Federal bureaucrats, much-maligned in today's political climate, sometimes make decisions that materially enhance our individual lives.¹ These decisions are perhaps nowhere more evident than within the processes by which regulatory agencies open new avenues for technological advance. An ongoing process that fits this description well is the Federal Communications Commission's ("FCC" or "Commission") and other agencies' efforts to establish an equitable set of rules that will permit competing telecommunications companies to launch and operate new satellite systems in low earth orbits. These are known as LEO systems ("LEOs").

LEOs promise a wide range of communications services that will be available to individuals and businesses worldwide.² Technical developments, business decisions, and corresponding rulemaking processes are moving inexorably toward deployment and operational stages.³ Therefore, the communications lawyer should be aware not only of what LEO systems are, but also of some of the existing domestic and international laws that these systems bring into play.

This Comment focuses on the proposed "Little LEO" systems and the legal issues that their construction, deployment, and operation raise. Part I defines Little LEOs. Part II takes the reader through a history of the FCC's involvement with Little LEO system developments. Part III discusses the vehicles necessary to deploy the systems. Finally, Part IV analyzes the proposed systems in relation to the need for, and possible consequences of, international regulation of the commercial development of space resources. This Comment concludes that Little LEOs present the FCC and other agencies with the first of several practical models on which to base an international legal regime for governing a broad range of commercial activities in space.

I. LITTLE LEOs DEFINED

The term "Mobile Satellite Systems" ("MSS") encompasses a number of emerging communications technologies that will offer new services or will offer established services in new ways.⁴ Examples of these services include portable telephones that can operate from any location in the world and digital audio radio programs that can deliver compact disc-quality music that will not fade from a car's stereo system during a long-distance drive.⁵

The satellites that will constitute the essential link between the service provider and the end user will orbit the Earth in one of four regions in space: 1) the geostationary orbit ("GSO"), an extremely narrow circular path in space that lies 22,300 miles above the earth's surface and directly above the equator; 2) mid-Earth orbits ("MEOs"), circular orbits approximately 5,000 to 10,000 miles above the surface of the earth (not necessarily above the equator); 3) highly-elliptical orbits ("HEOs"), specialized orbits on which a satellite continuously swings very close to the Earth, loops out into space and then repeats its Service, Public Notice, 9 FCC Rcd. 695 (1994) [hereinafter MSS Public Notice].


⁴ This is the goal of several of the Big LEO systems. See infra materials accompanying note 11; see also Frieden, supra note 3, at 34-35.

⁵ See Patrick Seitz, FCC To Hasten Licensing, SPACE NEWS, Jan. 16-22, 1995, at 4, 4. The signals will not fade because satellite-based retransmission extends the broadcast coverage area to include the entire United States. Id.
swinging; and 4) circular low-Earth orbits ("LEOs"). LEOs range in altitude from approximately 100 to 1,000 miles above the earth's surface. The satellites that are designed to fly in low earth orbits are also called LEOs.

The LEO systems currently under development have been divided into two classifications: "Big LEOs" and "Little LEOs." Systems in both classifications will be composed of multiple satellites.

Big LEOs will operate at frequencies above one Gigahertz ("GHz"), and will offer a full range of both voice and data services. Little LEO systems, by contrast, will operate at frequencies below 1 GHz, and are capable of transmitting data only. Little LEOs will be able to deliver inexpensive FAX, e-mail, and position-finding services to any point on the globe.

II. HISTORY OF THE PROPOSED SYSTEMS

Conventional communication satellites make use of the unique geostationary orbit ("GSO"). A satellite in the GSO—and in no other orbit—will appear to remain motionless above a particular spot on the globe. This unique feature of the GSO allows ground-based transmitting and receiving antennas to be aimed at (and fixed on) an unchanging location in space. Until recently, a spacecraft in any orbit other than the GSO had to be tracked continuously from the ground—a fact that required several ground-based tracking stations to be positioned at various points around the world. As a satellite rose above the horizon and passed over a tracking station, that station would "pick up the bird" and then, as the satellite dipped below the horizon, "hand off" its...
tracking data to the next station.\textsuperscript{18} Advances in defense-related switching technologies in the 1980s made it possible for a satellite dipping below the horizon to “hand off” its signals to another satellite, thus moving the “hand off” sequence from the ground to space.\textsuperscript{19}

A. First-Round Applicants

Once the technology became available for commercial use, several companies representing both Big and Little LEO interests announced their intentions to build systems. Of the companies proposing Little LEO systems, three filed applications with the FCC during the first round of application acceptance.\textsuperscript{20} the Orbital Communications Corporation (“Orbcomm”), a wholly-owned subsidiary of the Orbital Sciences Corporation of Dulles, Virginia; STARSYS Global Positioning, Inc., of Lanham, Maryland; and Volunteers in Technical Assistance (“VITA”), a non-profit medical information service based in Arlington, VA.\textsuperscript{21} VITA initially proposed to offer electronic packets of medical information, transmitted via two low-Earth orbiting satellites, to remote locations around the world.\textsuperscript{22} Because of the nature of VITA’s announced system and the kinds of information that it would handle, VITA was not expected to compete directly for a share of the same for-profit niche in the telecommunications market that Orbcomm and STARSYS are vying for.\textsuperscript{23} These latter two systems initially proposed constellations of 20- and 24-satellites, respectively.\textsuperscript{24}

VITA, Orbcomm and STARSYS also applied to the FCC for Pioneer Preference status.\textsuperscript{25} Although Orbcomm and STARSYS did not oppose VITA’s petition, they argued against each other’s petition.\textsuperscript{26} The FCC granted a Pioneer Preference to VITA in January, 1993.\textsuperscript{27}

In the wake of the system proposals, and at the urging of the FCC, the International Telecommunications Union (“ITU”) added spectrum allocation for Little LEOs to the agenda of the 1992 World Administrative Radio Conference (“WARC ’92”).\textsuperscript{28} In July, 1992, the FCC established a Negotiated Rulemaking Committee and began to solicit comments regarding technical sharing and coordination issues pertaining to the establishment and regulation of little LEOs.\textsuperscript{29}

The FCC Committee focused primarily on three issues: 1) providing rapid and sustained availability

\textsuperscript{18} Id. The cost of tracking antennas and the coordination between ground stations made non-geostationary systems much more expensive, and thus less attractive, for commercial telecommunications providers than geostationary systems. Id.; see also Dan Sweeney, Bird Watching: Megaplayers and Consortia are Aligning Themselves to Compete for Satellite-based Mobile Communications, CELLULAR BUSINESS, July 1993, at 23, 24.

\textsuperscript{19} Warwick, supra note 7, at 51. See also Sweeney, supra note 18, at 28.

\textsuperscript{20} See NVNG Report and Order, supra note 12, para. 2. The FCC dismissed a fourth application, Leosat’s, on grounds that the company had filed late. COMMUNICATIONS DAILY, Jan. 29, 1993, at 9.

\textsuperscript{21} NVNG Report and Order, supra note 12, para. 2. See also Patrick Seitz, FCC Deadline Stirs Up Satellite Ventures; Little LEO Ranks Swell as Latest Round is Closed, SPACE NEWS, Nov. 21-Dec. 4, 1994, at 4, 4.


\textsuperscript{23} Sweeney, supra note 18, at 26.

\textsuperscript{24} See Request for Pioneer’s Preference, supra note 22, para. 3.

\textsuperscript{25} Id. “The Commission’s pioneer’s preference rules are intended to provide a license preference to applicants that propose an allocation for a new service, or a substantial enhancement to an existing service.” Id. para. 2. In response to Congressional action regarding competitive bidding and the domestic implementation of the General Agreement on Tariffs and Trade (“GATT”), the Commission is modifying its pioneer’s preference program and has proposed sunsetting the program on September 30, 1998. See Action in Docket Case—Modifications Made in Pioneer’s Preference Program; Rules Proposed in Response to GATT Directives (ET Dkt. No. 93-266), FCC NEWS, Mar. 1, 1995, at 1, 7.

\textsuperscript{26} Request for Pioneer’s Preference, supra note 22, paras. 9, 11.

\textsuperscript{27} In re Amendment of Section 2.106 of the Commission’s Rules to Allocate Spectrum to the Fixed-Satellite Service and the Mobile-Satellite Service for Low-Earth Orbit Satellites, Report and Order, 8 FCC Rcd. 1812, para. 1 (1993). The Commission’s award was based on a preliminary finding that VITA was the first to experiment with, and to develop, an inexpensive scheme for LEO communications. Request for Pioneer’s Preference, supra note 22, paras. 15-16.

\textsuperscript{28} See Reed E. Hundt, Testimony Before the House Subcommittee on Telecommunications on the Global Information Infrastructure and the Role of Satellites, July 28, 1994, at 9 (on file with the FCC). International spectrum allocation is one of the primary functions of the WARC. Id. at 5-6. See generally HUDSON, supra note 8, at 250-66. Spectrum allocation for the second round applicants will be taken up at WARC ’95. Patrick Seitz, Companies Proposing Little LEO Systems Hit Roadblock, SPACE NEWS, May 1-7, 1995, at 8.

of Little LEO technologies to the U.S. consumer; 2) ensuring competition among Little LEO applicants; and 3) verifying that the applicants would be "able to operate technically within the planned spectrum, with room for additional entrants."80

The Commission announced preliminary rules in January, 1993.81 After obtaining further comments, the Commission adopted a slightly-modified version of the rules in October of the same year.82 The adopted rules identify, inter alia, requirements for obtaining permission to build both space-based and ground-based components of little LEO systems, the length of the license term (initially fixed at ten years), renewal procedures, guidelines for system construction milestones (i.e., setting completion dates for major portions of the construction plan) and frequency assignments.83

B. Competition in the First Round

In December, 1993, Orbcomm amended its application to reflect an expansion of its proposed system from twenty to thirty-six satellites.84 STARSYS vigorously objected to the planned expansion, claiming that it was inconsistent with a previously-negotiated agreement for sharing the limited Little LEO spectrum allocation.85

In March, 1994, VITA amended its application when it entered into a construction agreement with Rockville, Maryland-based CTA Space Systems.86 Both STARSYS and Orbcomm objected to the change on grounds that it altered VITA's commercial profile and that it, too, threatened the joint sharing agreement.87

In addition to the objections raised concerning the spectrum-sharing agreement, another issue provided ammunition for battles between the competing system builders. Pursuant to section 310 of the 1934 Communications Act, as amended ("1934 Act"), the FCC may not grant a radio license to a foreign government or representative thereof, or to a corporation that is directly or indirectly controlled by another corporation having more than a twenty-five percent foreign ownership.88 Little LEO systems are aimed at a global marketplace. They require technologies that make them too expensive for a single firm to afford without heavy infusions of outside capital.89 Moreover, foreign entities naturally want to acquire some stake in promising ventures before allowing those ventures to operate within their territories.

Both STARSYS and Orbcomm entered into business relationships with foreign entities. In 1993, Orbcomm entered into an eighty-million dollar joint venture with the Canadian firm TeleGlobe.80 Structuring the relationship as a joint venture allowed TeleGlobe to participate in the project while avoiding the issue of foreign ownership. Nevertheless, STARSYS accused Orbcomm of improperly reporting its financial relationship with the Canadian firm to the FCC.81 Orbcomm counterattacked, complaining that STARSYS was foreign-government controlled. In fact, STARSYS's ninety-five percent majority equity holder is a company called STARGOS, S.A.82

81 See '93 NPRM, supra note 30, para. 1.
82 NVNG Report and Order, supra note 12, para. 1.
83 Id. paras. 3-21.
84 MSS Public Notice, supra note 3, at 695.
85 'They Doubled Size of System'; STARSYS: Amended Orbcomm Application Conflicts With Prior Agreements, COMMUNICATIONS DAILY, Feb. 28, 1994, at 5, 5. The negotiated plan for dividing the available spectrum between the three applicants was called the "joint sharing agreement." Id.
87 Id. STARSYS also amended its application, requesting launch and operating authority in addition to the construction authority for which it initially applied. See In re Satellite Radio Applications Accepted for Filing, Public Notice, (May 18, 1994), at 2, 2.
88 47 U.S.C.A. § 310 (West 1994). The statute reads, in relevant part:

(a) Grant to or holding by foreign government or representative
The station license required under this chapter shall not be granted to or held by any foreign government or the representative thereof.
(b) Grant to or holding by alien or representative, foreign corporation, etc.
No broadcast or common carrier . . . license shall be granted to or held by—

. . .

(4) any corporation directly or indirectly controlled by any other corporation . . . of which more than one-fourth of the capital stock is owned of record or voted by aliens, their representatives, or by a foreign government or representative thereof . . .

80 Warwick, supra note 7, at 51.
81 See 'What We're Up Against'; Bankers See Unstable U.S. Policies as Adding to Risks of Commercial Space, COMMUNICATIONS DAILY, Mar. 14, 1994, at 4, 4.
82 Id.
STARGOS is owned in part by CNES (the French Space Agency) and other representatives of the French government.\footnote{Id.} Orbcomm’s complaint prompted STARSYS to petition the FCC for a declaratory ruling that would exempt it from the limitations under section 310 of the 1934 Act.\footnote{Id.}

Numerous government, trade, and popular press reports have intensified the competition between Little LEO applicants. These reports share a common motif: there is too much concentration of data transmission technologies in the market for Little LEO systems to survive.\footnote{Id.} The reports cite technologies that include existing cellular systems,\footnote{Id.} transponder leasing arrangements with geostationary satellite owners, and the proposed Big LEO systems, which will offer both voice and data services.\footnote{See supra text accompanying note 11.}

C. The Second Round and Beyond

Despite the squabbling and the skeptics, the work on Little LEO systems is proceeding apace. In September, 1994, the FCC initiated a second round of application submissions.\footnote{See, e.g., Warwick, supra note 7; Sugawara, supra note 11; and Pelton, supra note 13.} The Leo One USA Corporation of St. Louis, Missouri, was the first to file in the new round, applying for a license for a 48-satellite Little LEO constellation.\footnote{In fact, LEOs and cellular systems are not mutually exclusive: LEOs may be able to function as signal wholesalers to the cellular retailers. For a discussion of the relationship between LEOs and cellular services, see Sweeney, supra note 18, at 24.} Four additional companies also applied for licenses.\footnote{See supra text accompanying note 11.} GE Americom of Princeton, New Jersey, plans a 24-satellite constellation.\footnote{Wait For WARC ’95?, Next Round of Little Leo Applicants Will Have to Vie for Limited Spectrum, COMMUNICATIONS DAILY, Sept. 29, 1994, at 2, 2.} Final Analysis Communications Services of Greenbelt, Maryland, applied for a license for a 26-satellite constellation.\footnote{Satellite Application Acceptable for Filing, Public Notice, 9 FCC Rcd. 5261, 5261 (1994).} And VITA’s construction partner CTA applied for a license for its own 36-satellite GEMnet system.\footnote{Seitz, Little LEO Ranks Swell, supra note 21, at 4, 28; and see System Proponents Attack Competitors’ 2nd-Round Little LEO Applications, SATELLITE WEEK, Mar. 6, 1995, at 1, 1.} E-sat, the fourth second-round newcomer, proposes a three-satellite system.\footnote{Seitz, supra note 21, at 28.}

In October, 1994, the FCC issued the first Little LEO license to Orbcomm.\footnote{Seitz, Little LEO Ranks Swell, supra note 21, at 4, 4.} Orbcomm and VITA are each seeking to expand their systems, and their amended applications are also being considered in the second round of licensing applications.\footnote{Commercial Space Transportation; Licensing Regulations, 53 Fed. Reg. 11,004, 11,004-05 (1988).} Assuming that the three first round applicants and one or more second round applicants successfully complete their licensing and development phases, well over 100 small satellites (“smallsats” or “lightsats”) will have to be deployed in orbit. Following initial deployment, each system will require periodic replacement and/or maintenance flights. These systems’ viability, therefore, is intrinsically related to another technology-oriented industry: the commercial launch vehicle industry.

III. ACCESS TO SPACE

Until the 1980s, commercial launches in the United States were conducted exclusively by the government.\footnote{Id.} If AT&T, INTELSAT, or another commercial telecommunications provider needed to launch a satellite from the United States, the government would contract with a launch vehicle provider, and AT&T or INTELSAT then would purchase a launch from the government.\footnote{Id.}

The launch vehicle scene changed dramatically in the late 1970s and 1980s. One of several significant contributions to the change was the emergence of the French Arianespace as a leading contender for a large slice of the global commercial space launch market.\footnote{The Ariane launch system is backed by the fourteen member-nations of the European Space Agency (“ESA”). For a history of the ESA and Ariane, see DAVID BAKER, CONQUEST, 89-92 (1984). Ariane now accounts for about 60% of the global launch market. Peter B. de Selding, Proton Pricing Spurs More Complaints, SPACE NEWS, Jan. 9-15, 1994, at 1, 1.}

the growing domestic commercial launch industry.61 Pursuant to the 1984 Act, the Department of Transportation's Office of Commercial Space Transportation ("OCST") assumed licensing authority for commercial launches.62

On January 28, 1986, the space shuttle Challenger exploded over the Atlantic, seventy-three seconds into its tenth flight.63 The Reagan Administration responded to the tragedy by, inter alia, prohibiting NASA from using the shuttle fleet for routine commercial launches unless there was a specific need to do so.64 The grounding of the shuttles and the ensuing prohibition on shuttle-borne commercial satellite launches had the immediate effect of stimulating the nascent commercial launch industry as companies sought other means of getting their satellites into orbit.65

The prohibition also contributed to the development of Little LEO systems. The Orbital Sciences Corporation (Orbcomm's parent company) had won its first major NASA contract for an "upper stage" booster called the Transfer Orbit Stage ("TOS").66 Orbital intended to use the TOS to carry shuttle-deployed satellites from low earth orbit to their final destinations in space.67 Confronted with the prohibition against shuttle-borne commercial satellite launches, Orbital turned its attention to the small launch vehicle market. In 1988, Orbital announced its intention to build and market the Pegasus air-launched winged rocket.68

The Pegasus made its first flight in April, 1990.69 In February, 1993, a Pegasus launched Brazil's first satellite, the Satelite de Coletes de Dados do Brasil ("SCDI").70 The SCD1 was designed to aid the Brazilian government in monitoring the Amazon Basin.71 The flight also carried a small test satellite, or "pathfinder," for Orbcomm.72

Not all of the Pegasus flights have been successful. In May, 1994, a Pegasus delivered a military satellite to an unplanned orbit.73 In June, 1994, Orbital's new Pegasus XL malfunctioned shortly after launch and had to be destroyed in flight.74 In addition to the

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51 Press Kit, supra note 66, at 17.
61 See Craig Covault, Commercial Winged Booster to Launch Satellites From B-52, Aviation Wk. & Space Tech., June 6, 1988, at 14, 14-16. The Pegasus is designed to be launched from the underside of a carrier aircraft—early flights used a modified B-52 bomber aircraft belonging to NASA. Id. The rocket is "dropped" at an altitude of approximately 40,000 feet. Id. Its large triangular-shaped wing gives it stability and aerodynamic lift as its main rocket motor fires and drives it upward toward space. Id. The wing and spent motor separate from the remaining stages and fall away as successive stages fire. Id. Orbital now uses a modified Lockheed L-1011 aircraft to carry the Pegasus aloft. See Bruce A. Smith, OSC Seeks Cause of Pegasus XL Failure, Aviation Wk. & Space Tech., July 4, 1994, at 30, 30.
62 See Bruce A. Smith, Pegasus Booster Proves to be Highly Accurate in its First Launch, Aviation Wk. & Space Tech., Apr. 16, 1990, at 24, 24-25.
63 See Jeffrey M. Lenorovitz, Pegasus Launches Brazil's SCD1, Aviation Wk. & Space Tech., Feb. 15, 1993, at 64, 64-65.
65 See Bruce A. Smith, Pegasus-Launched STEP-2 in Lower Than Expected Orbit, Aviation Wk. & Space Tech., May 30, 1994, at 30, 30. The planned orbit was a circular, 450-nautical mile orbit with an 82-degree inclination. However, the spacecraft wound up in an elliptical, 325- by 443-nautical mile orbit with an inclination of 81.95 degrees. Id. The unexpected orbit did not damage the spacecraft, but it resulted in some degradation of mission objectives. Id.
66 Smith, supra note 68, at 30. Range officials determined that the vehicle was losing altitude, and they sent a destruct command during what should have been the second-stage burn. Id.
Pegasus, Orbital has developed a larger, more powerful, pad-launched rocket called Taurus.\textsuperscript{76}

Orbital’s rockets are not the only contenders for a share of the small launch vehicle market. Lockheed Missiles & Space of Calabassas, California, is a formidable competitor. Lockheed recently completed a merger with Martin Marietta of Bethesda, Maryland. The merger has made the new Lockheed Martin company arguably the world’s largest aerospace firm.\textsuperscript{76} Lockheed Martin is offering a series of “Lockheed Launch Vehicles” (“LLVs”) that are intended to meet a range of small launch vehicle needs.\textsuperscript{77}

Lockheed Martin is also involved in a joint venture with two Russian rocket builders, Khrunichev State Research and Production Space Center (“Khrunichev”) and RKK Energia.\textsuperscript{78} The Lockheed-Khrunichev-Energia consortium (“LKE”) plans to market Proton rockets to western customers.\textsuperscript{79} One of its customers may be second-round Little LEO applicant Final Analysis, which plans to use the Proton to launch its FAIsat system.\textsuperscript{80}

Two other contenders for a share of the small launch vehicle market are the American Rocket Company (“AMROC”)\textsuperscript{81} and Sea Launch.\textsuperscript{82} AMROC has developed a hybrid rocket motor that combines features of both solid and liquid rocket motors in the same propulsion system.\textsuperscript{83} Sea Launch is an international joint venture led by the Boeing Company and includes Russian, Ukrainian and Norwegian partners.\textsuperscript{84} Sea Launch plans to launch Russian Zenit boosters from a converted oil platform in the Pacific.\textsuperscript{85}

Finally, the Clinton Administration’s National Space Transportation Policy, released by the Office of Science and Technology in August, 1994,\textsuperscript{86} provides another source of competition. The policy permits the use of excess ballistic missile assets for space launches, subject to several conditions.\textsuperscript{87}

The market for small launch vehicles, like the market for the Little LEO systems they will deploy, is uncertain. In April, 1994, the Transportation Department’s Office of Commercial Space Transportation (“OCST”) released a report estimating that only one of the proposed Little LEO systems will make it to orbit.\textsuperscript{88} Evaluating several scenarios, the report predicts that only eight to twelve small launches per year will be required between 1994 and 2005.\textsuperscript{89}

Whether or not the Transportation department’s predictions are accurate remains to be seen. Meanwhile, the Orbital Sciences Corporation appears to be taking steps to ensure a dominant position in both the LEO and launch vehicle markets. In August, 1994, Orbital acquired a stake in the Big LEO competition when it bought Fairchild Space and Defense

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\textsuperscript{76} See Craig Covault, Pegasus, MX Boosters Combined for New Defense Launch Vehicle, AVIATION WK. & SPACE TECH., Sept. 18, 1989, at 47, 47.


\textsuperscript{79} de Selding, supra note 59, at 20.

\textsuperscript{80} Id. Khrunichev has agreed to launch some of the satellites that will make up the Big LEO Iridium system. \textit{It’s Within 15-20%: Transportation Dept. Makes Conservative Estimates On Leo Satellite Launches}, COMMUNICATIONS DAILY, Apr. 18, 1994, at 4. Other Iridium launchers include McDonnell Douglas (forty satellites on eight Delta rockets) and China Great Wall. Id. China Great Wall Industries Corporation produces the Long March rocket. See Patrick Seitz, Insurers Wary of Chinese Rocket, SPACE NEWS, Feb. 13-19, 1995, at 1, 1.


\textsuperscript{82} Amroc Set To Re-enter Small Launcher Market, SPACE NEWS, Jan. 23-29, 1995, at 2.

\textsuperscript{83} Small Launch Vehicles, supra note 77, at 5.

\textsuperscript{84} Id. For background on AMROC’s hybrid program, see Michael A. Dornheim, Amroc Hybrid Motor Tests Aimed at 1995 Flight, AVIATION WK. & SPACE TECH., Mar. 1, 1993, at 51.


\textsuperscript{86} Id.

\textsuperscript{87} Office of Science and Technology Policy, The White House, National Space Transportation Policy (1994).

\textsuperscript{88} Id. at 7. “Excess ballistic missile assets” are the ICBM boosters that are to be eliminated under the Strategic Arms Reduction Talks (“START”) agreements. Id. The policy applies only to government agencies, which are required to purchase launch vehicles and services commercially “to the fullest extent feasible.” Id. The agency seeking to use the surplus must “certify” the use of excess ballistic missile assets results in a cost saving to the U.S. Government relative to the use of available commercial launch services . . . . “ Id.

\textsuperscript{89} It’s Within 15-20%: Transportation Dept. Makes Conservative Estimates On Leo Satellite Launches, COMMUNICATIONS DAILY, Apr. 18, 1994, at 3, 4.
Corporation of Germantown, Maryland. Fairchild is building the Ellipsat Big LEO system. In December, 1994, Orbital bought Magellan Corporation, a manufacturer of hand-held navigation receivers. With the purchase of Magellan, Orbital has consolidated control over virtually every aspect of the Orbcomm system.

On April 3, 1995, a Pegasus delivered the first two Orbcomm satellites to LEO. Both satellites subsequently developed problems with their space-to-ground communications subsystems. As of mid-May, 1995, one satellite had been repaired, and the second was expected to be repaired within several weeks. Orbcomm hopes to offer initial services in mid-1995.

IV. FORGING A LEGAL REGIME FOR THE FUTURE

The foregoing discussions of Little LEO systems and their related launch technologies involve a broad range of domestic and international entities, both public and private: the FCC; the ITU; the Department of Transportation; NASA; Congress and the White House; aerospace giants and start-ups; a Canadian firm; the French government; and Russian rocket-builders. The list is by no means complete.

The reasons for the broad range of interested entities are clear: these systems are global, and the world is (still) a very big place. Space is even bigger, and activities in space have been, and continue to be, a subject of intense international interest.

The international components of the Little LEO system builders' activities are largely matters of private international law; however, Little LEOs also impinge on several aspects of public international law. Their activities touch on questions of possible future international management of a broad range of in-space activities.

A. Relevant Treaties

Early efforts to create an international framework for regulating space activities resulted in the 1967 Outer Space Treaty. The Outer Space Treaty is sometimes referred to as the "Principles Treaty," a term that reflects its importance as the basis for subsequent agreements.

Two of these agreements have a direct bearing on any organization that plans to launch objects into space: the Registration Convention and the Liability Convention. The Registration Convention recognizes the need for a regime that will allow states to register objects placed in space. The Liability Convention creates a regime for the liability of states for damage caused by objects placed in space.

Space L. 123-37 (1990). The article lists more than 60 national, regional, and global organizations having direct involvement in space activities. Id.


quires states to register spacecraft launched from their territories with the Secretary-General of the United Nations.\(^{104}\) The Liability Convention holds a launching state absolutely liable for damage that its spacecraft cause, either on the ground or to aircraft in flight.\(^{106}\) Liability for damage caused to another spacecraft is fault-based.\(^{108}\) Because the United States government would be held liable for damage caused by spacecraft launched from its territory, companies seeking a license to launch from the United States must take steps to minimize the government’s exposure. To do this, companies must enter into cross-waivers of liability with “contractors, subcontractors, and customers, and contractors and subcontractors of the customers.”\(^{107}\) Additionally, companies must provide insurance up to a statutory maximum of $500,000,000.\(^{108}\) The government will provide indemnification for amounts above a company’s level of insurance, provided the difference is not more than $1.5 billion.\(^{109}\)

The Registration and Liability Conventions are two documents that reflect an acceptance of the principles set forth in the Outer Space Treaty. However, another international document rejects one of the Outer Space Treaty’s central principles: the principle that no nation may make a claim of sovereignty over outer space or the natural objects within it.\(^{110}\) The Bogota Declaration, signed by eight equatorial nations in 1976, asserts on behalf of its signatories a claim of sovereignty over segments of the geostationary orbit.\(^{111}\) The Bogota Declaration describes the GSO as a scarce natural resource.\(^{112}\) Its claim reflects concern that equatorial nations, currently lacking the economic or technical ability to place satellites on the GSO, will be unable to use that orbit in the future because the GSO will become “saturated” with satellites owned by industrialized nations.\(^{113}\)

Other (non-equatorial) developing nations have expressed concerns similar to those found in the Bogota Declaration. Many of these concerns are reflected in the 1979 Moon Treaty, which also traces its origins to the Outer Space Treaty.\(^{114}\) The Moon Treaty declares space resources to be the “Common Heritage of Mankind”\(^{115}\) and calls for the creation of an “international regime” to manage their acquisition and use.\(^{116}\)
B. Little LEOs as a Practical Model

Any proposed international regime for the management of space resource acquisition and use should be tested against a real-world example of precisely what "acquisition" entails. The companies involved in creating Little LEO technologies provide such a model. They represent an emerging industry that is based on access to, and use of, space resources (i.e., low earth orbital positions) that must be shared with other users. Little LEO system builders' concrete interests in the acquisition and development of space resources have already taken a nascent form in the satellites they are constructing and in the regulatory waters they are navigating. As noted at the beginning of Part IV of this Comment, those systems touch a broad range of existing areas of domestic and international law. The issues that Little LEOs and their launchers bring before lawmakers are practical, not theoretical.

C. Defining the Model

If Little LEO systems are to serve as a model in the development of an international regulatory scheme, the features of the model must be defined. Three characteristics of the Little LEO model are worth noting especially.

First, although the model touches a broad range of existing legal entities, it is composed of a discrete set of interests. It does not span the entire telecommunications or satellite-building industries. Rather, the model currently is limited to a handful of companies using innovative technologies to explore non-voice non-geostationary satellite communications. Because the number of companies is small and the field of interest is narrow, the model is relatively easy to view and evaluate as a whole. Thus, it is a manageable model.

Second, although communications satellites have existed for three decades, and a United States commercial launch industry has existed since the early 1980s, the Little LEO model is a unique blend of the two industries. This factor is significant because the consolidation of the two industries' interests is likely to lead to greater economic interdependence between project originators and access providers. A close nexus between system designers and access providers will likely give rise to a greater range of innovative in-space endeavors.

Third, some of the key participants in the Little LEO industry have interests that extend well beyond telecommunications. CTA, for example, in addition to its Little LEO involvements, also is involved in remote sensing. Orbital Sciences and Martin Marietta provided the TOS upper stage booster for a mission to Mars. The new Lockheed Martin Corporation is one of the largest aerospace companies in the world, with a commensurately large range of interests.

This "broader interest" factor is perhaps the model's most significant aspect. If a government or an international consortium of large corporations were to embark on a non-telecommunications-related project (e.g., the construction of a human-tended microgravity materials processing facility), it is unlikely that a telecommunications-only firm would play more than a "communications-only" role in the venture. Orbital Sciences or Lockheed Martin, on the other hand, likely would be among the first companies approached by, or the first to submit bids to, an entity seeking a supplier of major components for the project.

In summary, Little LEO system builders embody three important characteristics that provide a useful model for international space resource acquisition and development: 1) a discrete field of current players; 2) a close nexus between launch vehicles and system design; and 3) the potential for an expanded range of in-space developments beyond the field of telecommunications.

Peaceful Uses of Outer Space ("UN COPUOS") in 1994. See Moon Treaty, supra note 114, art. 18. See also Round-up of Session, Committee on Peaceful Uses of Outer Space, Press Release (no number in original), Jun. 17, 1994, at 4. The UN COPUOS declined to take further action at that meeting. Id. To date, the Moon Treaty has been ratified by only nine states, with five additional unratified signatures. Id.

Other users include earth-imaging systems ("remote sensing") such as the U.S. Landsat and the French SPOT Image spacecraft, space materials processing interests, and human spaceflight programs. See, e.g., J. Starke, Introduction to International Law 171-173 (1984), reprinted in Carter and Trimble, supra note 100, at 1110 (citing examples of the constantly increasing scale of expansion of space technologies and interests).

118 "Every spacecraft manufacturer builds spacecraft to fit existing launch vehicles. So whatever exists, people will be building to that size. I know that Lockheed studied the market and decided to go for something larger than Pegasus, more of the Taurus size, because the cost per pound [to orbit] is less." Patrick Seitz, Newsmaker Forum (Interview with George Sebestyen, President, CTA Space Systems), SPACE NEWS, Oct. 17-23, 1994, at 22.

119 See Ben Iannotta, Lockheed Launcher May Boost Both Lewis, Clark, SPACE NEWS, Nov. 14-20, 1994, at 1, 1.
D. Applying the Model

United States government entities, such as the Departments of Transportation, State, and Defense, as well as independent agencies, such as NASA and the FCC, already are involved in ensuring Little LEO compliance with a number of international treaties. Representatives of these organizations work directly or indirectly with representatives of non-U.S. organizations such as the International Telecommunications Union ("ITU"), the World Administrative Radio Conference ("WARC"), and the United Nations Committee On Peaceful Uses of Outer Space ("UN COPUOS"). Patterns of interaction between these U.S. and non-U.S. entities are well-established, and their participants have years of accumulated practical experience within their respective organizations' interests.

If an international regime is required to manage the future acquisition and utilization of space resources, the model can be used to trace the working relationships that have already been called upon to establish and regulate the present Little LEO industry. Tracing the relationships would highlight the primary elements—and perhaps some of the personnel—necessary to such a regime, and would make it possible to bring all existing necessary expertise under one roof in the regime’s creation.

Little LEO system builders, by the accident of having been first to obtain licensing approval for their construction and launch programs, have provided a prototypical regulatory model for future commercial activities in space. Other models will surely follow, but all practical models are invaluable for future planning. Therefore, where the Little LEO model can be used in international space planning, it should be used.

V. CONCLUSION

Little LEO satellite systems are innovative, private sector communications technologies aimed at the global marketplace. Their novel approach to communication products and services demands equally novel regulatory solutions to the public domestic and international issues that their financing, construction, and operations present. The fledgling commercial launch industry that will install these systems on orbit also requires new rules and regulations, incorporating a broad range of government entities. Taken together, the Little LEO systems and their prospective launch vehicle suppliers represent the emergence of an industry that seeks the private acquisition and use of orbital space resources.

Proposals for the international management of space resources continue to receive serious consideration. Little LEO system-builders provide a “real world” model for interagency and intergovernmental coordination. They can and should be used to evaluate any international management plan.