

# LEX AMERICANA: THE NEW INTERNATIONAL LEGAL REGIME FOR LOW EARTH ORBIT SATELLITE COMMUNICATIONS SYSTEMS

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Since the dawn of satellite communications in the late 1950s<sup>1</sup>, the technology of bouncing messages off orbiting electronic machines<sup>2</sup> has played a crucial role in improving the quality of life enjoyed by people worldwide.<sup>3</sup> Due to recent advances in microelectronics<sup>4</sup>, it is now possible

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<sup>1</sup> Satellite communications may be dated to the launch, by organizations within the Soviet Union in October 1957, of Sputnik which transmitted self-generated tones received throughout the world. However, if one considers human speech to be a necessary concomitant of communications, then the dawn of satellite *communications* (as opposed to satellite *technology*) may more properly be dated to the launch of Score by organizations within the United States in December 1958. This satellite relayed tape recorded Christmas greetings from President Eisenhower to ground stations in Europe.

<sup>2</sup> The way messages "bounce" off of satellites has not changed appreciably since the launch of the first active real-time satellite, Telstar I, by Bell Laboratories and NASA in July 1962. An antenna on the satellite is energized by radio signals sent from a single location on the earth (or from an aircraft in flight), from a transmitter at an "uplink" frequency which signals are then conducted through the satellite's set of electronic receivers and amplifiers and then retransmitted out an antenna at a different "downlink" radio frequency back to the earth. Since the satellite is far above the earth's surface, its retransmitted signal unavoidably covers a large swath of the earth's surface, just as the area illuminated by a flashlight increases with the distance from the flashlight. An electronic device that is both in the line of sight to the satellite's retransmission, and tuned to the "downlink" frequency, such as the familiar rooftop "satellite dish", may then reproduce the original communication sent up to the satellite. In this way, any specific "uplink" location can communicate with any number of "downlink" locations, a feat which is usually impractical to replicate over very large distances with any other technology. For an excellent overview of the technology of satellite communications, see W. PRITCHARD, ET AL., *SATELLITE COMMUNICATIONS SYSTEMS ENGINEERING* (2nd ed. 1993). The history of satellite communications has been to add increasingly sophisticated and higher message capacity electronic machinery to the orbiting satellite, but not to change the basic principle of transmission of radio signals from one part of the earth and real-time relay of those radio signals for reception by others across large areas of the earth.

<sup>3</sup> The immediacy of satellite television news broadcasting creates global pressure to end wars and ameliorate suffering, the agony of which has been made more palpable than ever due to graphic visual imagery. The global reach of

to pack an unprecedented amount of computing power into both satellites and handheld electronic terminals.<sup>5</sup> One consequence of this microelectronic revolution is that it is practical, for the first time,<sup>6</sup> to use an interconnected network of low earth orbit (LEO) computerized satellites as the backbone for a global personal communications system.<sup>7</sup> The

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satellite videoconference networks enables doctors to diagnose sick persons in remote areas with disadvantaged health care capabilities, often resulting in lifesaving prescriptions. The low cost of satellite radio channels has enabled educational organizations to extend their course offerings worldwide, helping people to earn more money, grow more food, practice better hygiene and challenge oppressive ideologies. As noted recently by the Hon. Adigun Ade Abiodun of the United Nations Office for Outer Space Affairs, "the current annual market value of the global satellite industry exceeds US \$10 billion, with about 320 geosynchronous satellites in operation. Almost all countries depend on one form of satellite communications systems or another for their domestic, regional and international communications services such as business, entertainment, education and personal (phone) and general information (TV). In recent years, the launching of the high powered communication satellites has resulted in the establishment of very small Earth stations, thus making it possible to provide communications services, such as health care, literacy and agriculture-related information, particularly in rural areas of developing countries where communications infrastructure is often lacking." *Opening Address, Asia-Pacific Satellite Communications Council 94 Workshop, in PROCEEDINGS, APSCC '94 WORKSHOP 8* (Seoul, Korea 1994).

<sup>4</sup> A generally accepted metric is that computing power per dollar has doubled every 18 months since transistors first became generally available in the 1960s. In a similar vein, the telecommunications expert Dr. Joseph Pelton has calculated that "on the average, digital communications capabilities have doubled about every five years since [the Morse Code telegraph of] 1850." J. PELTON, *GLOBAL TALK* 131-32 (1981).

<sup>5</sup> The computing power of the low earth orbit satellite system *Iridium* exceeds that of all previously launched 320 geostationary satellites combined. A typical handheld satellite terminal has the computing power of a desktop computer, which itself equals in computing power a room full of 1970s era machines.

<sup>6</sup> Before the 1990s, computing power measured in the millions of instructions per second (MIPS), was so bulky (room-size) that even 1 MIPS could not fit within the size constraints of a satellite. Today, well over 100 MIPS of computing capacity can fit on a desktop, and hence within a satellite.

<sup>7</sup> Substantial satellite computing power is the *sine qua non* of a low earth orbit personal communications system because the satellites must operate similarly to a cellular telephone switching system in the sky, routing upcoming calls among different sister low earth orbit satellites and/or digitally reconstructing uplink radio signals so as to successfully relay them and other simultaneously received signals to the proper destinations. Unlike the communications satellites described in note 2, *supra*, low earth orbit personal communications satellite systems must do more than simply "bounce" signals back to the earth; they often must also direct them via intersatellite links to a satellite covering the appropriate portion of the earth, and digitally process relatively weak uplink signals coming from handheld devices as compared to simply retransmitting powerful uplink signals from satellite dishes.

revolutionary development of what this author will call "satellite communications" promises to set a new high water mark for the role played by orbiting technology in improving our planetary quality of life.<sup>8</sup>

Three kinds of low earth satellite communications systems have been proposed to date.<sup>9</sup> These systems may be called Little LEOS, Big LEOS and Giga LEOS.<sup>10</sup> They share in common the feature of worldwide satellite frequency utilization via constellations of regularly replaced satellites.<sup>11</sup> Their differences are in which part of the frequency spectrum they occupy and which kinds of markets they intend to serve.<sup>12</sup> The Little LEOS operate inbetween the television broadcast bands, around 100-400 MHz, and are intended to be used mostly for telemetry and teletype communications.<sup>13</sup>

<sup>8</sup> Satellite communications, digicomunications and other similar "signalculture" phenomena were first legally described in Rothblatt, *International Regulation of Digital Communications Satellite Systems*, 32 FED. COM. L.J. 393 (1980).

<sup>9</sup> The great preponderance of proposals have been made in applications for regulatory operating authority submitted to the United States Federal Communications Commission (FCC). The only current exceptions to this are the Russian-authorized GONETS Little LEO system and the British-sponsored I-CO Big LEO system. For an itemization of the current LEO systems proposed within the United States, see notes 13-15, *infra*.

<sup>10</sup> The FCC coined the terms "Little LEO" and "Big LEO" to reflect the fact that the Little LEOS were physically smaller and less expensive satellites compared to the Big LEOS. See, *In re Amendment of the Commission's Rules to Establish Rules and Policies Pertaining to a Mobile Satellite Service in the 1610-1626.5/2483.5-2500 MHz Frequency Bands*, 9 F.C.C. Rcd. 4936 (1994). This was largely a consequence of their chosen frequency bands and market objectives. The author is coining herein the term "Giga LEO" to refer to the yet more momentous scope of these satellite systems.

<sup>11</sup> This feature is extremely important for international legal purposes because the use of satellite frequencies in outer space by organizations under the jurisdiction of one country may preclude their use by organizations under the jurisdiction of other countries. Cf. Article II of 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, T.I.A.S. No. 6347, 610 U.N.T.S. 205 (entered into force Oct. 10, 1967) [*hereinafter cited as Outer Space Treaty*] ("Outer Space ... is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means.").

<sup>12</sup> Typically, a pioneering company selects a frequency band because it thinks it will have a realistic chance to gain regulatory approval for a particular type of intended service. The chances of regulatory approval are heightened if there there is a logical fit between the amount of spectrum requested and the amount of spectrum technically needed for the intended service. Generally speaking, higher capacity communications systems are a better fit with higher frequency bands, and lower capacity systems fit better in the lower frequency bands.

<sup>13</sup> Specifically, the FCC authorized three US companies, Orbital Sciences, StarSys, and Volunteers in Technical Assistance to operate three separate Little LEO systems providing non-voice telemetry and teletype messaging services worldwide in, and thereby practically occupying, the 137-138, 148-150 and 400-401 MHz bands. *Report and Order*, In the Matter of Amendment of the Commission's Rules

The Big LEOs operate in the microwave region, around 1600-2500 MHz (or 1.6-2.4 GHz), and are intended mostly for cellular phone type of communications.<sup>14</sup> The Giga LEOs operate well within what is known as the gigahertz region, around 20,000-30,000 MHz (or 20-30 GHz), and are intended to be used for all manner of "information superhighway" communications.<sup>15</sup> In practice, the Big LEOs can provide the same services as the Little LEOs (but not vice versa), and the Giga LEOs can provide the same services as the Big LEOs (but not vice versa). Consequently, it can be expected that each kind of LEO is a step in technology evolution, much as efficiency dictated that telegraph would become secondary to telex and telex would become secondary to fax.<sup>16</sup>

International space law clearly requires any activities of non-governmental entities in outer space to occur only pursuant to the jurisdiction and control of a State.<sup>17</sup> Accordingly, all of the LEO systems

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to Establish Rules and Policies Pertaining to a Non-Voice, Non-Geostationary Mobile-Satellite Service, CC Docket No. 92-76, Nov. 16, 1993 (hereinafter referred to as the *Little LEO Order*). The FCC denied a Little LEO license to a fourth "low price" firm ostensibly because of a single page missing from its application, but more believably because of intense lobbying by other firms to keep out low price competition. Nearly a dozen additional US companies are seeking permission to provide this service, and hence the United States is proposing the allocation of additional Little LEO frequency bands in the 200-400 MHz region. *In the Matter of Preparation for International Telecommunication Union World Radiocommunication Conferences*, IC Docket No. 94-31, June 15, 1995 at paragraphs 7-26.

<sup>14</sup> The FCC authorized four US companies, Motorola's *Iridium*, Loral's *GlobalStar*, TRW's *Odyssey*, and, provisionally, a fourth entrepreneurial startup firm to operate separate Big LEO systems providing cellular phone type of services worldwide in, and thereby fully occupying, the 1610-1626.5 and 2483.5-2500 MHz bands. *In re Amendment of the Commission's Rules to Establish Rules and Policies Pertaining to a Mobile Satellite Service in the 1610-1626.5/2483.5-2500 MHz Frequency Bands*, 9 F.C.C. Rcd. 5936 (1994).

<sup>15</sup> The FCC is preparing to authorize at least one US company, Teledesic, and perhaps more, to operate a Giga LEO system providing "global broadband services," i.e., videophone and world wide web services, in the 18.8-19.3 GHz and 28.35-28.85 GHz bands. *In the Matter of Preparation for International Telecommunication Union World Radiocommunication Conferences*, IC Docket No. 94-31, June 15, 1995 at paragraphs 63-68. The FCC often uses the terminology "Non-Geostationary Satellite Orbit" or "NGSO" instead of "LEO."

<sup>16</sup> Notwithstanding the probable pregnant obsolescence of the Little and Big LEO systems, the observation of geostationary orbit visionary Arthur C. Clarke should be recalled: no communications system has ever totally disappeared, although they become less and less important as the technological horizon expands.

<sup>17</sup> Article VI of the Outer Space Treaty provides, in relevant part, that "activities of non-governmental entities in outer space, including the moon and other celestial bodies, shall require authorization and continuing supervision by the appropriate State Party to the Treaty." Outer Space Treaty, note 11, *supra*.

Similarly, Article VIII provides that States retain "jurisdiction and control" over objects they launch into space. *Id.* at Article VIII. Furthermore, there is no doubt whatsoever that low earth orbits are part of outer space. See, e.g., the

require national authorization.<sup>18</sup> Since nearly all of the LEO systems have arisen in the United States, and there was very little pre-existing law in this area, that country has had a unique opportunity to establish a *Lex Americana* for low earth orbit satellite communications.<sup>19</sup> Somewhat remarkably, the *Lex Americana* has been accepted worldwide as *de facto* international space law.<sup>20</sup>

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excellent treatment of this issue in S. GOROVE, DEVELOPMENTS IN SPACE LAW: ISSUES AND POLICIES 358 (1991) ("As international customary law stands today, earth-orbiting satellites are regarded to be moving in outer space."). For one of the earliest, and certainly most trenchant, analyses of the delimitation of outer space, see S. Gorove, *On the Threshold of Space: Toward a Cosmic Law - Problems of the Upward Extent of Sovereignty*, in 1 PROC. COLLOQ. L. OUTER SPACE 69 (A. Haley ed., The Hague 1958) wherein we find *Gorove's Axiom*: "He who controls the Cosmic Space, Rules not only the Earth, But the whole Universe." With characteristic prescience, Gorove also predicted in 1958 that "it may be assumed that cosmic law will govern such relations as will or do arise out of or in reference to the use of cosmic space." *Id.* at 71, n. 1. In other words, if an activity depends upon and exists within the framework of outer space, then, *ipso facto*, it will be governed by the law of outer space. Clearly, then, low earth orbit satellites, which depend upon outer space for their very being -- without the near-vacuum of space the satellites would rapidly lose orbital velocity and fall to earth -- are subject to the law of outer space.

<sup>18</sup> In the United States, national authorization comes from the Federal Communications Commission (FCC) because federal law provides that no one may construct radio transmitting equipment except pursuant to a construction permit from the FCC. Communications Act of 1934, *as amended*, 47 U.S.C. 151 (1994). Low earth orbit satellites are specifically considered radio transmitting equipment that must be licensed by the FCC. See, e.g., 47 C.F.R. §§ 25.102, 25.142, 25.143 (1994). See, e.g., *In re Application of Motorola Satellite Communications, Inc. for Authority to Construct, Launch, and Operate a Low Earth Orbit Satellite System in the 1616-1626.5 MHz Band* (Jan. 31, 1995).

<sup>19</sup> Responding to European Community criticism that the United States should not establish a Big LEO regulatory regime without the full involvement and participation of other countries, the FCC responded that "we do not need to delay the domestic licensing proceeding until international agreements are finalized. ... Notwithstanding the EC's view, the United States has every right under established ITU procedures to move forward with licensing systems that are necessary to satisfy domestic demand for new communication services." *In re Amendment of the Commission's Rules to Establish Rules and Policies Pertaining to a Mobile Satellite Service in the 1610-1626.5/2483.5-2500 MHz Frequency Bands*, 9 F.C.C. Rcd. 6020-21 (1994).

<sup>20</sup> The Agenda for the first World Radiocommunication Conference to be held subsequent to the pre-emptive approval by the FCC of several American LEO systems contains no item which questions or undermines in any way the legitimacy of the FCC approvals. International Telecommunication Union Council, 14th Plenary Meeting, *Resolution 1065*, Doc. C94/149-E (16 May 1994).

### I. Details of the Low Earth Orbit *Lex Americana*

As established by the FCC, the United States has a qualified exclusive right<sup>21</sup> to use the frequency bands currently available<sup>22</sup> for commercial<sup>23</sup> low earth orbit satellite communications for at least the next 14 years, and probably much longer. More generally, under the *Lex Americana*, the first country to notify the International Telecommunication

<sup>21</sup> The exclusive right is qualified by the fact that the FCC stated that the LEO systems it authorized would not cause harmful interference to pre-existing uses of the frequency bands, such as land-based radiocommunications systems in 16 countries [Austria, Bulgaria, Cameroon, Germany, Guinea, Hungary, Indonesia, Libya, Mali, Mongolia, Nigeria, Poland, Romania, Senegal, Czechoslovakia, and the Russian Federation], the Russian satellite navigation system called GLONASS, and certain radio astronomy sites, and that the FCC recognized an obligation to negotiate with any other country that wanted to use the frequency bands for a satellite system. See, e.g., *In re Amendment of the Commission's Rules to Establish Rules and Policies Pertaining to a Mobile Satellite Service in the 1610-1626.5/2483.5-2500 MHz Frequency Bands*, 9 F.C.C. Rcd. 5936, 5996 (1994) ("it is important that we make clear the obligations of Big LEO operators to coordinate their systems worldwide [with other countries making use of the frequencies]"). See also, *id.* at 6020 ("Regardless of the spectrum licensing arrangement within the United States, we would work with affected administrations to resolve any spectrum sharing or technical issues."). On the other hand, the FCC elsewhere clearly determined that there was not enough worldwide spectrum available in the Big and Little LEO frequency bands for all of the applicants before it; *ipso facto* there is no spectrum available for other Big or Little LEO systems from outside the United States. See, e.g., *id.* at 5954-5975. Consequently, it would appear that the FCC's stated willingness to "work with affected administrations to resolve any spectrum sharing or technical issues" does not meaningfully apply to current LEO systems, but only to pre-existing users of the LEO frequencies or to possible foreign LEO systems more than 10-20 years from now..

<sup>22</sup> Additional Big LEO frequency subbands within the 1800 - 2200 MHz region, and Little LEO frequency subbands within the 200-400 MHz region, will likely become available soon after the turn of the century. See generally, *In the Matter of Preparation for International Telecommunication Union World Radiocommunication Conferences*, IC Docket No. 94-31, June 15, 1995 at paragraphs 16-26 and 39-45.

<sup>23</sup> Other frequency bands are available for low earth orbit satellites but are apparently occupied by defense systems and do not arise for discussion within the publicly available legal literature. Yet other frequency bands are available for Little LEO systems subject to constraints that may not be commercially acceptable. See, e.g., *ITU Radio Regulations* Article 8, Footnote Numbers 641 and 641A ("the bands 235-322 MHz and 335.4-399.9 MHz may be used by the mobile-satellite service, on condition that stations in this service do not cause harmful interference to those of other services .... The bands 312-315 MHz (Earth-to-space) and 387-390 (space-to-earth) in the mobile-satellite service may also be used by non-geostationary-satellite systems"). Also, one of the Little LEO systems, VITA, is classified as a non-commercial system. *Little LEO Order*, note 13, *supra*.

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Union (ITU)<sup>24</sup> of its intention to launch one or more LEO systems, and to subsequently implement that intention, has a qualified exclusive right to the frequency bands those LEO systems employ. Whether or not users can access a LEO system from any particular country is left up to each country's sovereign discretion, but countries can neither prevent the LEO systems from operating over their territory, nor can they operate their own LEO systems in the same frequency band. These are substantial departures from the satellite communications international legal regime that has prevailed to date.<sup>25</sup>

Perhaps the most striking evidence of how the new *Lex Americana* regime for LEO systems departs from that which prevails traditionally at the International Telecommunication Union (ITU) is the FCC's treatment of the "failed system" contingency.<sup>26</sup> While the FCC has claimed on behalf of

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<sup>24</sup> At the 1992 World Administrative Radio Conference, a detailed protocol was adopted for notifying to the International Telecommunications Union (ITU) all relevant technical parameters of Little and Big LEO systems, and for coordinating technical interference potentials among such systems and other occupants of the frequency bands. See *Final Acts of the World Administrative Radio Conference for Dealing with Frequency Allocations in Certain Parts of the Spectrum (WARC-92)*, Resolution 46 (1992). The ITU protocol does not contemplate, however, what occurs when one country arrogates unto itself all of the remaining spectrum available worldwide in a particular frequency band. Under the *Lex Americana*, this usurpation is apparently legitimate, provided it is not of unlimited duration and *pro forma* compliance with ITU protocols is maintained. *But compare* with *Little LEO Order*, *supra* note 13, at para. 20, where the FCC observes that Little LEO "system capacity may have to be decreased over time as U.S.-authorized NVNG [Non-Voice Non-Geostationary] systems coordinate their operations with those of neighboring jurisdictions." In other words, the U.S. has arrogated unto itself all of the available Little LEO spectrum, but is recognizing it has an obligation to share it pursuant to an unknown methodology with other countries.

<sup>25</sup> Non-LEO systems operated under the regulatory mandate to share every frequency band with as many other countries as were prepared to use it, albeit from different orbital locations. Rothblatt, *ITU Regulation of Satellite Communication*, 18 *STANFORD J. INT'L L.* 1 (1982). This regime has successfully enabled several international organizations (Intelsat, Arabsat, Inmarsat, Eutelsat) and many countries (Indonesia, Canada, United States, Russian Federation, China, Luxembourg, Japan, India, Brazil, Mexico, Israel, Turkey, the United Kingdom, France, Spain, Italy, Germany, Argentina and Australia) to each implement their own satellite systems in the 1.5, 4, 6, 7, 11, 14, and 20 GHz bands. Whenever this mutual accommodation approach became problematic, such as due to competing demands for the same orbital slots, the world community would develop a plan to segment the frequency band at the congested orbital slots into channels that could be allotted to each country. Butler, *World Administrative Radio Conference for Planning Broadcasting Satellite Service*, 5 *J. SPACE L.* 93 (1977). This regime has successfully enabled several countries to implement direct broadcast satellite television systems.

<sup>26</sup> Systems frequently fail to use -- or to continue to use -- the orbital positions and frequencies that are initially notified to the ITU. The entire Big LEO service, for example, is built upon the *Geostar* radiodetermination satellite service (RDSS) frequency bands. The author, N.A. Samara of WorldSpace Corp. and R.D. Briskman

the United States the entire unused portion of the Big LEO frequency band, it has issued licenses to three U.S. companies for each to use a sub-segment of the band and has said it will issue a license to a fourth U.S. company for the last remaining sub-segment.<sup>27</sup> All together, the four sub-segments represent the entire capacity of the Big LEO frequency band. In the event one of the companies fail to implement their satellite system, the FCC has decided that it will not return the associated Big LEO frequency sub-segment to the ITU for assignment to another country or international organization's Big LEO system. Instead, it will proportionately increase the frequency size of the three remaining sub-segments it has licensed to U.S. companies.<sup>28</sup>

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of CD Radio Inc. carved the radiodetermination satellite service frequency allocations out of aeronautical radionavigation and fixed microwave allocations during the mid-1980s, but these were then rendered obsolete in 1990 by the commercialization of the U.S. Air Force's Global Positioning System (GPS). *Amendment of the Commission's Rules to Allocate Spectrum for, and to Establish Other Rules and Policies Pertaining to, a Radiodetermination Satellite Service*, 104 FCC 2d 650 (1986). Nevertheless, during its years of operation the *Geostar* system saved several lives by locating remote accident victims, proved the feasibility of handheld satellite communications via a Motorola-Geostar prototype terminal, inspired its prime contractor Motorola to develop its proprietary Big LEO system *Iridium*, and cleared the frequency bands needed for the Big LEO systems of the 1990s. Author's interviews with company staff, 1989-90. See also M. ROTHBLATT, RADIO DETERMINATION SATELLITE SERVICES AND STANDARDS 3-9, 20-24 (1987).

<sup>27</sup> Of particular interest is the FCC's decision to auction the fourth sub-segment off to the highest bidder, assuming there are at least two U.S. companies still qualified to bid for it. *In re Amendment of the Commission's Rules to Establish Rules and Policies Pertaining to a Mobile Satellite Service in the 1610-1626.5/2483.5-2500 MHz Frequency Bands*, 9 F.C.C. Rcd. 5936, 5974-75 (1994) ("Consequently, we conclude that we have the statutory authority to award Big LEO licenses through an auction process. ... [T]o be qualified to participate in the Big LEO auction, applicants must submit an upfront payment to the Commission prior to the auction. ... For simplicity, we will round to the nearest million, and require an upfront payment of \$10 million."). Hence, LEO spectrum that could otherwise go to another country for use in their own Big LEO system, may instead be sold by the United States government to the highest bidder simply by virtue of the FCC's deft use of the ITU's satellite notification process and its implementation of *Lex Americana* in an otherwise legal vacuum. A similar situation is likely to prevail in the Giga LEO service, and with Microsoft founder Bill Gates and cellular phone pioneer Craig McCaw as Giga LEO applicant *Teledesic's* chief shareholders, the auction price could go to "astronomical" heights. Nor did the FCC ban arbitrage, noting that it "will not restrict auction winners from reselling" because "such flexibility enhances beneficial incentives." *Ibid.* While the FCC was certainly not motivated by concerns of national enrichment, it is highly unusual for a scarce *res communes* resource, global satellite frequency spectrum, to be sold off for the financial benefit of the richest nation in the world rather than allotted in some equitable fashion, as has traditionally been done, to other parts of the world.

<sup>28</sup> *Id.* at 5954. For the Little LEOs, the FCC also appears unwilling to return a failed system spectrum to the world at large, but would instead assign any failed

Another interesting feature of the FCC's legal regime for LEOs is its insistence on quasi-global coverage. For example, in the case of Big LEOs, the FCC requires them to "be capable of serving locations as far north as 70 degrees latitude and as far south as 55 degrees latitude."<sup>29</sup> This is directly counter to the usual satellite communications regime which seeks to restrict satellite coverage to the smallest practicable coverage area, thus maximizing the opportunities for many countries to launch satellite systems. However, the FCC noted its interest in "furthering the creation of the global information infrastructure,"<sup>30</sup> which in the context of LEO technology unavoidably involves global coverage areas and hence minimal opportunities for globally diverse satellite systems.

## II. Consistency of LEO *Lex Americana* With International Space Law

International space law relevant to LEO satellite communication systems includes both treaties specifically concerned with outer space and international law concerned with satellite communications. Article III of the *Outer Space Treaty* makes manifest the extra-territorial applicability of international law by proclaiming that State Parties "shall carry on activities in the exploration and use of outer space, including the moon and other celestial bodies, in accordance with international law" and in the interest of "promoting international co-operation and understanding."<sup>31</sup> With regard to space law itself, there is perhaps no more important provision than the command to use outer space "for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development, and [that space] shall be the province of all mankind."<sup>32</sup>

As to positive international law, the most relevant provision for assessing the legitimacy of the *Lex Americana* regime is that of the International Telecommunication Convention's Article 33, which provides in relevant part that "radio frequencies and the geostationary satellite orbit are limited natural resources, that they must be used rationally, efficiently and economically, in conformity with the provisions of the Radio Regulations, so that countries or groups of countries may have equitable access to both ...."<sup>33</sup> While there is specific reference to the

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system spectrum to new U.S. Little LEO applicants. *Little LEO Order, supra* note 13, at para. 17.

<sup>29</sup> *Id.* at 5947. The FCC could not initially impose a coverage requirement for Little LEOs because it lacked adequate technical and market information. *Little LEO Order, supra* note 13, at paras. 22-23. The FCC said it did "expect to address the issue of efficiency standards in future proceedings." *Id.* at n. 41.

<sup>30</sup> *Id.*

<sup>31</sup> *Outer Space Treaty, supra* note 11, at Art. III.

<sup>32</sup> *Id.* at Art. I.

<sup>33</sup> This provision was first adopted in somewhat modified form in *International Telecommunication Convention*, Oct. 25, 1973, art. XXXIII(2), 28 U.S.T. 2495, T.I.A.S. No. 8572. The current version cited may be found at ITU, FINAL ACTS OF THE PLENIPOTENTIARY CONFERENCE (1993). The ITU's important role in this area was

geostationary orbit in this article, and indeed concern about that unique orbit's usurpation inspired the article,<sup>34</sup> it nevertheless remains equally applicable to radio frequencies employed in other satellite orbits. This is clear from the linguistic construction -- both radio frequencies *and* the geostationary orbit are to remain accessible -- and from the intent of the drafters.<sup>35</sup>

It appears apparent, based on the traditionally accepted rules of constructing compliance with positive international law described below, that the regime imposed upon the world by the U.S. FCC is consistent with both international space law and international telecommunications law. The LEO systems promise to provide advanced personal communications capabilities in every country in the world without requiring from such countries the enormous costs associated with telecommunications infrastructure.<sup>36</sup> This is precisely the kind of technological and economic assistance the developing countries, representing some four-fifths of the world's population, are seeking.<sup>37</sup> Hence it is indisputable that the LEO systems are "in the benefit" and "in the interests" of all countries "irrespective of their stage of development."<sup>38</sup> It is similarly clear that the LEO systems "provide equitable access"<sup>39</sup> for all countries to frequency bands that the vast majority would otherwise not access at all.<sup>40</sup>

It may also be argued that the United States is benefiting disproportionately from the use of the LEO frequency bands, and that more could be done to benefit other countries or provide them with more palpable equitable access, such as free or discounted service or gifted

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foreseen quite early on in Vereshchetin, *Remarks on Certain Legal Principles of Building Space Telecommunications Systems*, 11 PROC. COLLOQ. L. OUTER SPACE 210, 213 (1969).

<sup>34</sup> Rutkowski, *Six Ad-Hoc Two: The Third World Speaks Its Mind*, SAT. COMM., Mar. 1980, at 22.

<sup>35</sup> A thoughtful discussion of the evolving intent behind Article 33 is offered in S. GOROVE, *DEVELOPMENTS IN SPACE LAW* 56-60 (1991).

<sup>36</sup> See text accompanying notes 9-15 *supra*.

<sup>37</sup> "WE RECOMMEND that manufacturers and operators be encouraged to develop systems, using the latest technologies where appropriate, which will enable the needs of the more remote areas of developing countries to be met at lower costs. In many cases this would include satellite systems." International Telecommunication Union, *The Missing Link: Report of the Independent Commission for World Wide Telecommunications Development* (The "Maitland Commission") 34 (1984).

<sup>38</sup> Note 32, *supra*.

<sup>39</sup> Note 33, *supra*.

<sup>40</sup> Compare the pre-LEO uses of their frequency bands -- mostly isolated hilltop-to-hilltop radio relay links in a handful of countries -- to the direct access to satellite communications offered via Little LEOs (\$100 two-way alphanumeric pagers that work anywhere), Big LEOs (extension of telephone service to literally every village in the world for the capital cost of a single satellite telephone handset for each village -- no wires, switching centers, maintenance costs), and Giga LEOs (enabling personal computers anywhere in the world to plug directly into the world's information databases).

system ownership rights.<sup>41</sup> However international law requires good faith, not exuberant, compliance with its provisions.<sup>42</sup> Compared with the *status quo*, the *Lex Americana* regime represents a huge step forward, on the part of the United States, in complying with international law. Indeed, it may fairly be said that no other country is undertaking to do nearly as much in bringing the benefits of space communications to humanity.<sup>43</sup>

Finally, it could be alleged that notwithstanding the American compliance with the above-stated provisions of international space and telecommunications law, the *Lex Americana* nevertheless constitutes a "national appropriation" of outer space "by means of use" in contravention of Article II of the Outer Space Treaty,<sup>44</sup> or an abrogation of the obligation in Article IX of the Outer Space Treaty to conduct activities in outer space "with due regard to the corresponding interests of all other States Parties to the Treaty."<sup>45</sup> For example, if a Giga LEO American system precludes a Giga LEO European or Asian system, it could be argued that there was a failure to show "due regard" for the planned outer space activities of those other geographical regions.

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<sup>41</sup> "WE RECOMMEND that Member States of the ITU consider in the light of their own circumstances a rearrangement of their international traffic accounting procedures with the aim of setting aside a small proportion of revenues from calls between developing countries and industrialized countries. The resources transferred thereby should be devoted to the telecommunications sector in the developing country or countries concerned, or contributed to a fund and used for example to finance pre-investment costs." International Telecommunication Union, *The Missing Link: Report of the Independent Commission for World Wide Telecommunications Development* (The "Maitland Commission") 61 (1984). Contributing economic value from radio spectrum and orbital usage rights have also been suggested by developing country representatives. *Id.* at 62. For example, monies received by governments from auction of satellite frequencies might quite properly be used for global telecommunications development aid. Cf. the FCC's expected windfall described in note 27, *supra*.

<sup>42</sup> Vienna Convention on the Law of Treaties, Article 31; Kearney & Dalton, *The Treaty on Treaties*, 64 AM. J. INT'L L. 495, 518 (1970). See, generally, M. McDUGAL, H. LASSWELL & I. VLASIC, LAW AND PUBLIC ORDER IN SPACE 774-76, 781 (1963); M. McDUGAL, H. LASSWELL & J. MILLER, THE INTERPRETATION OF AGREEMENTS AND WORLD PUBLIC ORDER (1967).

<sup>43</sup> For example, some four years after the FCC first welcomed Little and Big LEO applications from private companies, and fifteen years after the basic business concept was first described, no other country in the world has yet issued a similar invitation to their industry to provide global telecommunications via licensed use of satellite frequencies. The basic business concept was first enunciated by the illustrious ITU Secretary General Richard Butler in *The Application of Telecommunication Technology to Development* (paper delivered at International Colloquium on Science, Technology and Society, Vienna, 1979). In most regards, the various Little, Big and Giga LEOs are simply privately organized manifestations of Butler's "Glodom" vision of a globally operated common system for the cost-effective provision of domestic telecommunications requirements.

<sup>44</sup> Outer Space Treaty, Art. II, note 11, *supra*.

<sup>45</sup> Outer Space Treaty, Art. IX, note 11, *supra*.

The aforementioned legal objections stand on very weak ground. Far from appropriating outer space, the FCC Little and Big LEO approvals did no more than provide the approved companies with a brief ten year license, running from the date of initial operations.<sup>46</sup> In fact, the FCC specifically refused to even offer its licensees a "renewal expectancy," despite their expenditure of billions of dollars, observing that "intervening international agreements or changes in technology may affect our determination as to whether a replacement system would serve the public interest."<sup>47</sup> Hence, the United States specifically contemplated that it might enter into international agreements to share the LEO frequency bands.

As to the obligation to use outer space with "due regard" for the interests of other States, the FCC refuted an objection from the European Community that "unilateral solutions to orbit, frequency and coverage issues"<sup>48</sup> were being imposed with a promise to engage in "good faith negotiations with respect to whatever non-US" LEO systems might exist and to "follow coordination procedures prescribed by the ITU...."<sup>49</sup> Once again, it could be argued that the United States could have done more to coordinate with other countries and to proceed in more of a globally consensual manner. But the international legal obligation is not to achieve a theoretical level of maximum compliance; by any reasonable measure the United States proceeded and promised to continue to proceed with due regard for any interference it might cause with the LEO outer space activities of other countries. That was all that was required under

<sup>46</sup> *In re Amendment of the Commission's Rules to Establish Rules and Policies Pertaining to a Mobile Satellite Service in the 1610-1626.5/2483.5-2500 MHz Frequency Bands*, 9 F.C.C. Rcd. 5936, 6006-07 (1994); 47 C.F.R. §25.120 (1994) (Little LEO license term and renewals).

<sup>47</sup> *Id.* at 6008. On the other hand, the FCC "assure[d] Big LEO licensees that given the enormous investment necessary to construct and operate a satellite system, we will consider replacement applications in this service similar to other satellite services, that is, we will grant authority to implement a next generation system unless extraordinary circumstances prevent us from doing so." *Id.* In a similar vein, the Little LEOs were told they "will generally be given replacement system authority if the frequencies remain available for use by comparable types of systems." *Little LEO Order, supra* note 13, at para. 17.

<sup>48</sup> *Id.* at 6021.

<sup>49</sup> *Id.* The FCC similarly spurned a demand from a start-up firm called "Leo One" that "the Commission consult with 'appropriate ITU organizations' before the promulgation of final rules...." The FCC replied that "while the United States is an active participant in a number of global fora, including the ITU and its Radiocommunications sector, we believe that it is unnecessary and imprudent to await further global action on LEO MSS issues prior to the promulgation of wholly domestic regulations. ... we will follow the coordination procedures prescribed for non-geostationary satellite systems, will work with the global community to promote LEO services through discussion of sharing techniques and other technical issues; and will continue to require our licensees to meet both their international obligations and any national requirements imposed by other licensing administrations." *Little LEO Order, supra* note 13, at para. 28.

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international law.<sup>50</sup> Indeed, the longer the United States spent in going through bureaucratic international consensus procedures, the longer the other countries of the world would have to wait for "equitable access" to the "benefits of outer space" communications.<sup>51</sup> Consequently, it would appear that the United States struck a reasonable balance between its obligations to consult with other countries and its obligations to share the benefits of outer space technology with "all mankind."<sup>52</sup>

### III. Evolving Frontiers of Low Earth Satellite Communications Law

While the *Lex Americana* has created a framework, there are still many issues of LEO space law left to be determined. Prominent among these issues are the need for additional frequency allocations, the need for technical standards, and the question of portability of LEO user terminals from one country to another. Answers to many LEO legal questions will unfold bi-annually at the International Telecommunication Union's new every other odd year meeting schedule.

A vast array of new frequency locations will be considered by the ITU's World Radio Conferences over the next several years for the accomodation of additional LEO systems.<sup>53</sup> In addition, new rules will be

<sup>50</sup> See note 42 and accompanying text, *supra*. The standard is "good faith compliance" with words interpreted in accordance with their "ordinary meaning" in light of a wide range of factors including a treaty's context, objectives, related agreements, and practical experience.

<sup>51</sup> "Delaying our regulatory process would delay the improved communications and economic growth that Big LEO services will create. ... Such a delay would also harm developing countries by limiting their opportunity to improve their communications infrastructure." *Id.* at 6019.

<sup>52</sup> The differing views of the United States and the European Community regarding whether the *Lex Americana* complies with international law may very well be explained by differing views as to who is the beneficiary of space law. The European Community appears to believe, as has traditionally been the case, that States are the beneficiaries and that the United States has therefore failed to pay due regard to the interests of other States. The United States appears to believe, at least in this techno-entrepreneurial driven context, that "humanity" is the beneficiary and that therefore so long as new satellite services are coming to billions of people it matters little which State authorizes such services. This dialectic was beautifully summarized by space law elder statesman Aldo Armando Cocca, who has observed: "Politicians began to fear a loss of power with the birth of mankind as a legal subject, and therefore, they prefer to speak of 'all countries' instead of 'all mankind' or 'mankind as a whole.' But jurists noted this change would imply a serious step back in the progress of the legal science, specially in connection with understanding and solidarity among peoples, the only way to achieve the so longed permanent peace." Cocca, *Space Law and the Right of Mankind*, 33 PROC. COLLOQ. L. OUTER SPACE 278, 279 (1991).

<sup>53</sup> Additional Little LEO frequencies under consideration include 216-218 MHz, 400-404 MHz and 455-460 MHz. However, sharply competing demands for nearly all of these frequencies may result in very little, if any, frequency growth at all. An extremely complex array of considerations plague proposals for additional Big

written to set technical standards for avoidance of interference and interoperability among systems.<sup>54</sup> The issue of LEO user terminal portability may prove to be difficult because some such terminals, such as those in Giga LEO systems, are also effectively broadcast receivers.

Just as the transmission of pornography over the Internet and World Wide Web<sup>55</sup> is an emotional issue today within information age societies such as the United States, various kinds of sociopolitical content may be an even more highly charged issue when sharp geo-cultural boundaries are crossed. For example, a Giga LEO terminal in a patriarchal country where women have very few social rights would have access via the

LEO frequencies in the 1700-2200 MHz region. Giga LEOs are desperately seeking frequencies in what is called the spectrum "final frontier," around 20-30 GHz, because above these frequencies the atmosphere becomes increasingly opaque to satellite transmissions. However, technology optimists believe these atmospheric problems will be conquered with yet more advanced technology, such as laser satellite communications capabilities currently being developed for strategic defense purposes.

<sup>54</sup> For example, it is important to the Giga LEOs that they have separate frequency allocations from geostationary satellite systems because, under existing ITU space law, LEO satellite systems must not cause frequency interference to geostationary satellite systems. ITU Radio Regulation 2613 (1992). This is a major stumbling block to the implementation of Giga LEO systems, and is therefore likely to be changed at an ITU World Radio Conference scheduled for October 1995. During September 1995 several large geostationary satellite communications companies asked the FCC to subjugate Giga LEOs to less grandiose "Giga" concepts for satellite-based global information infrastructure systems. Rules may also be needed to ensure the satellites don't collide with one another: more than a *thousand* LEO satellites are envisioned over the next ten years. Who's liable in case of collision? For a comprehensive review of the Convention on International Liability for Damage Caused by Space Objects, *opened for signature* March 29, 1972, 24 U.S.T. 2389, T.I.A.S. No. 7762 (*entered into force* for the United States on Oct. 9, 1973), see Rothblatt, *International Liability of the United States for Space Shuttle Operations*, 13 INT'L LAW. 471, 479 (1979) ("If the damage occurs on the surface of the earth, or to aircraft in flight, then strict liability exists. If damage occurs in outer space, liability is based on fault.").

<sup>55</sup> The Internet is essentially a massive addressing network for sending messages to, or getting messages from, digital terminals (like personal computers), and operates over the worldwide telephone network. If you register an address with the Internet system, then anyone else on the Internet system can send you messages, and you can send others messages, using Internet software. Messages may also be sent to, or retrieved from, subject-defined "chat spaces" or "bulletin boards" such as "space law." This allows a person to meet and communicate with people who have common interests without ever leaving their computer terminal. As of 1995, over 50 million people worldwide were regularly using the Internet system to communicate. The World Wide Web is an image-based means of communicating via the Internet, and thus makes using the system more interesting than just looking at lines of text. The World Wide Web also allows users to easily move from a set of images on one subject to sets of images on other related subjects. This is sometimes called "surfing the net." The author's Internet address for those who wish to communicate is [martine@mail.worldspace.com](mailto:martine@mail.worldspace.com).

World Wide Web to images of socially active women that such a country might vigorously suppress via print or broadcast media. But while forbidden books, magazines or satellite television dishes are ready proof of "social crime," the Giga LEO terminal used for "acceptable" purposes can just as easily, and with no evidentiary trace, be used for "unacceptable" purposes. The Giga LEO terminal may function as the ultimate Trojan horse, bringing multiculturalism to monocultural corners of the world through an innocuous mass-produced satellite communication terminal facade.

If satellite past is prologue, efforts to suppress LEO terminal portability will fail. Inexorably a "maximum channel dispersion" principle<sup>56</sup> operates to extend ever more bandwidth to ever more places with ever more interconnectivity. Channels expand in depth (communications capacity), distribution (communications distance) and directivity (communication destinations).<sup>57</sup> Today, satellite television dishes can be found in every country in the world, bringing in every kind of message, from religion to rock and roll. Tomorrow, satellite phones will be found in every community in the world, bringing instant access to news, to family and to help.

In the not too distant future, Giga LEO PCs<sup>58</sup> will be found in almost every home in the world. They will form the fabric of the new global village<sup>59</sup>, the fiber of a multicultural world. Images, messages, communications and information will flow through Giga LEO networks like hot blood through animal veins. Stopping any particular message will be as impossible as stopping any particular cell. Blocking the portability of user terminals will be blocking the pulsation of modern global life.

#### IV. The Implications of LEO *Lex Americana*

Little, Big and Giga LEOs are the latest wave in satellite communications technology. They also solve a nagging problem of space law, the implementation of a global mandate to use outer space for the benefit of all peoples, regardless of their stage of economic or technical development.

In order to fulfill the global benefits sharing obligations of international space law, the United States had to compromise on the extent to which it could fully involve other countries in the planning and authorization of LEO satellite systems. Nevertheless, no precepts of space

<sup>56</sup> The "maximum channel dispersion principle" is articulated in Rothblatt, *Satellite Communication and Spectrum Allocation*, 76 AM. J INT'L L. 56, 57-58, 70-73 (1982).

<sup>57</sup> *Id.* at 59-65.

<sup>58</sup> Personal Computers. The Giga LEO PC will not have a satellite "dish" per se, but just a very innocuous flat patch or flip-up antenna for signal reception. A similar capability will be available via Giga GEO's.

<sup>59</sup> The media-created global village was first conceptualized in M. McLuhan, *UNDERSTANDING MEDIA* (2nd ed. 1964).

law were abridged; no appropriation of outer space has occurred. Instead, the dream of a global information infrastructure is being realized with multiple competitive options and with equal access being provided to people in every part of the world.

Many people remember President John F. Kennedy's 1961 inaugural address for his famous phrase, "ask not what your country can do for you, but ask what you can do for your country." In that same address Kennedy also challenged a wider audience in a manner that applies especially well to the LEO space law questions we have explored herein:

"My fellow citizens of the world: Ask not what America will do for you, but what together we can do for the freedom of man."<sup>60</sup>

President Kennedy was challenging the citizens of the world to ask not what handouts America could give them, but to ask instead what all peoples could do, working together, to banish privation and suffering from the face of the globe. The Little, Big and Giga LEOs are a big step toward this goal. Every country can participate by promptly authorizing the use of the LEO systems within their borders and the transportation of LEO user terminals across their frontiers. Every organization can do something constructive by pooling resources to stake a claim in the space communications game.<sup>61</sup> Whether it is a satellite dish<sup>62</sup> or a satellite radio<sup>63</sup>, a satellite phone<sup>64</sup> or a satellite PC<sup>65</sup>, participation in space communications will help provide the information one needs to work more productively, live more cleanly, and co-exist more peaceably. Virtual solidarity through space communications is the onramp to a global community based on mutual concern, assistance and empowerment.

A decade before Marshall McLuhan saw the global village that satellite communications enabled, his fellow Canadian scholar, Harold Innis penned the treatise *Empire and Communications*.<sup>66</sup> This paradigm-

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<sup>60</sup> Inaugural Address of Pres. John Fitzgerald Kennedy, January 20, 1961, Washington, DC. Today, the quote would probably end "freedom of us all."

<sup>61</sup> Indeed, any country and most people can even own at least some piece of these systems because the shares of the companies operating them are sold to the public. As of September 1, 1995 a share of Big LEO *Globalstar* cost \$12 on the New York Stock Exchange and a share of Little LEO *Orbital Sciences* cost \$17 on the Over the Counter market. No shares of Giga LEOs are currently available for sale, but they undoubtedly will be before the turn of the century.

<sup>62</sup> Satellite dishes can be made from chicken wire.

<sup>63</sup> The *WorldSpace* satellite radio system will offer dozens of channels of multicultural audio programming, anywhere in the world. N. Samara, *Satellite Sound Broadcasting*, 59 TELECOM. J. 76 (1992).

<sup>64</sup> The FCC has noted that it expects satellite phone charges to be as little as 22 cents per minute. *In re Amendment of the Commission's Rules to Establish Rules and Policies Pertaining to a Mobile Satellite Service in the 1610-1626.5/2483.5-2500 MHz Frequency Bands*, 9 F.C.C. Rcd. 5936 (1994).

<sup>65</sup> Giga LEO *Teledesic* satellite PCs could cost as little as \$100.

<sup>66</sup> H. INNIS, *EMPIRE AND COMMUNICATIONS* (1950).

shaking opus demonstrated that, throughout history, empires arose from major advances in communications. *Empire and Communications*<sup>67</sup> also clearly proved that governments could not extend further than their communications networks, and would succumb when those networks were either destroyed or obsolesced by newer technology from abroad. And hence we return to Gorove's Axiom, described earlier in connection with the definition of outer space:

"He who controls the Cosmic Space, Rules not only the Earth, But the whole Universe."<sup>68</sup>

As far as communications networks go, the Giga LEOs will control this planet's cosmic space. They are the ultimate manifestations of the maximum channel dispersion principle,<sup>69</sup> delivering more bandwidth to more places with more interconnectivity than any other system yet conceived. Hence, whether one marches to Gorove's Axiom, or believes in *Empire and Communications*, the logical conclusion is that the Giga LEOs harken the ascendancy of a new world power with an unquestionably firm global reach.

Who is this new world power? It is us, all of us, the fellow citizens of the world heralded by John Kennedy, the heritage of humanity empowered by space law.<sup>70</sup> The Giga LEOs give to humanity itself, for the first time ever, the freedom and the power to communicate with itself irrespective of national borders and regardless of sociocultural divides. The Giga LEOs give humanity *its* communications network, and thereby humanity establishes *itself* as the new world force supreme.

## V. CONCLUSION

Barriers have always existed between the world's many peoples. Cultural, geographical and ideological divides have always circumscribed the distances we and our ideas could travel. These walls are formidable. Only relentless attack can break them. These walls are organic. New ones invariably rise in the wake of their predecessor's destruction.

The mastery of electromagnetic radiation via shortwave broadcasting and VHF television gave us a powerful barrier-smashing tool. Geographical divides faded as thoughts traversed the globe at the speed of light. Cracks raced through cultural bedrock as colorful foreign lifestyles flickered through a picture tube. Ideological walls swayed and crumbled before heretical broadcasts from distant transmitters.

Isolation persists. Radio jamming creates electromagnetic mountains where ones of substance once existed. Nationalism and xenophobia cement cracks in the cultural bedrock. Harsh measures against

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<sup>67</sup> *Id.* at 1-13.

<sup>68</sup> Note 17, *supra*.

<sup>69</sup> Notes 56 - 57 and accompanying text, *supra*.

<sup>70</sup> See note 52, *supra*.

dissidents brace ideological walls. National poverty maintained by selfish elites or incompetent administrations keep the means of accessing democratic images beyond the reach of the masses.

By the turn of this century the new LEO technology will rise and soar in the outer space over every country on the earth. Dozens of times each day fleets of LEO satellites will sail across the sky, blasting messages everywhere, ferrying countless communications, and delivering endless information. Isolation will be impossible. Jamming will be infeasible. Nationalism and xenophobia will become the artifactual relects of a pre-LEO past, as senseless in an age of global multicultural empire as were Luddites in a nation of machines.

*Pax Brittanica* prepared the world for industrialism. *Lex Americana* prepares the world for multiculturalism. The new sailing ships are satellites in space, and the new worldly goods are global information. A single world empire of peoples is emerging, and its common heritage shall be a vanguard of Giga LEO satellites, keeping national sovereignty at bay so that the consciousness of a planet may run free.

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