SPACE LAW AND PRACTICE IN THE 1980'S AND BEYOND: A PRACTITIONER'S PERSPECTIVE

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The field of space law has evolved considerably since publication of early landmark treatises in the 1960's.[1]. It is now possible to practice space law, and it is to this subject that the instant article is addressed.

This article categorizes space law into three substantive areas: space communications law, space transportation law and space property law. Any categorization of real-life phenomena is, to some extent, imprecise; yet categorization is an essential component of understanding. Hence this article speaks of "space law," and includes therein legal rules which pertain to outer space activity but which may also be found in scholarly works devoted to non-space subjects. A similar situation exists in almost every legal field—the well-known overlap of the law of torts and the law of contracts is but one example. The decision rule employed here is simple: if the rule or regulation applies by its express terms to outer space activity, then it is part of space law.

Three issues will be addressed for each of the three substantive divisions of space law (space communications, space transportation and space property) that presently or prospectively offer significant opportunities for private practice. First the nature of the underlying subject matter will be explained so that its relationship to outer space is clear. Next will come answers to the question which arises most frequently in this area—why are there legal issues? Finally the article provides a detailed exposition of the opportunities for practicing each division of space law—the opportunities for resolving conflicting legal rights and obligations pertaining to the limitless cosmic frontier.

I. SPACE COMMUNICATIONS LAW AND PRACTICE

A. What Is Space Communications?

Space communications is the transfer of information from beyond the earth's atmosphere to within it, or from within the earth's atmosphere to beyond it. Usually this process involves sending information from a transmitter at one location on the earth's surface (the "transmit earth station") to a relay facility with both transmit and receive capabilities some 22,300 miles above the equator in geostationary orbit (the "space station" or "satellite") and then back down to one or more receivers at other locations on the earth's

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[1]A. HALEY, SPACE LAW AND GOVERNMENT (1963); M. MCDOUGAL, LAW AND PUBLIC ORDER IN OUTER SPACE (1965); C. CHRISTOL, THE INTERNATIONAL LAW OF OUTER SPACE (1966); L. LIPSON & KATZENBACK, REPORT TO THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ON THE LAW OF OUTER SPACE (1961); M. JENKS, SPACE LAW (1965); N. MATTE, AEROSPACE LAW (1969); S. GOROVE, STUDIES IN SPACE LAW: ITS CHALLENGES AND PROSPECTS (1977).

surface (the "receive earth stations".)[2] Because the information is sent as an altered or "modulated" band of electromagnetic energy, it moves at the speed of light (300,000 kilometers per second) and consequently takes less than a second to reach its destination via satellite.

Space communications is also effected in less well-known ways. For example information may be transferred between two objects in space, such as between the Space Shuttle and one or more of NASA's Tracking and Data Relay Satellites (TDRS). This is known as intersatellite service. Another important activity is the transfer to a receive earth station of electromagnetic energy received by a satellite from portions of the earth's land, water and air masses. This is known as earth exploration satellite service or "remote sensing". Perhaps the most significant information received from space is that which arises naturally from cosmic phenomena such as stellar fusion, novae and various atomic quantum physical processes. This information, the receipt of which is known as radio astronomy, allows scientists to determine the chemical make-up of the universe (including the existence in deep space of dozens of different organic and inorganic molecules), the ages of stars and galaxies, the velocity at which the fabric of space is expanding and the very extent of "time".[3]

Hence space communications is concerned with the movement of information outside of earth's atmosphere. It presently represents the most significant human activity in space. This should be expected because information has no mass and mankind is just beginning to learn how to get mass out of the deep gravity well provided by the earth. Space communications is, nevertheless, a truly remarkable achievement. The satellites which relay information are, in essence, sophisticated robots capable of operating farther from earth than anyone other than Apollo astronauts have travelled, and are capable of doing so for a decade or more without any hands-on maintenance whatsoever. They have permitted, for the first time ever, hundreds of millions of persons to witness the same televised events, individuals in remote locations to be diagnosed and treated by medical experts at distant hospitals and all forms of organizations to operate efficiently despite the fact that their members may be separated by many thousands of miles. Space communications is a space activity with terrestrial applications: what kinds of legal questions does such an activity create?

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[2]See, C. JANSKY, COMMUNICATION SATELLITES IN THE GSO (1982). In 1945, Arthur C. Clarke first identified the key beneficial attribute of a communications satellite in geostationary orbit—it could, on a virtually continuous basis, relay signals between ground stations spread across 40% of the globe. Clarke, *Extra-Terrestrial Relays: Can Rocket Stations Give World-Wide Coverage?* WIRELESS WORLD, Oct. 1945, at 305-08.

The international legal definition for a geostationary satellite is: "A satellite, the circular orbit of which lies in the plane of the Earth's equator and which turns about the polar axis of the Earth in the same direction and with the same period as those of the Earth's rotation." Final Acts of the World Administrative Radio Conference for Space Telecommunications 47 (1971). The "geostationary satellite orbit" is the "orbit on which a satellite should be placed to be a geostationary satellite." *Id.* But space law and technology expert James Gehrig has observed that because satellites are subject to perturbing forces few, if any, geosynchronous satellites can meet the technical international legal definition. Gehrig, *Geostationary Orbit—Technology and Law* PROCEEDINGS OF THE NINETEENTH COLLOQUIUM ON THE LAW OF OUTER SPACE 267 n.4 (1977). Hence, as a matter of common acceptance, geosynchronous satellites in orbits with small inclinations to the plane of the equator, no more than 5°, are still considered "geostationary satellites." *Id.*

[3]J. KRAUS, RADIO ASTRONOMY (1976); Comments of the National Academy of Sciences in the Third Notice of Inquiry, Inquiry Relating to Preparation for an International Telecommunication Union World Administrative Radio Conference on the Use of the Geostationary-Satellite Orbit and the Planning of the Space Service Utilizing It, Dkt. No. 80-741, Dec. 15, 1983.

B. Why Are There Legal Questions?

Consider the following as a general rule: only one kind of information can be received on an electromagnetic channel, in one place, at one time. "Channel" means contiguous group or "band" of frequencies within the electromagnetic spectrum, and this is about as much electrical engineering as one needs to know to participate in space communications law. To affirm the sensibility of this general rule consider an analog: a person can only understand one person talking to him, in one place, at one time. Here, "talking" or sound waves is the channel and if two people talk simultaneously, in the same place, the listener is confused. (If one person talks while the other communicates with facial expressions we can understand both because the facial expressions are on another channel, a visual one). Similarly if two different types of information are transferred simultaneously, in the same place and on the same channel, the information becomes confused. In space communications this confusion is called "interference."

The need to avoid interference gives rise to most current space communications law questions. When three or more people meet to talk, social norms provide the rules for sharing a common auditory channel and for thereby avoiding "interference." When different American companies decide to launch and operate space communications systems, the U.S. Federal Communications Commission (FCC) must establish rules for sharing a common frequency channel. And when different nations and international organizations decide to launch and operate space communications systems, the International Telecommunication Union must adopt a regulatory framework for international sharing of space channels. These domestic and international rules for sharing frequencies and avoiding interference constitute the bulk of space communications law. They occupy dozens of pages of formally adopted FCC Orders[4] and of the ITU Radio Regulations, an international treaty.[5] Underlying this law are thousands of pages of legal advocacy in support of various approaches to sharing space communications channels.

The primary means of avoiding interference between different space communications systems is to have the channels they generate operate in different "places" from each other. Operating different systems at different times is not practical at present; operating different

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[4]Establishment of Domestic Communications-Satellite Facilities by Non-Governmental Entities, *Report and Order,* (in Dkt. No. 16495), 22 FCC 2d 86 (1970); *Second Report and Order,* (in Dkt. No. 16495), 35 FCC 2d 844 (1972); Processing of Pending Space Stations Applications in the Domestic Fixed Satellite Service, *Memorandum Opinion and Order,* 77 FCC 2d 956 (1980); Assignment of Orbital Locations to Space Stations in the Domestic Fixed Satellite Service, *Memorandum Opinion and Order,* 84 FCC 2d 584 (1981); Applications for New Space Stations in the Domestic Fixed Satellite Service, *Memorandum Opinion and Order,* 93 FCC 2d 1260 (1983); Development of Regulatory Policy in Regard to Direct Broadcast Satellites, *Report and Order* (in Dkt. No. 80-603), 90 FCC 2d 676 (1982); Applications for Transborder Satellite Services, *Memorandum, Opinion, Order* and Authorization, File No. 1-F-C-82-048, *et al.* (adopted 23 August, 1983).

[5]Final Acts of the World Administrative Radio Conference, Radio Regulations Relating to Space Telecommunications, Geneva, July 17, 1971, 23 UST 1527, T.I.A.S. No. 7435; Final Acts of the World Administrative Radio Conference (Geneva, 1979) *reprinted in* Nat'l Tech. Info. Serv., U.S. Dept. of Commerce.

The International Telecommunication Convention, December 9, 1932, 49 Stat. 2391, T.S. No. 867, created the International Telecommunication Union (ITU) of periodically convened "Plenipotentiary Conferences" to revise Convention provisions, "Administrative Conferences" to revise the detailed Radio Regulations appended to Conventions, separate "Consulting Committees" to study radio and telephony, and the "Berne Bureau" (now the International Frequency Registration Board) to keep track of the rapidly growing number of frequency assignments.

Since 1932, the ITU has agreed to several modified versions of an International Telecommunication Convention: International Telecommunication Convention, Oct. 2, 1947, 63 Stat. 1399, T.I.A.S. No. 1901; International Telecommunication Convention, *opened for signature* Nov. 12, 1965, 18 U.S.T. 575, T.I.A.S. No. 6267; International Telecommunication Convention, done Oct. 25, 1973, 28 U.S.T. 2497, T.I.A.S. No. 8572. The latest was adopted in Nairobi, Kenya in the late 1982.

systems on different channels is only a partial solution because there are important economic reasons to operate on one of two favored channels, the so-called "C-band"[6] and "Ku-band."[7] Satellite systems can operate at different "places" in one of two ways—they may operate from different orbital positions in the geostationary orbit and/or they may relay communications from different portions of the earth's surface. Hence space communications law involves making decisions as to which organizations within one country, and countries within the global community, are entitled to which orbital positions in an orbit some 100 times farther out into space than the Shuttle will ever travel! These are the space communications law decisions of today.

Space communications law questions also arise for reasons unrelated to sharing of a common frequency band. One such question involves the rights of countries to implement and/or use satellite communications systems other than the Intelsat system for international telecommunications. Over 100 countries are parties to the Intelsat Agreement,[8] which establishes a worldwide satellite system operated by an international organization to provide international telecommunications service and aims to preclude other satellite systems which cause the Intelsat system significant technical or economic

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[6]The frequencies used for Western Hemisphere public communications satellite service in these bands are 5.925-6.425 GHz uplink and 3.7-4.2 GHz downlink for the C band; 11.7-12.7 GHz downlink and 14.0-14.5 GHz uplink for the Ku band; and 17.7-21.1 GHz downlink and 27.5-31.0 GHz uplink for the Ka band. ITU Radio Regulations, Art. N7, §4; *see also* Jackson, *The Allocation of the Radio Spectrum*, SCIENTIFIC AMERICAN, Feb. 1980, at 34-39.

From a signal propagation standpoint, the C band is "ideal" and accounts for the great majority of satellite communications traffic. J. MARTIN COMMUNICATIONS SATELLITE SYSTEMS 138 (1978). However, Ku-band conditions are also quite favorable and most new communications satellite systems will utilize this band. Rothblatt, *International Regulation of Digital Communications Satellite Systems*, 32 FED. COM. L.J. 403-11 (1980). Although Ka-band signals propagate better than those transmitted at some neighboring frequencies, further technology development is needed to handle the band's characteristic rain attenuation problems. J. MARTIN, COMMUNICATIONS SATELLITE SYSTEMS 139 (1978). NASA is developing this technology, and the satellite industry is depending upon the Ka band to satisfy mammoth satellite communications needs in the next decade.

[7]The acronyms "C" and "Ku" stem from the use of code words during the second World War.

Higher 14/12 GHz (14-14.5 GHz uplink; 117.7-11.2 GHz downlink) frequencies will bring ground stations to users' premises in urban centers—a move which could not be made with traditional, lower frequency 6/4 GHz satellite service because of interference by the terrestrial Bell System microwave links which blanket all high traffic areas—and have the further advantages of: (1) narrower beam width and, hence, room for more of these satellites in geostationary orbit without interference; (2) a more directional beam from an antenna of a given size than that obtainable at lower frequencies and, hence, more opportunity to reuse a frequency in multiple highly-directed beams; (3) higher antenna gain than that obtainable at lower frequencies, thus increasing effective satellite power and reducing ground station size and cost; and (4) less need to impose harsh limits on satellite radiated power, as at 4 GHz downlinks, to minimize interference with terrestrial microwave distribution systems. J. MARTIN, COMMUNICATIONS SATELLITE SYSTEMS 136-47 (1978).

As these high frequencies get as saturated as the 6/4 GHz band, technology will enable use of the still higher 30/20 GHz frequency band where the U.S. Government has reserved 2/3 of the available 1.5 GHz bandwidth. Jain, *Use of EHF Bands in Further Military Satellite Applications*, 2 IEEE 1979 International Conference on Communications 33.4.1. Commercial systems will operate in the remaining 500 MHz some time this decade. Ward, *NASA Advanced Communications Systems Analysis*, 1 IEEE 15.2.21 (1979). *See also* Establishment of Domestic Communications Satellite Facilities by Non-Governmental Entities, 35 F.C.C. 2d 844, 851 (1972).

[8]Agreement Relating to the International Telecommunications Satellite Organization, 23 U.S.T. 3813, T.I.A.S. No. 7532 (1973) (hereinafter cited as INTELSAT Agreement). *See generally* R. COLINO, THE INTELSAT DEFINITIVE ARRANGEMENTS: USHERING IN A NEW ERA IN SATELLITE TELECOMMUNICATIONS (1973); DOYLE, *Permanent Arrangements for the Global Commercial Communications Satellite System of Intelsat*, PROCEEDINGS OF THE 17TH COLLOQUIUM ON THE LAW OF OUTER SPACE 123 (1975); PELTON, *The Intelsat Global Satellite System and the Pacific: Past, Present and Future* PACIFIC TELECOMMUNICATIONS CONFERENCE 2E-23 (1979).

harm. Legal issues include what constitutes significant economic harm,[9] what types of international communications fall within the purview of the Intelsat agreement and what are the legal options available to a country or group of countries if Intelsat advises that a satellite system they contemplate is inconsistent with their Intelsat obligations.

On a domestic level, space communications law issues relating to Intelsat arise because of laws which usually reserve to one organization an exclusive right to transmit information to Intelsat satellites and/or to participate in the Intelsat organization. Today, Intelsat satellites can interact with small earth stations, and new companies are seeking the privilege of transmitting information to, and receiving information from, these international space-based relays. Many issues exist in the U.S. and other countries as to whether such non-exclusive access to Intelsat should be permitted, and if so, how it should be regulated. There is a tie-in with transborder data flow issues since a new Intelsat International Business Service (IBS) offering would allow vast stores of data to be transmitted out of a country, from anywhere in the country, in a matter of seconds.

Another space communications law issue that is not directly related to orbital positions is that of international satellite broadcasting.[10] Here the question is whether the intentional transmission of information from one or more countries to others via satellites in geostationary orbit should be subject to a legal regime of prior consent. This issue exemplifies nicely the "seamless web" of space communications law. In anticipation of future problems with regard to sharing of the geostationary orbit, the ITU, in 1977[11]

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[9]*See, e.g.,* Reply of Communications Satellite Corporation to Opposition to Petition to Deny, In re International Satellite, Inc., file Nos. CSS-83-004-P(LA), I-P-C-83-073, Oct. 24, 1983, where Cosmat states: "ISI indicated in its Application, the framers of the INTELSAT Agreement amended a draft of Article XIV(d) to substitute "significant" economic harm for "substantial" economic harm. Contrary to ISI's interpretation, this word choice indicates an intent on the part of the members to refrain from causing lesser degrees of harm—that is, harm that would have only a 'significant,' albiet not a "substantial," effect on INTELSAT. Moreover, the very source relied on by ISI for the change in language indicates clearly that Article XIV(d) was intended only to provide the flexibility to enable members, in certain circumstances, to establish or use limited regional satellite systems, and that Article XIV(d) reflects a majority position, as advocated by the United States, "that each Participating State obligate itself not to establish, or join in the establishment of, a space segment in competition with the space segment of the Organization."

[10]The term "international" is often reserved for the case where the satellite broadcast is *intentionally* aimed at a foreign country. However, satellite broadcasting transmissions may reach a foreign country also in the form of "spillover." Spillover occurs since it is impossible to tailor the satellite footprint so as exactly to match the borders of the transmitting country.

[11]The 1977 Broadcasting-Satellite Conference marked a break with ITU tradition and signalled a new, deeper level of ITU involvement in satellite communications. Drawing strength from a preponderantly Third World membership and from a broad mandate of resolutions and recommendations from earlier ITU Conferences, the principles of efficient and equitable use of space service frequencies and orbital positions were interpreted to mean, at least for 12 GHz band broadcasting-satellite service, *a priori* assignment of the orbit/spectrum resource among all ITU members. The Secretary-General of the ITU, Richard Butler, noted that the broadcasting-satellite service "plan" contains "a collection of all the technical parameters necessary for the purpose of ensuring the optimum use of available resources." This list of "technical parameters" essentially assigns to specific countries the frequencies and orbital positions they may employ for satellite broadcasting. This assignment is accomplished by dividing the bandwidth, associating each group of channels with an orbital position, and then allocating to countries the right to specific channels at specific orbital positions. Countries have from two (Brunei) to sixty-five (Soviet Union) channel assignments; most countries receive four, depending on size, population and foreseeable communication needs.

The plan just described was executed for Regions 1 and 3, but, largely because of American opposition, the decision on an assignment plan for Region 2 (Western Hemisphere) was postponed for action at a 1983 regional conference. *See* Butler, *World Administrative Radio Conference for Planning Broadcasting Satellite Service,* 5 J. SPACE L. 93, 98 (1977); Mili, *World Administrative Radio Conference for the Planning of the Broadcasting-Satellite Service in Frequency Bands 11.7-12.2 GHz* (in Regions 2 and 3) *and 11.7-12.5 GHz* (in Region 1), PROCEEDINGS OF THE 20TH COLLOQUIUM OF THE LAW OF OUTER SPACE 346 (1978).

and 1983, gave all countries specific orbital positions at a frequency band reserved for satellite broadcasting and required that these orbital positions be used only for transmissions centered on an orbital position assignee's own country.[12] While this minimized interference problems, it also left very little room for intentional international satellite broadcasting at the reserved frequency band. It is also possible, however, to broadcast from satellites to slightly larger receive earth stations in a frequency band within which such transmissions could be considered international telecommunications subject to the Intelsat Agreement. Were such transmissions to be effected from a country's own satellites, then signatories to the Intelsat Agreement which did not want their populace to receive such transmissions could oppose them on the ground that they were international satellite communications capable of causing economic harm to the Intelsat system. There is no shortage of space communications legal issues. Fortunately, there are many opportunities to practice space communications law as well.

C. What Are The Opportunities For Practicing Space Communications Law?

The largest opportunity for practicing space communications law is to represent private companies which desire authority to construct, launch and operate a satellite communications system.[13] There are many such companies now, and there will certainly be many more in the years to come. The first companies to receive the necessary permission to operate a satellite communications system were Western Union, RCA Americom and Comsat General.[14] They and all subsequent U.S. grantees of satellite communications operating authority applied to and received permission from the U.S. Federal Communications Commission.

Subsequently, in 1977, Satellite Business Systems received permission to operate an advanced Ku band network.[15] In 1980 replacement and/or new satellites were granted, on application, to GTE Satellite, Southern Pacific Spacenet, Hughes Communications, Satellite Business Systems, Western Union, RCA Americom and Comsat General.[16] Still more recently, applications to operate satellite systems were received from and granted to the above-listed companies as well as new applicants such as American Satellite

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[12]In 1983 the U.S. was allotted 32 broadcasting satellite channels at eight different orbital positions. The eight companies authorized by the FCC in late 1982 to enter the direct broadcast satellite business have proposed building and launching 21 satellites to offer 43 channels of national service. For various technical and economic reasons, most of the DBS companies have requested orbital slots at 101 degrees west longitude to serve the eastern half of CONUS or the Eastern and Central time zones and at 148 degrees to serve the western half of CONUS or the Mountain and Western time zones. Five companies requested 34 channels at 101 degrees and eight asked for 46 at 148.

[13]Useful scholarly works dealing with space communications law are S. GOROVE, U.S. SPACE LAW (1983) and D. LEIVE, INTERNATIONAL TELECOMMUNICATIONS AND INTERNATIONAL LAW: THE REGULATION OF THE RADIO SPECTRUM (1971).

[14]Western Union Telegraph Company, 38 FCC 2d 1197 (1973); COMSAT General Corporation, 42 FCC 2d 677 (1973), 45 FCC 2d 444 (1974); RCA Global Communications, 56 FCC 2d 660 (1975).

[15]Satellite Business Systems, 62 FCC 2d 997 (1977).

[16]Replacement satellites and expansions of existing systems were authorized in COMSAT General Corporation, 84 FCC 2d 547 (1981); RCA American Communications, Inc., 84 FCC 2d 633 (1981); Western Union Telegraph Company, 86 FCC 2d 196 (1981); and Satellite Business Systems, 86 FCC 2d 180 (1981). Initial satellites for new system entrants were approved in Hughes Communications, Inc., 84 FCC 2d 578 (1981); Southern Pacific Communications Company; 84 FCC 2d 650 (1981) and GTE Satellite Corporation, 84 FCC 2d 562 (1981).

Company, United States Satellite Systems and Rainbow Satellite.[17] As of February 1984 the FCC had yet more applications to operate satellites from Ford Aerospace, National Exchange, Systematics General, Federal Express, Martin Marietta and several other firms.

In all, there are presently 29 different companies with applications at the FCC for over ninety satellites. Most of these companies are seeking permission to operate traditional satellite communications systems, but others, such as Geostar Corporation, are applying for authority to implement new types of systems (satellite based position location and navigation satellites).[18] Each of these companies has retained legal counsel to help prepare their applications to the FCC, to draft all manner of pleadings as required under the FCC's Rules and the Administrative Procedure Act (petitions to deny, oppositions, comments, reply comments and others) and to assist the company in obtaining the orbital positions they desire. Space communications counsel are somewhat like celestial gladiators fighting first for an opportunity to enjoy a perch in space and then over preferred orbital positions in the geostationary arc.

In addition, there are significant opportunities in space communications law practice to represent private companies which have rights to use a satellite of another company,[19] which desire an opportunity to operate earth stations capable of transmitting directly to Intelsat satellites and thereby establishing a dedicated international message transfer network[20] or which are concerned with the claims of other countries in the Western Hemisphere to the orbital positions they desire. For example, between 1984 and 1988 the ITU will hold several meetings and conferences in Geneva for the purpose of establishing a regime that will guarantee in practice the rights of all countries to equitable access to the geostationary orbit and space service frequency bands. The conferences are called Space WARC's (World Administrative Radio Conferences) and the meetings are convened for preparatory purposes. The FCC has established a Space WARC Advisory Committee to serve as a focal point for non-government input into what U.S. policy should be with regard to equitable access to the geostationary orbit for satellite communications purposes. Dozens of private companies send legal representatives to the Advisory Committee's meetings to monitor, report on and participate in its proceedings.[21] Even radio astronomers, whose interest in space communications was described above, retain legal counsel to ensure that satellites transmissions are not allowed to drown out reception of important cosmic radio waves.

In sum, there are a great many opportunities to practice space communications law. They center around representing private company interests before the Federal

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[17]Memorandum Opinion and Order, Assignment of Orbital Locations to Space Stations in the Domestic Fixed-Satellite Service, FCC 83-186 (August 12, 1983).

[18]*See Geostar,* POPULAR SCIENCE, March, 1984 and Petition of Geostar Corporation for Issuance of a Notice of Proposed Rulemaking to Allocate Frequencies to the Geostar Satellite System, RM-4426, March 31, 1983. (available in FCC Docket File, Wash. D.C.)

[19]*See* Domestic Fixed Satellite Transponder Sales, 90 FCC 2d 1238 (1982).

[20]Regulatory Policies Concerning Direct Access to Intelsat Space Segment for the U.S. International Service Carriers, 90 FCC 2d 1446 (1982) Modification of Policy on Ownership and Operation of U.S. Earth Stations that Operate with the INTELSAT GLobal Communications Satellite System, 90 FCC 2d 1458 (1982).

[21]*See* Report of the Legal Implications Subcommittee, FCC Space WARC Advisory Committee, Dkt. No. 80-742 (Dec., 1983).

Communications Commission.[22] These interests range from fervent desires for particular orbital positions in the geostationary arc to a driving motivation to provide new satellite services to millions of customers. The excitement clients feel for their efforts to help build a space-based "nervous system of mankind" cannot help but be felt by the counsel they retain, and help to make space communications law one of the most exhilerating fields of legal practice today.

II. SPACE TRANSPORTATION LAW AND PRACTICE

A. What Is Space Transportation?

Space transportation is the transfer of physical objects into or within the region beyond the earth's atmosphere, or from that region to the surface of the earth. The definition is similar to that provided above for space communication; the obvious difference is that matter rather than information is being transferred. Examples of space transportation include the Space Shuttle, expendable launch vehicles (Delta, Atlas, Titan, Ariane) and orbital transfer vehicle concepts for moving objects between various orbits about the earth.

The rate of worldwide space transportation activity has exceeded one launch per month and is expected to continue increasing. Much of this increase comes from heightened worldwide demand for additional communication satellites, which must be placed in orbit by an appropriate launch vehicle.[23] In the United States, the Space Shuttle[24]

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[22]The authority requested in applications for satellite systems includes requests for construction permits pursuant to section 319 of the Communications Act, 47 *U.S.C.* §319. A recent amendment to the Act exempts common carrier stations from the construction permit requirement unless the Commission finds that the public interest would be served by such a requirement. *See Communications Amendments Act of 1982,* Public Law No. 97-259, Section 119. However, the Commission has decided to retain the present licensing procedure, including the construction permit requirement, until it can initiate a rulemaking proceeding to implement this amendment. *See Public Notice.* No. 740 (released November 10, 1982), and *Notice of Proposed Rulemaking,* FCC 83-140, adopted April 7, 1983.

[23]"In the space sector, launch projects are superseding space exploration in importance. World space launches are virtually booked solid for the next five years because of the strong demand for civil and military satellites and space research projects. Although most launches currently are with expendable launch vehicles, the reusable Space Shuttle will carry a large share of future payloads. Plans call for the operation of four U.S. Space Shuttles by the end of 1984. Foreign manufacturers will continue to offer expendable vehicle services at competitive rates." ". . . The need for space launches for a forecasted 500 satellites worldwide by year 2000 will translate into a demand for more than $50 billion-worth of space launch equipment." "1983 Industrial Outlook," U.S. Dept. of Commerce. Battelle's Columbus Laboratories under contract to NASA in its "Outside Users Payload Model" report dated July, 1982, projects a High Model 667 launches and a Low Model 413 launches through 1987. This model does not include NASA's own missions but does provide a level of activity of the civil market including estimates of new programs as well as continuation of existing programs. The growth in launch requirements is compounded to some extent because of the need to replace spacecraft at intervals of five to eight years. Replacement may be stimulated by malfunctions, projected end of life, or by technical obsolescence.

[24]The Space Shuttle is the United States Government's primary spacecraft launch vehicle in the now established Space Transportation System (STS). With an approved fleet of four ships (variously projected at up to seven in earlier NASA budget requests), the Shuttle was intended to launch all military payloads, some particularly heavy or large spacecraft such as SPACELAB, scientific and commercial payloads, and, due to its unique capabilities, to provide a means for in-orbit operations including manufacturing and material processing, LEO spacecraft repair or retrieval, and then to return to a soft landing on earth. Designed to carry up to 65,000 pounds into LEO from Kennedy Space Center, Florida, the Shuttle, with spacecraft payloads having an additional upper stage, can launch in excess of 12,000 pounds from the Orbiter cargo bay into geosynchronous transfer orbit (GTO). This capability also allows as many as four separate Delta-class spacecraft to be launched into geostationary orbit. Although the Shuttle is presently utilized in large part for missions which could be performed

is garnering the preponderant share of launch contracts, although a market may exist for a revitalized expendable launch vehicle based on the Delta, Atlas or Titan rockets. There is also a good possibility that one or more of three new types of launch vehicles being developed with private capital (Space Service's Conestoga, Starstruck's Dolphin and TranSpace's Space Van) may see commercial service. Most European spacecraft will be launched via Arianespace's Ariane rocket from Korou, French Guyana.[25] The Japanese will probably rely on their Delta-derived N and H rockets. The Soviets enjoy an ample supply of boosters and India and China have an active launch vehicle development program.

To maintain a viable space transportation program one normally requires an expensive launch facility, a clear flight path and a tracking and data relay network, in addition to an extensive support infrastructure for rocket design, testing and modification. Despite these formidable requirements there appear to be clear opportunities for private involvement in space transportation activity, and therein lie most of the current opportunities for practicing space transportation law. As President Reagan announced in his January 25, 1984 State of the Union Message:

> "The market for space transportation could surpass our capacity to develop it. Companies interested in putting payloads into space must have ready access to private-sector launch services."

During the late 1980's and 1990's a significant transorbital transportation market may arise with important opportunities for private involvement. The existence of this market flows from the large energy difference between low earth orbits and the geostationary orbit into which most civil spacecraft are placed. When an appropriate support infrastructure exists, such as that which would be provided by one or more large space stations, high energy orbital transfer vehicles can help to ensure that spacecraft safely reach their destinations in higher orbits.

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by EIV's such as the launching of communications satellites, it is anticipated that, eventually, heavy demand will be placed on the four ship fleet for the many unique and intended mission capabilities of the Space Shuttle. The construction cost of additional Shuttles is in excess of a billion dollars each.

NASA originally priced Space Shuttle launch services based on projected average cost of operations over a 12 year period. More recently, the agency has changed its pricing policy due to higher costs to reflect actual costs of operations. A Shuttle Delta-class spacecraft launch to GTO in 1986 is expected to cost between $26.2 million and $36.7 million, depending on the actual spacecraft weight.

[25] Ariane was developed by the European Space Agency (ESA) to vest within its 11 member countries a launch capability independent of that of the United States. Ariane was developed as an EIV for earth launch of spacecraft to outer space, and specifically, to geostationary orbit. In recognition of the need to operate Ariane in a commercial enterprise in contract to a governmental program, Arianespace was formed as a private company under French law. Production, launch and marketing responsibilities for Ariane transferred from ESA to Arianespace. Ariane is intended eventually to provide a range in lifting capability to GTO from about 3,870 pounds for the present Ariane I to over 9,000 pounds for Ariane IV scheduled for 1986 operations. Ariane launch facilities are at near-equatorial Kourou, French Guiana. In comparison with Kennedy Space Center, Kourou by virtue of geography offers an 8-10% payload weight advantage for launch to GTO. The Ariane design includes the capability of launching a single large spacecraft or two Delta-class spacecraft. Although Ariane has experienced two launch failures in its first five launches, it is expected that substantial effort will continue toward achieving commercial viability.

B. Why Are There Legal Questions?

Legal questions arise primarily because the rights of private entities to engage in space transportation activity, and the corresponding obligations of States to oversee this activity, have not yet been fully explicated. Article VI of the Outer Space Treaty provides, in relevant part, that:

> "States Parties to the Treaty shall bear international responsibility for national activities in outer space, including the moon and other celestial bodies, whether such activities are carried on by governmental agencies or by non-governmental entities, and for assuring that national activities are carried out in conformity with the provisions set forth in the present Treaty. The 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."[26]

The key concept in this article is that a State must authorize, be responsible for and exercise continuing supervision over space transportation activities of private entities within its jurisdiction.[27] Hence the prevailing legal considerations revolve about the form and requirements of space transportation "authorization," the limits and extent of State "responsibility" and the structure or framework for "continuing supervision." These are important legal questions because too strict an interpretation of the State requirements could stifle private space transportation activity; it may also be argued that too lax an interpretation exposes the State of jurisdiction to international liability for events beyond its control.

During the early 1980's there has been extensive debate in the executive and legislative branches of the U.S. government, and within the space transportation community, as to what form "authorization" of space transportation activity should take.[28]. The current consensus appears to be that such activity should be licensed on a per-launch basis by the U.S. Department of Transportation. There has been relatively little discussion of how the requirement of "continuing supervision" should be implemented in practice, although submission of brief written reports and reliance upon existing Defense Department space object tracking facilities appear to be reasonable solutions.

In the next decade the fundamental principle of international State responsibility for private space activity is likely to engender complex legal questions with regard to far-flung transorbital transportation projects that may not clearly fall within the jurisdiction of any one State. Should such projects eventually achieve an entirely space-based character, and hence a large degree of independence from terrestrial resources and sovereignties, it may be difficult to assert rights of State control and, consequentially, it may be impossible

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[26]Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, *opened for signature* Jan. 27, 1967, [1967] 18 U.S.T. 2410, T.I.A.S. No. 6347, 610 U.N.T.S. 205 [hereinafter cited as Outer Space Treaty).

[27]For cogent analyses of this article, *See* Galloway, *Interpreting the Treaty on Outer Space,* PROCEEDINGS OF THE 10TH COLLOQUIUM ON THE LAW OF OUTER SPACE 143 (1967); Gorove, *Sovereign Rights in Outer Space,* PROCEEDINGS OF THE 20TH COLLOQUIUM ON THE LAW OF OUTER SPACE 244 (1978); Dekanozov, *Juridical Nature of Outer Space, Including the Moon and Other Celestial Bodies,* PROCEEDINGS OF THE 17TH COLLOQUIUM ON THE LAW OF OUTER SPACE 200 (1975); Bocksteigel, *Legal Implications of Commercial Space Activities,* PROCEEDINGS OF THE 24TH COLLOQUIUM ON THE LAW OF OUTER SPACE 1 (1981).

[28]*See* H.R. 1011, 98th Cong., 1st Sess. 129 CONG. REC. H200 (daily ed. Jan. 27, 1983) ("Space Commerce Act"); H.R. 3942, 98th Cong., 1st Sess. 129 CONG. REC. H7283 (daily ed. Sept. 21, 1983) ("Expendable Launch Vehicle Commercialization Act") S. 560, 98th Cong. 1st Sess., 129 CONG. REC. S1507 (daily ed. Feb. 23, 1983) ("Private Satellite Launching Authorization Act of 1983").

to identify State responsibility. If the underlying "linchpin" of State responsibility is problematic, the duties of authorization and continuing supervision may become moot.

The legal questions raised by space transportation activity are enticing because they require both the establishment of a framework for hundreds of private space launches and, at the same time, broach a perhaps inevitable scenario in which the very question of State responsibility may begin to lose meaning. It is, therefore, particularly pleasant to be able to report that opportunities to practice space transportation law do, in fact, exist.

C. Opportunities For Practice

It must be conceded at the outset that space transportation is still in its infancy and that detailed rules, such as those which abound in space communications, do not generally exist. As a result, there is much less opportunity, at the present time, to represent private clients than is the case in space communications law. The largest current opportunities are to (1) negotiate space transportation contracts and (2) to monitor, report on and help to influence the space transportation legislation and administrative rules now being developed.

There are about a dozen companies with a sufficiently strong interest in space transportation legislation now pending in Congress to retain legal counsel for monitoring and other related purposes. About half this number of companies retain legal counsel to help obtain the necessary permits (State Department munitions export authority for sending missiles outside the United States; FCC experimental radio licenses for launch vehicle telemetry and remote control) for conducting non-governmental launches. Over the next couple of years the Department of Transportation can be expected to initiate rulemaking activity to develop specific guidelines for the authorization of private launches. Satellite, launch vehicle and space insurance companies can all be expected to have a direct interest in this rulemaking activity.[29]

The best opportunities for practicing space transportation law probably still exist within NASA, where Mr. Neil Hosenball, a dean of this field, is General Counsel. Nevertheless, as the rate of space transportation activity continues to increase, and as the number of players in this game continues to grow, the private opportunities to practice space transportation law will soon rival those described above for space communications.

III. SPACE PROPERTY LAW AND PRACTICE

A. What Is Space Property?

Space property is something natural or man-made located beyond the earth's atmosphere. Natural space property includes asteroids such as the Apollo-Amur group which are found within the earth's orbit about the sun, the moon and other celestial bodies. Also included in this category are the natural resources of such property. Man-made space property includes all types of communication satellites, future space stations and the thousands of pieces of fragments of space objects known as space debris. In the future, such property would include any processed form of natural space resources.

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[29]With regard to insurance industry interest, AFIA NEWS, Winter, 1983, reports: "Insurance premium volume for commercially launched satellites has not exactly skyrocketed in the last 15 years. During that time period, satellite insurance has generated only $310 million in premiums. The potential for such business, is, however, about to erupt. Over the next 10 years, premiums are expected to total $3 billion to cover insurable values of more than $40 billion."

The amount of man-made space property is increasing rapidly and now includes hundreds of satellites and over 10,000 pieces of trackable space debris. The thirty ton payload capacity of the Shuttle will certainly increase significantly the amount of man-made property in space over the next several years. More importantly, however, will be the Space Shuttle's role in creating large space structures[30]—a form of space property that will engender some of the most vexing questions encompassed by the field of space law.

B. Why Are There Legal Questions?

Two rather different legal questions arise from the subject of space property. First, there is the issue of liability for damage caused by or to space property. This issue exists because a concomitant of the right to own and control space property is the obligation to not allow such property to interfere with the health, safety or property of others. Second is the issue posed by a potential conflict between two fundamental tenets of space law—one such tenet holds that space cannot be appropriated by any nation[31]; the other mandates that States retain jurisdiction and control over the property they launch into outer space[32]. When space structures become very large, the exercise of jurisdiction and control over such objects and their adjacent spatial regions may very well constitute a form of national appropriation.

Rather specific rules have been developed for liability for damage caused by space objects. Simply stated, if an object launched into space causes damage within the atmosphere of the earth, the "launching state" is liable for any damage caused regardless of fault.[33] If such damage is caused to property in space, liability is based on fault.[34] "Launching state" is defined to include States which launch an object, which procure the launch of an object and from whose territory an object is launched.[35] Further legal issues exist however because of inexactitude in the definition of the liable party, because of the difficulty of establishing fault in space-based harm or damage and because determination of the amount of liability is left to diplomatic negotiations in the first instance and, if this process fails, to a Claims Commission tribunal the decision of which is not necessarily binding.[36] Furthermore, the above-stated rules do not apply if both

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[30]*See,* G. O'NEILL, THE HIGH FRONTIER (1976); R. Kline, *A Program to Develop Efficient Manned Operations in Space* SPACE MANUFACTURING 1983, 53 ADVANCES IN THE ASTRONAUTICAL SCIENCES 107 (1983).

[31]Outer Space Treaty, *supra* note 26, art. II.

[32]*Id.* art. VIII.

[33]Article II of the Convention of 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); S. Gorove, *Cosmos 954: Issues of Law and Policy,* 6 J. SPACE L. 141 (1978).

[34]Liability Convention, art. III; Hosenball, *Space Law Liability and Insurable Risks,* 12 FORUM 141, 151 (1976).

[35]Liability Convention, art. I.

[36]*Id.,* arts. IX - XIX. *See also* C. CHRISTOL, THE MODERN INTERNATIONAL LAW OF OUTER SPACE 59 (1982); Christol, *Liability for Damage Caused by Space Objects,* 74 AM. F. INT'L. LAW 1980. Foster, *The Convention on International Liability for Damage Caused by Space Objects,* 10 CANADIAN Y.B.I.L. 141-42 (1972); Cheng, *Convention on International Liability for Damage Caused by Space Objects,* 1 MANUAL OF SPACE LAW 83 (eds. Jasentuliyana & Lee 1979).

the tortfeasor and the victim are nationals of the same country—a not unlikely occurrence for a country such as the United States with many objects in space.[37]

Consider a scenario in which several pieces of space property are joined together into an integrated multi-functional structure. It could grow to dimensions of hundreds of meters through use of modularity and dynamic control systems. Such structures are normally referred to as "space stations"; the United States is committed to building at least one before 1995. Just as privately-owned satellites appeared soon after government satellites proved the art, and as privately-owned launch vehicles are springing up in the wake of the Shuttle's success, one must certainly expect privately-owned space stations to take their rightful places in orbits about the earth. What legal questions arise?

One can certainly expect regulatory and legislative efforts to ensure that private space stations are "authorized" and under the "continuing supervision" of a State party to the Outer Space Treaty. But should this responsibility rest with the same entity that approves space transportation service—probably the Department of Transportation in the United States? What would be the terms of any authorization for a permanent privately-owned space station? And what of revocation of authority? Does a citizen of a country which believes in and practices freedom of movement, and which does not and constitutionally cannot restrict choice of residence, have to obtain a "license" to live and/or work in a space station?[38] If the answers to these questions imply much government restriction over privately-owned space station activities, then, in countries like the United States, these restrictions will be major legal issues and gradually will be whittled down. But if a very liberal regime prevails from the beginning, the international legal requirement for "authorization" and "continuing supervision" may be meaningless in practice. Without some means of State control, it is senseless to burden the State with international responsibility for non-governmental space activity. This leaves the space station owner with full responsibility for its own activities. It paves the way for the ultimate redefinition of property—the declaration of self-determination.[39]

A somewhat more subtle legal issue involves the conflict between the right of a State to maintain jurisdiction and control over objects it launches into outer space and the mandate in Article II of the Outer Space Treaty that space, including the moon and other celestial bodies, "is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means." This issue arises because large space structures may encompass large volumes of space or surface areas of the moon. Well before the end of this century space law jurists will have to address and resolve whether the exercise of jurisdiction and control over an enclosed portion of the lunar surface or over an enclosed or utilized portion of some well-defined orbital plane (at a given distance from the earth) constitutes national appropriation "by means of use or occupation."

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[37] *See* Rothblatt, *International Liability of the United States for Space Shuttle Operations*, 13 INT'L LAWYER 471 (1979).

[38] Consider, for example, section 5 of H.R. 1011, which provides 5 of that "no person may launch a space object from territory of the United States, and no person who is a national of the United States may launch a space object from international waters or air space, except in accordance with a license issued under this section. Any person violating this subsection shall, upon conviction, be subject to a fine of up to $1,000,000 per violation and up to five years in prison or both.

[39] *See generally* in this regard Glazer, *Domicile and Industry in Outer Space*, 17 COLUMB. J. TRANS. L. 67 (1978). The treatises which provide helpful analyses of space station law and policy issues are S. GOROVE, STUDIES IN SPACE LAW: ITS CHALLENGES AND PROSPECTS (1977) AND C. CHRISTOL, THE MODERN INTERNATIONAL LAW OF OUTER SPACE (1982).

C. Opportunities For Practice

The current opportunities for practicing space property law, as defined above, are quite small. The future opportunities, however, will almost certainly dwarf those for space communications and space transportation law. Indeed, it appears as if an inverse relationship exists between the present opportunities for practicing a particular division of space law and those which are likely to exist around the turn of the century.

Today, space property law counsel may be retained to provide expert advice to clients with long-term plans for building large space structures, for engaging in non-terrestrial mineral exploitation or for establishing solar power satellites. In the late 1980's there will probably be opportunities for representing clients interested in legislation dealing with space property rights, including non-government space stations—this is similar to the work space transportation lawyers perform today. During the 1990's and beyond a space property law practice might reasonably include (1) maximizing a private company's freedom of action over the construction and operation of large space structures within the context of regulatory application and rulemaking procedures, (2) obtaining government support for protective zones around space development areas, (3) negotiating clear rights to develop and transport non-terrestrial materials, and (4) generally using law as a tool to maximize a space development company's rate of return on space projects—that is, to help increase revenues, reduce costs and reduce perceived risks. This last point is important because raising private capital for large space development projects with long payback periods will not be easy.[40]

IV. SUMMARY

Most current and prospective opportunities to practice space law fall into the areas of space communications law, space transportation law and space property law. Space communications law offers the best chances for a viable practice today. Over the next several years, however, space transportation and space property law will very likely come into their own as specialties with enough client interest to occupy several dozen attorneys in private practice on a full or part-time basis.

An underlying theme of this article is that space law issues arise because private activities in outer space have a significant potential for conflicting with each other and with governmental interests. While criticism is often levelled at attorneys, it should be remembered that, in simplest terms, lawyers are conflict resolvers. And, far more often than not, conflicts rationally resolved by law are conflicts *not* resolved by fist, by fiat, by fortuity or by chance. In space, where a narrow margin of human technological ingenuity can be all that separates life from death, mankind can afford to rely upon only the most rational mechanisms for conflict resolution. In other words, in space the rule of law and the laws of science and technology are inseparable companions in the quest for prosperity and in the search for peace.

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[40]For an excellent analysis of the relationship between law and space commerce, *see* M. Menter, "Legal Aspects of Commercial Space Activities," delivered at American Bar Association National Institute on Aviation Litigation and Space Law, Washington, D.C. (May 27-29, 1982).