efficiency, then, can be divided into two separate forms: procedural efficiency and substantive efficiency. A regulatory system is procedurally efficient when it minimizes the transaction costs associated with its operation. For example, efficiency suffers when an otherwise necessary regulatory process imposes excessive licensing delays or employs insufficient resources to process expeditiously a license application.

Such procedural efficiency is important to the promulgation of an effective regulatory scheme, but it is not sufficient. The process must be crafted in a way that is also substantively efficient. In the case of international telecommunications, the parties are presented with transaction costs that have been created by the legal system. For example, a substantively inefficient regulatory structure can either directly or indirectly encourage excessive development of geostationary activities at the expense of future users of geostationary orbits or purveyors of other classes of wireless communication systems. Such incentives prevail where the regulatory

133. *See* ITU Constitution, *supra* note 86, art. 1.

134. *See* Ronald Coase, *The Problem of Social Cost*, 3 J. ECON. 1 (1960).

standard permits end users to capture substantial communal benefits or fails to transmit social costs to those best able to mitigate them.[135]

There are a number of guiding principles that can be applied to the legal regime to enhance efficiency considerations. These principles include the clarity of prevailing doctrine, the speed in establishing that doctrine and adjudicating disputes which arise from the regime, the legitimacy of the standard and the organization propagating it, and the effectiveness of dispute resolution mechanisms.

As a general proposition, legal standards should be as unambiguous as possible. Clearly drafted provisions greatly reduce the possibility of behavior by system operators that is deleterious to the provisions' objectives. Clarity also shrinks efficiency losses by minimizing misunderstandings that arise out of differing interpretations of legal text, and it reduces the likelihood that such misunderstandings will result in significant expenditures of time and resources. In addition, any dispute resolution process that is invoked will be more expensive and time-consuming than it might otherwise be when the procedure must not merely resolve issues of fact but must also settle the ambiguous issues of law.

Further, speed is essential for maximizing efficiency. The more quickly a system can process developers' applications, for example, the greater the effective financial return to those developers. The need for expeditious action also applies to structural improvements to legal standards. In this context, the cost is the difference in savings between the existing, less efficient standard and the proposed revision until such time as the revision enters into force. As a consequence, a regulatory structure should ideally be able to adapt automatically to changes in the regulated environment. The more a system is forced to rely upon renegotiation by political actors in order to adapt to changes in circumstance, the less efficient it tends to be. This is especially true in industries, such as satellite communications, that are continually and rapidly assimilating technological advancements.

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135. This problem is familiar to any student of environmental regulation. Where the legal regime effectively treats a particular resource as a product free to all, an incentive system is created whereby each individual user of this good is encouraged to make as much use of the resource as possible despite the fact that such exploitation carries a greater cost to society as a whole than the benefit derived by the individual user. The market system which might otherwise moderate development and encourage efficient husbandry of the resource has been disrupted by the commons regime engendered by the regulatory structure. *See generally* Garrett Hardin, *The Tragedy of the Commons,* 162 SCIENCE 1243 (1968) (analyzing economic results of *res communis* standards).

Legitimacy of a legal structure has a powerful impact on efficiency. Like most international legal regimes, the ITU does not have the authority to enforce its rulings directly; it is dependent upon its own legitimacy to influence the behavior of its Members. As a consequence, the ITU's effectiveness is bound up in the Member's perception of the process's efficacy. As perceptions of legitimacy decline, the tendency increases for individual Members to act in their own short-term best interest, rather than in accordance with a legal system that, under ideal conditions, maximizes community benefit over the long-term.

The mechanisms employed to resolve disputes among the parties to an agreement can have a strong influence on efficiency, magnifying or minimizing inefficiencies present in other parts of the legal structure. Consistency and impartiality of the process are essential to enhancing legitimacy. For example, the consequences of ambiguity in international dispute proceedings can be still more costly given the civil law traditions and the resulting absence of stare decisis within most international organizations. Without stare decisis or a principle of similar effect, each adjudicating body must revisit the ambiguous issue of law every time it arises. Stare decisis also improves the consistency of decisionmaking, thereby enhancing the ability of developers to plan space systems with greater confidence and less risk.

2. *Equity*

A regime that is truly efficient will maximize the total benefit derived from space communications development. An efficient system, however, does not guarantee a distribution of benefits that is either fair or broadly disbursed. Notwithstanding efforts aimed at reducing trade barriers, the nation-state system itself imposes transaction costs that impair the distribution of economic benefits from states that own and operate extensive space-based communication and broadcast systems to those states that do not. Just as important to the success of any regime, it must be acknowledged that the benefits of communication services are not merely economic. Governments with greater abilities to disseminate information are able to transmit their authority more effectively both domestically and internationally.[136] Communication services, therefore, directly affect sovereignty concerns of nation-states. This issue, as much as the economic consequences, exacerbates equity concerns among many states and increases the need to consider equity principles in conjunction with efficiency interests.

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136. MARTINEZ, *supra* note 28, at xiv.

3. *Benefits to International Relations*

The final objective, enhancement of international relations, is often congruent with efficiency and equity goals. Expanding the available supply of a resource or apportioning its benefits in an equitable fashion can help to reduce friction in international relations. Many of the same mechanisms that enhance the first two objectives will have a similar salutary effect on relations issues. A strong perception of legitimacy and clarity of policy, in particular, can minimize rationales for disputes. Other mechanisms are uniquely suited for enhancing relations. Organizational structures, for example, which allow for more discourse among Members should be preferred. The most prominent exemplification of this idea is the United Nations itself. It provides a convenient, perpetual forum for international dialogue, which creates the opportunity for the resolution of issues before they grow into significant diplomatic conflicts.

Conversely, crafting regulations that, through elegant definition, minimize the need to resort to the international system or separate political considerations from merely economic ones can eliminate international friction by eradicating potential conflict at its source. For example, though historically prevalent, the use of national actors in international agreements to settle commercial disputes is often unwarranted. Such provisions merely serve to slow down the dispute resolution process, impose added costs on the private parties interested in resolution, allow disputes to fester where the commercial parties lack sufficient resources to prompt their national governments to take up their case, and elevate disputes to a level of political prominence which can undermine international relations. The tendency of legal constructs to intertwine regulatory and distributive elements also promotes conflict by including political accommodations within a regulatory scheme at a cost to efficiency.

Any successful regulatory regime for geostationary communications must be able to support each of the three basic criteria. The interaction between efficiency, equity, and international relations, however, can be fiendishly complex. Occasionally, a single regulatory change can produce positive effects in one element that in turn have beneficial ripple effects for others. Alternatively, support for one measure often results in a diminution in one or both of the regulatory measuring sticks. This can make the creation of an efficacious structure an extremely difficult and delicate undertaking. It is understandable, therefore, how the current geostationary regime may not fully promote the interests of efficiency, equity, and international relations.

B. The Problems of Geostationary Regulation

The ITU greatly furthers the objectives of efficiency and equity when compared with the bilateral and multilateral approaches that predate the organization. By providing a universal and regular, albeit intermittent, forum through which the nations of the world can coordinate their disparate communications needs and goals, procedural efficiencies have been dramatically enhanced. The ITU has also made strides toward ensuring that the benefits of telecommunication systems are enjoyed more widely.

Nevertheless, the existing regulatory regime for commercial communications is far from ideal and suffers from a wide range of problems. First, the system has been overburdened by the task of managing the proliferation of specious satellite applications, commonly known as "paper satellites." Second, there are myriad administrative and regulatory lacunae, many identified by the ITU itself, which undermine the effective coordination of the geostationary orbit. Third, concerns by a significant minority of state Members over distribution of the economic value of positions and frequencies continually threaten to obstruct the efficient distribution of communication resources and sharpen the tenor of international discourse. Fourth, current economic incentives have produced a system that encourages the proliferation of orbital debris—an environmental hazard that could eventually lead to the elimination of the geostationary orbit as a viable resource. Finally, ambiguities in the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies ("Outer Space Treaty"), particularly with regard to questions of international appropriation, greatly reduce the efficiency of orbital resource allocation while degrading international relations in the process.

1. Paper Satellites

The most daunting problem facing the ITU is the administration and coordination of the burgeoning number of applications for satellite frequencies and orbit slots. The plethora of applications has, at its root, a desire to internalize the inherent value of the geostationary orbit commons. The ITU is not responsible for making a legal commons of the geostationary orbit. The origins of the orbit's status as a common property can be found in the Outer Space Treaty. Nevertheless, the "first come, first served" approach to registration has not helped to mitigate the negative effects that arise because of the commons nature of the orbital resource. The relatively low costs of filing an individual application with the ITU for a particular orbital position are grossly inadequate to deter developers from attempting to seize the potentially significant financial benefits associated with a valid registration. Consequently, developers have raced to file as many applications as their resources permit as quickly as possible and thereby prevent others from doing the same. This problem is exacerbated because developers are aware that there are far more applications than positions capable of accommodating them.[137] Developers file still more applications than they expect to use to ensure that they will be granted the number of positions actually required for operating their contemplated networks.[138] They have also filed for swaths of spectrum or geographic coverage in excess of present need in order to handle potential growth, whether such growth is realized or not.[139]

Still other entities file applications not for the purpose of operating a satellite network, but instead to sell the rights secured to satellite operators. The most notorious of such exchanges involved the Pacific island nation of Tonga. Tonga, a kingdom with a population barely in excess of one hundred thousand citizens,[140] filed applications for sixteen geostationary positions useful for connecting Asia and the United States.[141] Under pressure from the international community, Tonga reduced the total number of filings to six.[142] Even this reduced number, however, was far in excess of the number required to address national communications needs.[143] Though extensive, Tonga's applications were merely the first efforts at a process in which satellite "rights" are effectively resold to developers. Both Papua New Guinea and Gibraltar, for example, have entered into agreements with American satellite manufacturers to provide for their nations' com-

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137. By the mid-1990s, applications for orbital positions over Asia were eight times greater than the number of available slots. Clayton Mowry, *Shred the Paper Satellites*, SATELLITE COMM., Nov. 1996, at 61.

138. *Major Issues to be Considered in the Review of the ITU's Frequency Coordination and Planning Framework for Satellite Networks,* Working Group of the Radiocommunication Advisory Group, ITU Doc. WGRAG1/10 (Rev. 1)-E (Apr. 7, 1995) [hereinafter *Working Group Report*].

139. *Report of the Special Committee*, *supra* note 126, at 10.

140. Jonathan Ira Ezor, *Costs Overhead: Tonga's Claiming of Sixteen Geostationary Orbital Sites and the Implications for U.S. Space Policy*, 4 LAW & POL'Y INT'L BUS. 15 (1993).

141. *Id.*

142. Henry Wong, *The Paper 'Satellite' Chase: The ITU Prepares for Its Final Exam in Resolution 18*, 63 J. AIR L. & COM. 849, 854 (1998).

143. Francis Lyall, *The International Telecommunications Union: A World Communications Commission?*, *in* INTERNATIONAL INSTITUTE OF SPACE LAW OF THE INTERNATIONAL ASTRONAUTICAL FEDERATION, PROCEEDINGS OF THE THIRTY-SEVENTH COLLOQUIUM ON THE LAW OF OUTER SPACE 188 (1995).

munication needs. In the process, these states exchange spare capacity secured from the ITU for a variety of economic returns.[144]

The deluge of filings represents more than a simple bureaucratic bottleneck. As the number of applicants and the number of filings increase, coordination among the myriad conflicting applications rises exponentially.[145] Administrations making later filings that represent legitimate projects are forced to coordinate their systems with earlier, perhaps more fanciful, applications. The difficulty is exacerbated by filings that have been accepted, but for various reasons do not result in an operating network. Delinquent notification of such failures can delay for years the assignment of these frequencies to other users.

2. *Administrative and Regulatory Issues*

The Radiocommunication Board has expressed concern over use of positions and spectra by satellites that operate absent the imprimatur of ITU registration. In testament to the general efficacy of the ITU, a relatively small number of craft operate entirely without regard to ITU procedures.[146] On the other hand, at least a dozen instances have arisen where networks attempt to use the notification process, are unable to reach a satisfactory conclusion regarding coordination, or obtain a disadvantageous ruling from the Radiocommunication Bureau, yet initiate operations or continue to operate in spite of the potential hazard of interference.[147]

The Radiocommunication Board raised a number of additional issues worthy of further exploration. Though perhaps not as serious as the paper satellite problem, these issues present a significant challenge to the advancement of ITU objectives. For example, the Board expressed concern over the adequacy of the current dispute resolution procedure.[148] The primary difficulty with the present mechanism is that it is heavily reliant on negotiation. Though negotiation may prove to be beneficial to international relations over the short-term, extensive reliance on this form of dispute resolution can undermine efficiency through inconsistent results across similar disputes and the tendency for negotiation power to supersede reasoned outcomes.

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144. Wong, *supra* note 142, at 859-60.

145. The broader class of applicants has also resulted in applications of inferior quality. This produces lengthier delays as the ITU is obliged to spend time and funds ensuring adequate filings.

146. *Report of the Special Committee*, *supra* note 126, at 11.

147. *Id.* at 10.

148. *Working Group Report*, *supra* note 138, at 2.

The Board also considered the extensive time period allocated for developers to commence satellite operations.[149] Generous time frames allotted for satellite developers to proceed from application to orbit often result in unwarranted delays in service benefits because they fail to discourage dilatory behavior during construction or launch, or hamper the recovery of allocated frequencies and positions from developers incapable of constructing their proposed system.

Further, new technologies that might permit a greater number of craft in orbit by allowing closer spacing between satellites along the geostationary arc are not being integrated into the regulatory process.[150] The application of new technologies to the international regulatory environment has been a perpetual challenge to the ITU. Even at its best, the system's focus on administrative rules to manage the exploitation of the resource increases inefficiency. Though necessary to an extent, such management invariably results in either resources being wasted because of inferior technology standards or added costs arising from administrative efforts designed to advance the technological state of the art. Even where assessments accurately reflect the current cost-benefit analysis, changes in technology and economic efficiencies require constant reevaluation of standards. There is also the ever-present concern within the debate over reallocation of how these newly freed resources are to be distributed in an equitable manner.[151]

In addition to the problems posed by reallocation as a result of advancing capabilities, improvements in satellite technology have exacerbated some spacing challenges by increasing the operational lifetimes of spaceborne assets. Longer lived spacecraft reduce the rate at which occupied positions become available for redistribution by the organization. The ITU has thus far been unable to resolve this problem.[152]

The ITU has also been beset by other allocation challenges. Efforts to tailor existing licenses more closely to the regional service areas actually served by the operators have met with limited success. Planning for all services has been made more difficult by the emergence of satellite services using frequencies set out by the ITU for a single purpose being used for multiple or hybrid services.[153]

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149. *Id.*

150. *Id.* at 4-5.

151. *See id.* at 6.

152. *Id.* at 2.

153. *Id.* at 6-7. The pursuit of financial opportunities has resulted in networks designed or designated for one purpose being retasked to service other clients and industries. Current survey data indicate that at least twenty-five percent of operating satellite

Accurate and current data on the status of craft in and around geostationary orbit has always been in short supply at the ITU.[154] Even worse, the organization has proven reluctant to rely on such survey data for regulatory decisions even when it is available from national sources. This has meant that frequencies and positions that might otherwise be made available to new applicants remain allocated to derelict spacecraft.

The Board also raised the question of whether it would be beneficial to involve satellite system operators in the coordination process.[155] The end users have the advantage of possessing information superior to that of the international regulators, and they have a greater motivation to coordinate conflicting uses. Also, excessive involvement by ITU intermediaries adds to procedural transaction costs and encourages inefficiencies in final allocations.

The World Radiocommunication Conference held in 1997 modestly revised the application process by requiring applicants to submit information concerning the dates of contracts with the satellite manufacturer and launch service provider.[156] This reporting requirement aids the coordination process by providing information useful for discriminating between committed development and speculative activity. This reduces the volume of geostationary applications to some small extent.

More generally, the 1998 Plenipotentiary Conference instructed that certain ITU services defray their costs by receiving direct payment.[157] The Council was also granted authority to establish the same policy for certain other ITU services. The objective of the resolution was not to permit the organization to use such authority to generate a profit, but merely to recover expenses incurred.

Applied to the application process, the cost recovery policy will likely have two consequences. First, just as with the added reporting requirement, the cost recovery policy may have the effect of reducing the number of superfluous applications because the costs of an additional application will be balanced against its marginal benefit. In addition, by reducing the financial burden on the ITU, the cost recovery policy could reduce potential friction posed by conflicts within the budgetary process.

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networks are operating outside of their designated service. *See* Peter B. de Selding, *ITU Unable to Keep Pace with Operator Conflicts*, SPACE NEWS, Oct. 18. 1999, at 1.

154. *Working Group Report*, *supra* note 138, at 2-3.

155. *Id.* at 3.

156. *Administrative Due Diligence Applicable to Some Satellite Communication Services*, ITU Res. 49 (1997), *reprinted in* SPACE LAW, *supra* note 21, at C.IV.3.8.

157. *See Cost Recovery for Some ITU Products and Services*, ITU Plenipotentiary Conf. Res. Plen/4 (1998), http://www.itu.int/stratpol/CWG/Res%20Plen4.htm.

3. *Space Debris*

Just as the regulatory structure of the ITU has skewed the market behavior of developers of geostationary networks, decisionmaking by developers is similarly influenced by other international legal instruments affecting outer space. The fundamental instrument guiding space activity is the Outer Space Treaty.[158] Because it was drafted at a time when space activity meant rare and expensive government forays, little attention was paid to the possibility of pollution of the space environment. Instead the provisions of the treaty focused on ensuring freedom of access[159] and forestalling the exercise of national control,[160] not operational efficiencies. As a consequence, outer space itself was treated as a commons.

Satellite developers forego costs when they can design and operate spacecraft that take advantage of the communal environment. Losses due to pollution are borne by society as a whole, while the cost savings accrue solely to the developer. In this instance, the costs to the community environment manifest themselves in the form of orbiting debris.

The U.S. Satellite Catalog lists nine thousand pieces of orbiting debris larger than one meter in geosynchronous orbit and ten centimeters in lower Earth orbit.[161] Moreover, the debris population is growing steadily larger,[162] and each piece of debris involved in a collision produces still

158. Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, Jan. 27, 1967, 18 U.S.T. 2410, 610 U.N.T.S. 205 [hereinafter Outer Space Treaty], *reprinted in* INTERNATIONAL LAW: SELECTED DOCUMENTS AND NEW DEVELOPMENTS 670 (Barry E. Carter & Phillip R. Trimble eds., 1994).

159. "Outer Space, including the moon and other celestial bodies, shall be free for exploration and use by all States without discrimination of any kind, on a basis of equality and in accordance with international law." *Id.* art. I.

160. "Outer space, including the moon and other celestial bodies, is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means." *Id.* art. II.

161. Nicholas L. Johnson & Joseph P. Loftus, *Reducing Orbital Debris: Standards and Practices*, LAUNCHSPACE, Mar.-Apr. 1999, at 24. More detailed research suggests a population of approximately 100,000 pieces of debris between one and ten centimeters. *Id.* The vast majority of particulates, however, are smaller than one centimeter and cannot readily be tracked by present technology. *See* Kunihiko Tatsuzawa, *The Protection of the Space Environment: The Problem of Space Wreckages*, *in* INTERNATIONAL INSTITUTE OF SPACE LAW OF THE INTERNATIONAL ASTRONAUTICAL FEDERATION, PROCEEDINGS OF THE THIRTY-SECOND COLLOQUIUM ON THE LAW OF OUTER SPACE 173 (1990). *Accord* HOWARD A. BAKER, SPACE DEBRIS: LEGAL AND POLICY IMPLICATIONS 8 (1989).

162. The 1989 debris figures cited by the National Security Council's Interagency Group on Space indicated a large debris population of seven thousand for particles greater than ten centimeters and debris in the one to ten centimeter range of only 17,500. William B. Wirin, *Space Debris 1989*, *in* INTERNATIONAL INSTITUTE OF SPACE LAW OF

more debris. Consequently, once the debris population reaches a sufficiently high density in a particular orbital region, the likelihood of a chain reaction of debris causing yet more debris becomes substantial.

Space debris constitutes a hazard due to the extremely high kinetic energies associated with the particles speeding around the planet. In low Earth orbits, a collision with space debris only one centimeter in diameter can destroy a spacecraft.[163] Even the smaller particulates can degrade spacecraft operations. In geostationary orbit, however, the nature of the hazard is somewhat different.[164] Differential velocities among active spacecraft and debris tend to be lower, both because the absolute velocity of objects in geosynchronous orbit are lower and because uses of the geosynchronous orbit tend to confine the direction and orbital angle of working satellites, derelicts, and other forms of debris to similar vectors.[165] Nonetheless, the unique utility of the geostationary orbit has resulted in high concentrations of debris being located there. Finally, unlike low Earth orbit debris, which gradually disappears as drag effects produced by the upper reaches of the atmosphere eliminate it, geosynchronous debris tends to remain a continual threat in the area.

4. *The Equity Debate*

Both previous and current methods for allocating geosynchronous orbital positions and frequencies have resulted in a relatively small number of nations taking up the lion's share of these resources. In the 1970s, developing states began to recognize that the developed states were quickly making use of the new satellite communications technologies and that occupancy of geostationary slots might foreclose access at some future date.[166] Of even greater concern to the developing states were the uses to which communication technologies were being put. Distribution of news and other information to developing populations was perceived as former colonial powers foisting inappropriate and dangerous perceptions and values on the citizens of developing states.[167]

THE INTERNATIONAL ASTRONAUTICAL FEDERATION, PROCEEDINGS OF THE THIRTY-SECOND COLLOQUIUM ON THE LAW OF OUTER SPACE 173 (1990).

163. BAKER, *supra* note 161, at 10.

164. *See* Gunnar Leinberg, Note, *Orbital Space Debris*, 4 J. L. & TECH. 93, 98 (1989).

165. *See id.*

166. *See Report of the U.N. General Assembly Committee on the Peaceful Uses of Outer Space*, U.N.GAOR, 33rd Sess., Supp. No. 20, pt. II, § D, ¶ 77, U.N. Doc. A/34/20, (1978).

167. This *de facto* situation . . . concretizes [sic] a form of domination—not to say colonisation—on all fronts: political, economic, social and cul-

These fears manifested themselves most publicly in the 1976 Declaration of Bogotá.[168] Eight equatorial developing states[169] sought to secure the rights to the geostationary positions directly over their territories.[170] In making their declaration the equatorial states were limited; they could not simply claim ownership of the selected regions given that, as previously noted, the Outer Space Treaty expressly bars claims of national appropriation for any and all portions of outer space.[171] Even if the declarants had chosen to violate treaty provisions, the precedent for doing so would almost certainly be detrimental in other ways. At the time, none of the Bogotá signatories was directly capable of space activities.[172] The possibility that space-capable states would use the Bogotá Declaration as an opportunity to stake claims to other regions of space was unpalatable.

The eight signatories were careful to claim an exceptional status for the geostationary orbit. Reasoning that the orbital arcs above each declaring nation were fixed, the declarants argued that those arcs should not be considered a part of outer space at all, but rather should be considered a natural resource arising directly out of terrestrial gravitational phenomena.[173] Since each nation has a right of control over its own natural re-

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> tural. The point is that information given . . . by these agencies, whether government run or private is very often, no doubt not deliberately, tendentious and subjective in the eyes of their Third World users.

Racine Sy, *For a New World Information Order*, EBU REV., Nov. 1983, at 26, *excerpted in* SAVAGE, *supra* note 56, at 153.

168. *See* Declaration of the First Meeting of Equatorial Countries of Dec. 3, 1973, ITU Doc. WARC-BS-81-E [hereinafter Bogotá Declaration], *reprinted in* SPACE LAW, *supra* note 21, at B.IV.1.

169. The signatories to the Bogotá Declaration included: Brazil, Republic of Colombia, People's Republic of Congo, Ecuador, Indonesia, Republic of Kenya, Uganda, and Zaire.

170. Gregory C. Staple, *Current Development: The New World Satellite Order: A Report From Geneva*, 80 AM. J. INT'L L. 699, 711-12 (1986).

171. *See* Outer Space Treaty, *supra* note 158, art. 2.

172. Brazil is presently making some effort to engage in space-related activities both as a direct participant and as a commercial provider of launch facilities. *See* Justin Ray, *Brazil Ready for the Birth of its Space Program, at* http://www.flatoday.com/space/explore/stories/1997b/102997d.htm (last visited Oct. 18, 2000); *see also* Gerald M. Steinberg, *Satellite Capabilities Of Emerging Space-Competant [sic] States, at* http://faculty.biu.ac.il/~steing/military/sat.htm (last visited Oct. 18, 2000).

173. "The equatorial countries declare that the synchronous geostationary orbit is a physical fact arising from the nature of our planet, because its existence depends exclusively on its relation to gravitational phenomena caused by the Earth, and for that reason it must not be considered part of outer space." Bogotá Declaration, *supra* note 168, ¶ 1.

sources, they argued, the portions of geostationary arc should be controlled by those nations having territory directly underneath.[174]

The Bogotá declarants' argument, though it did receive some measure of support from other equatorial nations,[175] was ultimately unavailing. Space-faring states dismissed the claims out of hand because the declarants could not physically enforce them.[176] Conversely, other developing states which lacked the fortuitous equatorial position of the declarants were unwilling to support a redistributive argument that seemed limited and arbitrary.[177] This reception, however, did not discourage equatorial nations from continuing to press their claims for many years.[178] Develop-

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174. In qualifying this orbit as a natural resource, the equatorial States reaffirm 'the right of peoples and nations to permanent sovereignty over their natural wealth and resources, which must be exercised in the interest of their national development and of the well-being of the people of the State concerned.' ... [This provision] lead[s] the equatorial States to affirm that the synchronous geostationary orbit, being a natural resource, is under the sovereignty of the equatorial States.

Id. ¶¶ 2-3.

175. The Gabon Republic and the Somali Democratic Republic have at various times voiced their support for the concept. *See generally* World Administrative Radio Conference on Broadcasting Satellite of the International Telecommunication Union, Feb. 13, 1977, WARC BS-77, ¶ 51, *reprinted in* THE FUTURE OF INTERNATIONAL TELECOMMUNICATIONS: THE LEGAL REGIME OF TELECOMMUNICATIONS BY GEOSTATIONARY-ORBIT SATELLITE 375 (Umberto Leanza ed., 1993) [hereinafter FUTURE OF INTERNATIONAL TELECOMMUNICATIONS].

176. In responding to an effort by the Bogotá Declarants and their supporters during the World Administrative Radio Conference on Broadcasting Satellite to reserve their rights under the Declaration, a number of developed states registered their objections:

> The Federal Republic of Germany, Austria, Belgium, Canada, Denmark, United Sates of America, Finland, France, Ireland, Italy, Luxembourg, Monaco, Norway, Netherlands, United Kingdom of Great Britain and Northern Ireland and Sweden ... consider that [the claims made by the Bogotá Declarants] cannot be recognized by this Conference and declare that the decisions of this Conference to assign frequencies and orbital positions in the geostationary orbit are fully in accordance with the International Telecommunications Convention ... by which this conference is bound.

Id. ¶ 74.

177. *See* Michael J. Finch, *Limited Space: Allocating the Geostationary Orbit*, 7 NW. J. INT'L L. & BUS. 788, 790 (1986).

178. *Report of the U.N. General Assembly Committee on the Peaceful Uses of Outer Space* ¶ 6, U.N. Doc. A/AC.105/288 (1981), *reprinted in* FUTURE OF INTERNATIONAL TELECOMMUNICATIONS, *supra* note 175, at 355; Regional Administrative Radio Conference for the Planning of the Broadcasting-Satellite Service in Region 2 of the International Telecommunication Union, Final Acts, July 16, 1983, ITU Doc. No. 290-E (1983),

ing states have continued to press for special treatment in any prospective allocation of geostationary resources, either in conjunction with preferences for equatorial states or absent such preferential treatment.[179]

The most successful application of equity principles to the geostationary orbit arose out of negotiations during the sessions of the Space World Administrative Radiocommunications Conference held in 1985 and 1988 ("WARC 85-85").[180] The result was a compromise that produced a hybrid system which combined the "first come, first served" system with an a priori allotment system.[181] Under the plan, each ITU Member was granted an allotment consisting of a nominal orbital position which represented a center point around which to base a maximum ten degree arc on the geostationary orbit,[182] eight hundred megahertz of bandwidth, and a designated service area roughly equivalent to each Member's terrestrial borders.[183] The allotments should not be confused with actual reserved assignments of positions and frequencies for fixed satellite service. They more closely resemble a right of coordination priority. The actual positions and frequencies remain available for use under the traditional allocation process; it is only when a Member begins the process of notification that the allotment plan becomes a factor in the distribution process.

At first blush, it would appear that the allotment plan strikes a reasonable and rather elegant compromise by alleviating the developing states' concerns of being frozen out of direct benefits from geostationary telecommunication networks, allowing a gradual integration of national networks, and maintaining the existing regulatory mechanisms wherever possible. Moreover, while the plan offers potentially equal rather than equitable access, economic realities have thus far made actual exploitation of the geostationary orbit viable only for those states with sufficient resources.[184]

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reprinted in FUTURE OF INTERNATIONAL TELECOMMUNICATIONS, *supra* note 175, at 1038-39.

179. Regional Administrative Radio Conference, *supra* note 178; *see also Report of the U.N. General Assembly Committee on the Peaceful Uses of Outer Space*, *supra* note 178, ¶ 6.

180. SMITH, *supra* note 24, at 219.

181. Provisions and Associated Plan for the Fixed-Satellite Service in the Frequency Bands 4,500-4,800 MHz, 6,725-7,025 MHz, 10.70-10.95 GHz, 11.20-11.45 GHz and 12.75-13.25 GHz (App. S30B), *reprinted in* SPACE LAW, *supra* note 21, at C.IV.2.8.

182. This arc is employed for satellite networks in the pre-design phase. Networks that were being designed at the time the regulations entered into effect are entitled to placement within five degrees of the nominal orbital position. *Id.* art. 5.

183. *Id.* art. 7.

184. *See Report to the Special Committee of the Radiocommunication Study Groups* § 3.1, ITU Doc. SC97-2/2-E (1996).

There is some question, however, whether the WARC 85-88 allotment plan fully advances the ITU's goals. If equity is to be defined as equality of opportunity, then this principle is advanced by the plan. On the other hand, if equity implies that some measure of rights to the benefits derived from a natural resource such as the geostationary orbit should accrue to all states regardless of their relative ability to exploit the resource directly, then the principles established at WARC 85-88 fall short of full equitable distribution. In addition, the issue remains whether the allotment plan unduly sacrifices the interests of efficiency over the long-term. Changes in the economic calculus of space activity can have a significant effect on the equity balance. For example, technological advances, which increase demand and lower the cost of development and operation, threaten to alter what is at present an equitable principle into one where equal access for each nation is the norm, regardless of the efficiency of the national satellite networks that would emerge as a result of the new economic calculus.

5. National Appropriation

The question arises whether occupancy of the geostationary orbit violates international nonappropriation principles given the traditional notion that national authority is the basis for communication activity at that location. While mere occupancy by a state or a party for which such state exercises jurisdiction might be insufficient to constitute national appropriation in light of the endorsement of free access and use under Article I of the Outer Space Treaty, the broad prohibition contained in Article II limits the scope of that use.[185] The prevailing interpretation of "appropriation" is a taking for exclusive use with a measure of permanence.[186] Permanence has typically been measured by the intent of the occupying party,[187] with some lengthy objective presence representing at least evidence of intent. The time frame for determining appropriation has been open to question.[188] The ambiguity inherent in gauging intent presents significant problems for any application of the national appropriation principle and undermines its probative value with respect to nonconforming uses of the geostationary orbit.

185. *See* MARTINEZ, *supra* note 28, at 87-88.

186. STEPHEN GOROVE, STUDIES IN SPACE LAW: ITS CHALLENGES AND PROSPECTS 82 (1977).

187. *See* MARTINEZ, *supra* note 28, at 92.

188. *See* GOROVE, *supra* note 186, at 55-56.

C. Previously Proposed Solutions

The modest procedural changes to the ITU have proven to be insufficient to implement fully the objectives of the organization. The present system, cumbersome at best, has become far too unwieldy as the incentives for filing applications continue to add to the ITU's bureaucratic burdens. Moreover, equity concerns continue to hobble the organization. Equally significant, the process, though useful for encouraging debate among administrations, continually resorts to resolution mechanisms at the governmental level, even where such mechanisms are unnecessary and merely serve to place the conflicts in an arena where they are subject to the whims of international politics.

There has been no shortage of suggested reforms to the regulatory structure of the ITU. The recommendations generally fall into one of four basic categories: (1) proposals to improve administrative oversight of satellite applications by the ITU; (2) measures which encourage greater participation by private developers in the process; (3) standards that would increase the economic costs of filing; and (4) revisions to the basic voting and financial structure of the organization. Though many of the suggested reforms have merit, most are at best partial solutions that treat the symptoms of the ITU's problems rather then their root causes.

1. Administrative Due Diligence

Many of the satellite system reform proposals have emerged from within the ITU itself. The organization's members passed Resolution 18 at the Plenipotentiary Conference in Kyoto in an effort to reexamine comprehensively the ITU methodology.[189] ITU study group 4, one of the working groups that were formed as a result of Resolution 18, has recommended using intermittent independent monitoring of the satellite environment and transmission procedures as a means of ensuring the reliability of data contained in the Master International Frequency Register.[190] The intent would be to require the responsible administration to address publicly any discrepancies between information on file and the survey data. Though the proposal would add to the expenses of the organization, the benefits accruing to the international community would likely outweigh

189. Resolution 18 adopted by the Plenipotentiary Conference (Kyoto, 1994), *at* http://www.itu.int/publications/cchtm/dec_res_rec/res18.htm.

190. *Report to the Special Committee of the Radiocommunication Study Groups* § 2.4, Rapporteur Group SC-5, ITU Doc. SC-RG5/45 (1996).

the costs under the present system, which relies upon the diligence and competence of each and every national administration.[191]

The Special Committee charged with reviewing procedural matters relating to Resolution 18 felt strongly that the time period between initial filing and satellite network operations was too long. The committee recommended that the maximum permissible time frame between filing and operations and available extensions be reduced and that any administration applying for an extension would have to provide detailed reasons for the extension request.[192] The objectives of these changes, though modest, would enhance efficiency by forcing developers to place their proposed systems into operation more quickly or risk loss of priority. They would also allow frequencies and positions to be employed more effectively by reducing the period of time the allocated resources remain unused and by reducing the tendency of administrations to request extensions by forcing them to justify further delays.

2. *Participation of Satellite Developers*

In some ways, the ITU is a victim of its own traditions. Formed primarily as an organization of nations, at a time when international policy was almost exclusively the province of governments, it prefers resolutions that rely upon national administrations as direct participants. At one time, when national governments were the primary movers with regard to telecommunication activity and technological change was relatively slow, this approach might have been appropriate. The enhanced role of the private sector in policy activities, however, has caused some reconsideration of the traditional role of national administrations in the ITU process.

At least one administration has suggested that efficiencies could be increased through greater involvement by satellite system developers in the filing and coordination process.[193] Control of the process would not necessarily be vested entirely in the system operators. It is expected that there would be some measure of oversight by the respective administrations and that the extent of that control would be at the discretion of each nation.[194] Nevertheless, by permitting system operators to prepare filings, corre-

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191. At least one report would eliminate the costs of such surveys by employing existing national resources as the source of data. The Radiocommunication Board lacks the authority to use such data to unilaterally amend the frequency register. Currently, a filing cannot be amended absent the consent of the administration that submitted it. *Report of the Special Committee*, *supra* note 126, at 4.

192. *Id.* at 3.

193. *See Views On Preliminary Reports Of Rapporteurs,* ITU Docs. SC-4/53, SC-5/46, 21-22 (Nov. 16, 1996).

194. *See id.*

spond with other administrations and the ITU, and conduct coordination negotiations, the proposal eliminates the costs associated with the use of intermediaries. In addition, the direct participation of operators should speed the filing process by not only eliminating superfluous steps, but also by placing the parties with the greatest incentive towards expediting the procedures in a position to manage them.

Efficiencies might be improved still further through a coherent policy regarding the scope of control exercised by national administrations over their operators. However, the potential for misunderstandings concerning authority remains high, and the proposed solution would impose additional costs on both the operators and the ITU as they adapt to each variant of authority on a case by case basis.

3. *Financial Due Diligence*

Some effort was made on the part of the Special Committee to consider financial mechanisms in regulating the application process as an adjunct to procedural approaches.[195] Though the Committee did not reach a consensus with regard to use of the financial mechanisms,[196] it did identify some preferred solutions. The committee examined the possibility of employing a deposit system and explored using an annual registration fee as a means of reducing applications.[197]

Under a deposit system, applicants would be required to place funds in escrow at the start of the coordination process, those funds being returnable upon launch of the satellite system.[198] A deposit would likely reduce the volume of superfluous and speculative filings by increasing the cost of each filing. The process would also increase the quality of parties requiring coordination by mandating that they secure at least some measure of legitimate financing. The costs incurred by tying up financial resources through the deposits might also promote more rapid conclusion of the coordination process. Lastly, the deposit would encourage the operators to tailor their applications more carefully so as to avoid the possibility of a lengthy coordination phase.

The deposit system is not without its detractors. Foremost among them is the government of the United States. In a critique of any potential deposit system, the U.S. government raised a number of questions that would have to be answered in order to implement a successful deposit regime. These included concerns over deposit levels, administrative overhead and

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195. *See Report of the Special Committee*, *supra* note 126, at 26-29.
196. *Id.* at 29.
197. *Id.* at 27.
198. *See id.*

bureaucratic delays, adequacy of Union authority, and ambiguous dispute resolution mechanisms.[199] While it is important to keep in mind that American registrations represent a significant majority of satellite operations, and that any costs imposed through a deposit system might be deleterious to U.S. interests, there is little question that certain efficiency considerations are ill-served by the push for resolution in a politically charged environment, even where solutions are achievable.

The problems with the deposit process involve more than the difficulty of creating a proper administrative structure. From an economic perspective, the deposit process adds costs to satellite development, creating a trade-off between substantive inefficiencies and procedural efficiencies of fewer superfluous applications. In order to be effective, such a deposit must be substantial. This means that developers must apply additional capital to an already capital intensive enterprise, with the result that part of the expense of reducing unwarranted applications would include the prospect that some worthy projects will not be viable.

In addition to the deposit approach, the Committee examined the use of registration fees. By requiring successful registrants to make payments either as a lump sum or on an annual basis, the payments should be able to internalize fully the communal benefits that have been accruing to the individual developers.

While the registration fee would theoretically go a long way towards eliminating the paper satellite deluge, in practice the approach suffers from several flaws. First, the challenge of setting a proper value on the resource through an administrative process makes it likely that each asset will be significantly over or undervalued. Second, the high financial stakes involved are likely to create significant political turmoil and delay the imposition of a reasonable approximation of an efficient fee standard by years or decades. Other questions, such as how to allocate the funds, would delay the process further. Most significantly, changes in the technological and economic environment would require continual adjustment of the fee structure so as to maintain the appropriate market incentives. Similarly, absent careful drafting, changes in geopolitical alignments and economic performance can be a considerable source of friction in the international arena.[200] Allocations that once appeared appropriate could quickly

199. *Id.* at 2-3. Further concerns included which precise criteria would be used to arrive at specific deposit levels, and who would administer and fund such a system. *Id.*

200. The most noteworthy example of this effect can be found in the perceived disconnect between the dramatic growth of the United Nations organization membership as a whole and the relatively stagnant size of the Security Council. *See* James A. Paul, *Secu-*

seem unjust, thereby undermining the legitimacy of the fee-based system. Despite the particular drawbacks of a registration fee process, the central premise of the system, market internalization, is essential to any successful approach.

4. *Voting Power and Finances*

Not all of the difficulties associated with managing satellite networks relate directly to the specific rules pertaining to the geostationary orbit. Some concerns are a result of problems endemic to the organization as a whole. This is true of the basic voting and financing arrangements employed by the ITU. Given the wide productive disparity between the developed states and the significantly larger number of developing nations, the concept of measuring voting power solely on the basis of national sovereignty strongly supports the organization's equity goal. The growth in the number of Members and the corresponding increase in emphasis on development in ITU instruments would appear to support the relationship between the voting system and its redistributive effects.[201] The process, however, has not been as successful at furthering efficiency principles. Moreover, legitimacy standards are threatened when one considers that there is a wide disparity in ITU financial contributions between the developed and developing states. The net effect to the ITU of this accounting structure is that ten percent of the total membership is responsible for ninety percent of the organization's general budget.[202] This relationship can only serve to breed dissatisfaction among the developed states and a desire to seek recourse outside of the ITU.[203]

One commentator has suggested reallocating voting power so that it more closely approximates financial contributions to the organization.[204] This would have a number of beneficial effects. First, it would largely eliminate the disconnect between level of contribution and relative authority. Second, it would provide a positive incentive for nations to make larger contributions as a means of garnering voting authority. The difficulty with this proposal, however, derives from its fluid and idiosyncratic ap-

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rity Council Reform: Arguments about the Future of the United Nations System, at http://www.globalpolicy.org/security/pubs/secref.htm (last visited Oct. 18, 2000).

201. *See* Francis Lyall, *International Telecommunications Discussion Paper, in* UNISPACE III: INTERNATIONAL INSTITUTE OF SPACE LAW WORKSHOP 8 (1999).

202. *Id.*

203. The tumultuous experience of UNESCO during the 1980s is instructive. *See* Francis Lyall, *The Role of The International Telecommunication Union, in* OUTLOOK ON SPACE LAW OVER THE NEXT 30 YEARS: ESSAYS PUBLISHED FOR THE 30TH ANNIVERSARY OF THE OUTER SPACE TREATY 253, 253-267 (Gabriel Lafferranderie ed., 1997).

204. *Id.* at 262.

proach to voting power. Given that the budgetary requirements of the ITU are finite, the financial contribution mechanism would not necessarily relate to any objective value of respective national interest. Moreover, there is no reason to expect that such a mechanism would enhance the efficiency or equity mechanisms of the ITU, and there is every reason to believe that there will be efficiency losses as administrations are constantly forced to alter behavior to take account of repeated fluctuations in voting strength. While the disparity in power and financial contribution should be eliminated, and reallocation of voting weight represents a valid technique for redressing the inconsistency, more objective criteria should be applied to the problem.

There is little question that the proposed solutions to the problems facing the ITU will have a salutary effect on the workings of the organization. While equity and international relations interests are largely neglected, the recommendations do make significant strides toward enhancing efficiency. That said, most of the proposals suffer because they largely treat the symptoms of the commons structure of the geostationary orbit rather than the root cause. Even where a solution would address the incentives posed by the market dysfunction, it has only a partial internalizing effect on the commons or does not easily adapt to changes in the commercial environment. In fact, those measures that merely enhance the procedural efficiency of the organization will eventually exacerbate the paper satellite problem as the lower bureaucratic costs associated with filing procedures make the submission of greater numbers of applications more economical. This does not diminish the importance of the proposed procedural enhancements, but it highlights the importance of eliminating the tragedy of the commons in conjunction with these other measures.

V. A MARKET APPROACH TO THE GEOSTATIONARY ALLOCATION PROBLEM

A. The Proposed Model

Internalization of the geostationary communications environment through a market-based approach offers the best opportunity to address the challenges facing the organization. Permitting available orbital positions and frequencies to be auctioned instead of simply coordinated among competing applicants enhances the procedural efficiency of the process, eliminates the substantive market subsidy, reduces the likelihood of conflict within the international community, and allows for the allocation of the benefits of geostationary communications on a more equitable basis.

Frequencies within the commercial fixed satellite bands as well as designated orbital positions would be auctioned to the highest bidder. The bidding population would be composed of all classes of entities from international organizations such as the International Telecommunications Satellite Organization ("INTELSAT") and the International Maritime Satellite Organization ("INMARSAT") to national governments and private corporations. The frequencies could be parsed so that each license is limited to a particular geographic region within a specific coverage area or allotted for broader viewing areas.

In return for an immediate, nonrefundable payment,[205] the winning bidder would be entitled to the same priority benefits already granted to successful applicants under the current ITU procedures with two important exceptions. Instead of indefinite allocations, the successful bid would be entitled to a limited term license of twenty to thirty years after which time the license would be returned to the ITU. The ITU would then determine whether the returned frequencies and positions should again be employed for commercial use. If so, the resources could be auctioned in a manner at the discretion of the organization.

While sales of spectrum and orbital positions are possible through the transfer of operational space-based assets, the effective rights to the use of spectrum and orbit positions could be resold far more easily under the proposed approach. Speculation, currently considered an unwarranted taking of public benefits, would be recast as a mechanism for making maximum use of available resources. The rights conferred would allow the holder to parse those rights in any manner deemed appropriate by the stakeholder, provided such transfer meets certain minimum requirements and the information relating to the revised allocation is transmitted to the ITU.

Considering the nature of the bidding parties, diplomatic negotiation will likely prove to be insufficient to resolve disputes relating to a license. With a license grant must come the ability to pursue a private cause of action against those parties interfering with the use and enjoyment of that

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205. It has been suggested that an installment payment option might enlarge the available market for spectrum. *See* Ian Coe, *Legal Issues Surrounding Spectrum Auctions, in* PROCEEDINGS OF THE FORTY-FIRST COLLOQUIUM ON THE LAW OF OUTER SPACE 200 (1998). There is no evidence to suggest, however, that having the ITU act as a lender in lieu of private sources of capital would maximize returns to the organization. Given the probability that the ITU will be less efficient than private lenders, permitting installments will likely undermine overall efficiency. The use of installments, however, might be warranted where the objective is to enhance the equitable character of the process by aiding the undercapitalized projects of developing states.

license. This cause of action could take many procedural forms. At a minimum, ITU Members would grant a license holder the right to bring an action in the courts of any jurisdiction in which one of the parties is a citizen.

Even under ideal conditions, though, this minimal standard would be prone to forum shopping. More particularly, a dispute brought in the jurisdiction of the license holder may place undue hardship on the purported violator, or result in a judgment that cannot be satisfied locally. Where the jurisdiction of the defendant gives full faith and credit to a judgment from the plaintiff's home state, the potential perceptions of prejudice make the option somewhat unpalatable as a systemic remedy. Conversely, the licensee's fear of a prejudicial hearing in the defendant's jurisdiction would likely discourage use of that judicial system. It is possible that as a matter of self-preservation most operators would incorporate under a "flag of convenience," giving them protection against suits of this type.

In order to give full effect to the regime, it will probably be necessary to amend basic ITU documents so as to require that disputes be settled by binding arbitration.[206] Enforcement could be further enhanced by obligating all Members to give full faith and credit to the decisions of the arbitral panel.[207] Although parties may choose by mutual agreement to have the decision of an arbitral panel communicated to the ITU for use in future disputes, the process could benefit by greater transparency and by adoption of a principle closer to traditional notions of stare decisis.

The auction process greatly enhances operational efficiency in myriad ways. An auction mechanism eliminates procedural inefficiencies by eradicating the need for the majority of administrative actions. Allocation, instead of being achieved through drawn out negotiation processes among large numbers of administrations and applications, is rapidly made on the basis of the developer who values a particular position or frequency most. Because the value of the frequencies and positions are almost completely internalized, there is no incentive for developers to file superfluous appli-

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206. If applied to a broader set of parties, an arbitration procedure similar to that outlined in Article 41 of the Convention would be adequate for the purpose. *See* ITU Convention, *supra* note 84, art. 41.

207. There is legitimate concern that a binding arbitration process will prove politically untenable. The limited recourse to the current binding arbitration proceedings would seem to indicate a reluctance on the part of the Members to accept the procedure. Still, it is difficult to extrapolate from existing conditions given that most disputes arise during a coordination process involving nation-states: a system potentially more amenable to multilateral negotiated settlements. In addition, the availability of intermediate approaches to dispute settlement, such as recourse to national courts, makes the eventual emergence of regular, international binding arbitration of disputes more likely.

cations for resources which they have little intention or capability of exploiting.

Furthermore, technological coordination concerns are greatly reduced through the dispersion of rights into private hands. Instead of mandating specific technologies and subjecting the satellite economy to fallible estimates of the appropriate state of the art, the economic incentives produced by the property right would serve as an inducement for each license holder to introduce and quickly upgrade efficient technologies so as to maximize revenue. The state of the art from current practice would then aid the organization when it proves necessary to determine how returned frequencies and positions are to be placed back on the auction block.

Financing of ITU operations could be achieved without resort to national contributions, thereby eliminating at least some of the friction caused by discrepancies between financial contribution and voting power. Financing could be accomplished either by a combination of cost recovery mechanisms and auction proceeds or exclusively through an attribution of a portion of auction revenues to operations expenses. The proceeds from recent national frequency auctions may be indicative of the large revenues that could result from an auction process. For example, five wireless licenses netted the British government thirty-five and a half billion dollars[208] while Germany received nearly fifty billion dollars in its latest auction of similar service licenses.[209] Auction proceeds for these services across Europe are expected to approach one hundred and fifty billion dollars.[210] While comparisons between national licensing rights and the inherently softer rights conferred by the ITU make actual estimates of auction returns difficult at best, it is reasonable to presume that the funds collected by the organization would be substantial. Given the potentially large sums involved, it would be wise to set financial caps on the availability of proceeds for administrative expenses in order to prevent unwarranted growth in the organization. Below an absolute cap on expenses there might also be an additional figure, above which special or supermajority Council approval might be required.

The equity objective likely benefits most from the auction process. Unlike the current standard, a market approach would provide substantial sums that could be redistributed in an objective manner. This could be done in a number of ways. For example, some portion of the funds might

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208. Stephen Labaton, *The Battle of the Bandwidths*, N.Y. TIMES, Aug. 11, 2000, at C1.

209. Edmund Andrews, *$50 Billion for German Wireless Licenses*, N.Y. TIMES, Aug. 18, 2000, at C4.

210. *Id.*

be used to further the ITU's telecommunication development mission. As with the budgetary contributions from auction proceeds, development funds could be limited to a specific fraction of income or absolute value. Considering the size of the windfall accruing to the ITU, the funds might be applied to broader development objectives although this might conflict with the ITU's mandate and extend beyond the organization's competence.[211]

Additionally, surplus funds could be allocated on the basis of national population directly to the Members for use at their discretion. The argument for such an allocation is that the benefits of the international resource should be shared equally among all of the world's citizens. Alternatively, the basis for allocation might be gross domestic product. The rationale would be that those nations with the greatest economic success have contributed most to the development of the resource, have the greatest incentive to promote further communication growth, and have been the basis of demand for telecommunication services. Most likely, the optimal allocation formula would combine elements of all measures.

The auction process accomplishes what more direct regulatory schemes cannot—it separates the debate over equity from efficiency concerns. By transferring benefits as an ownership interest, the development process can proceed unimpeded even under conditions in which the debate over allocation of proceeds remains unsettled. Likewise, some or even all auction proceeds could be placed in escrow pending agreement on a final allocation scheme.

Given that a need for a regular coordination process would dissipate with the auction transfer process, the points of international friction posed by that process would be similarly reduced. Moreover, by allowing disputing parties to resolve their conflicts outside of government auspices, economic issues are less likely to grow into diplomatic incidents.

B. Limits to the Model

The auction paradigm is not without its limitations, however. First, the process should not be applied to all services. Many uses, such as military communications and public services like weather forecasting might be better served through more traditional, administrative allocation mechanisms because of the noncommercial nature of the applications and their greater impact on interests related to national sovereignty. Second, there is no

211. The use of the ITU as a development agency has not always been met with acceptance. The perception is that other organs of the United Nations are better suited for development responsibilities than the more technically adept ITU. *See* Lyall, *supra* note 201, at 12.

ideal auction mechanism. Different approaches can produce markedly different outcomes under a variety of circumstances.[212] The process is complicated further where the values of the resources to be auctioned are interdependent and where there is a need to give preferential treatment to certain classes of bidders for public policy reasons.[213] Third, the potential complexities of an auction process that incorporates a wide variety of policy interests may make it too difficult for participants to calculate appropriate values for the resources. Still, given the generally high level of expertise among the anticipated participants, it is reasonable to assume that many of the irrational behaviors associated with the auction process will be avoided. Fourth, although the allocation of monetary benefits is fairly independent of the mechanism that allocates spectrum and orbital position, the process could conceivably be held hostage to the proceeds distribution debate. In such event, however, the outcome delays should be no greater than for other redistributive mechanisms such as registration fees. Fifth, auction mechanisms applied solely to the geostationary orbit raise the issue of equal treatment for competing telecommunication services that potentially pose interference problems. The application of auction procedures to other commercial spectrum users, however, introduces additional political challenges to implementation of the system.

Finally, the transfer of license rights might raise some concern that the procedure would be in conflict with the nonappropriation provisions of the Outer Space Treaty. Such concerns, however, are largely unfounded; while activity conducted in geostationary orbit may operate under the color of national authority, the use of the resources of geostationary orbit are made possible only through the coordination measures conducted under international auspices. In a very real sense, activities conducted cannot take place absent international approval. Given that any presence in orbit is enabled through the international consensus embodied in the legal rights conferred by the ITU, and that those rights can be amended or withdrawn through acts of the organization, it is difficult to characterize any conforming conduct to be an exercise of national appropriation no matter the

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212. For example, the classic "English auction" maximizes information transfer among the bidders and allocates a particular resource to the most capable bidder who holds it in highest esteem. The English auction, however, is vulnerable to collusion, most often when similar products are auctioned over time. In contrast, the "Dutch auction," a process of reverse pricing in which descending prices are posted until one bidder accepts the current quoted price, make information transfer of true market value extremely difficult. *See* Coe, *supra* note 205, at 196.

213. The simultaneous ascending-bid multiple-round auction approach developed by the Federal Communications Commission is an example of one effort to accommodate public policy interests with a desire to ensure maximum economic return. *Id.* at 198.

length of occupancy. Rights conferred through international agreement to national entities should not constitute national appropriation. Repeated affirmations of the transitory nature of geostationary occupancy by the ITU merely serve to reinforce the notion that geostationary operations are compliant.

Although the rights associated with the auction process are more clearly defined, they are no more extensive than under the current system. Indeed, under some interpretations, the present system could be considered to represent a greater exercise of national sovereignty over geostationary resources. The fixed term licenses clearly delineate the limits to any geostationary presence while the current mechanism confers an open-ended allocation for which the occupying parties possess the incentive to extend for as long as possible.

C. Additional Reforms

Though an auction mechanism can make the operations of the ITU more consistent with its overall goals of promoting efficiency, equity, and positive relations, other corrective measures would also enhance the success of its regulatory regime. By addressing ambiguities surrounding the issue of national appropriation, correcting voting power disparity within the ITU, and reducing the hazard of space debris, the structure can be made still more effective.

1. National Appropriation

While the concerns over national appropriation may be moot for conforming geostationary operations, the ambiguity concerns with regard to the national appropriation doctrine remain a problem for nonconforming operations. Such ambiguity merely serves to undermine efficiency considerations and provide the potential for increasing the prospect for international disputes. Clearly, a more transparent definition of appropriation is required in order to give effect to the provisions of Article II for limited resources such as the geostationary orbit. The source of ambiguity lies in determining the intent of the occupying party. A definition of appropriation that does not rely upon intent would greatly enhance the effectiveness of the provision. For example, a state may be considered to have "appropriated" a resource where that resource is no longer readily accessible from other locations or sources. Though such a position would certainly encourage conformance with international standards, it may represent a draconian remedy for the nonconforming user. The basic premise, however, can be softened by providing an extended grace period before terminating the nonconforming use.

2. *Voting Mechanisms Revisited*

Auction distribution mechanisms and their consequential impact on the financial health of the ITU reduce some of the legitimacy concerns associated with a voting procedure that extends a single vote to each state Member. Efficiency considerations would be enhanced, however, with a voting system that is more conducive to telecommunication development interests. Consider, for example, a voting process which weights voting in relation to each nation's percentage of gross global product. In doing so, the system gives the greatest weight to those states most able to exploit telecommunications resources, the greatest need for such services, and the least in need of the revenue from spectrum and position auctions. The weighting system tends to discourage institutional choices that might be geared towards maximizing auction revenue at the expense of resource exploitation. It is important, however, to limit such a voting system to issues related solely to commercial telecommunication uses. To take but one potential instance, national interests would have far more significance in a debate over allocation of spectrum for military communications in the context of other uses. Consequently, the "one state, one vote principle" should be retained for all questions relating to allocation of spectrum among services. Only those issues relating directly to specific allocations within the commercial sectors—such as determining how positions and frequencies are to be auctioned and the basic minimum technical criteria—would be subject to the revised voting standard.[214]

3. *Space Debris Mitigation*

Since 1993, the ITU has recommended that satellites nearing the end of their service lives be placed in a disposal orbit not less than three hundred kilometers above the geostationary orbit.[215] Direct environmental regulatory approaches, like the administrative techniques for alleviating geostationary licensing issues, address the symptoms rather than the cause of the problem. Even when such bureaucratic techniques address the commons dilemma, it is extremely difficult to determine the value of such responses. While some regulatory choices may be easily justified by a cost-benefit analysis, it is unclear whether more marginal approaches are efficient.

214. If a two-tiered voting mechanism proves to be too unwieldy for the ITU, a unified voting mechanism which combined elements of the "one state, one vote" system and a mechanism weighted according to gross domestic product, though flawed, could represent an acceptable compromise.

215. Johnson & Loftus, *supra* note 161, at 28.

Resolving the problem in the most cost-effective manner would require techniques similar to those used for addressing allocation issues. By clarifying terms contained in the Outer Space Treaty and the Convention on International Liability for Damage Caused by Space Objects[216] and establishing mandatory insurance provisions for debris incapable of being detected or identified, the hazards posed by the space debris commons can be greatly reduced.[217] Moreover, by resolving the issue without continuous governmental action and requiring those most responsible for propagating debris to be financially responsible for its reduction, the equity interest is fully supported and international relations are not endangered.

VI. CONCLUSION

The venerable International Telecommunication Union has withstood the test of time and technology. Nevertheless, the seeds of its own noble traditions have left it ill-prepared to manage the demands of the twenty-first century. The organization is not, however, irretrievably lost. Though flawed, most of the proposals that seek to revise the ITU allocation process through enhanced administrative techniques will improve the efficiency and legitimacy of the organization.

The challenges, though, promise only to increase. As national auctions for frequency continue to gain in popularity around the world, the true value of international rights to use of the geostationary orbit will continue to grow. The rise in value will engender renewed interest from developing states to secure portions of this asset against encroachment from developed nations. Most likely, these efforts will produce plans which either forestall allocation of the resource until such time as a greater number of states can make direct use of it or redistribute geostationary assets using

216. Convention on International Liability for Damage Caused by Space Objects, Oct. 3, 1973, 24 U.S.T. 2389, *reprinted in* GOROVE, *supra* note 186, at 378.

217. For a more comprehensive analysis of the regulatory regime relating to space debris, see Lawrence D. Roberts, *Addressing the Problem of Orbital Space Debris: Combining International Regulatory and Liability Regimes*, 15 B.C. INT'L & COMP. L. REV. 51 (1992).

mechanisms that will likely greatly undermine the efficiency of satellite communications and degrade the perceived legitimacy of the ITU.

Though not a panacea, market allocation of geostationary resources in combination with judicious regulatory reform holds the potential for the ITU to promote global development, and ensure that the benefits of that development are apportioned fairly and in a manner which helps to aid the discourse of nations for the next century and beyond.