JOURNAL OF SPACE LAW

VOLUME 18, NUMBER 2
1990

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A journal devoted to the legal problems arising
out of human activities in outer space

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All correspondance should be directed to the JOURNAL OF SPACE LAW, University of Mississippi Law Center, University, Mississippi 38677. JOURNAL OF SPACE LAW. The subscription rate for 1991 is $65 (domestic) and $70 (foreign) for two issues. Single issues may be ordered at $36 per issue (postage and handling included).

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THE GROWTH OF DOMESTIC SPACE LAW: A U.S. EXAMPLE

Stephen Gorove*

Introduction

More than three decades have passed since the beginning of the Space Age, during which time the United States has not only contributed to the scientific and technological achievements but has also played a leading role in the establishment of rules and regulations governing the activities associated with the exploration and use of outer space. While the international community focused its attention on the world-wide implications of the emerging activities in outer space, and drafted a number of major international agreements, in the domestic field the United States took the leadership in passing several important legislative enactments and in promulgating hundreds of rules and regulations, thereby underscoring the unique role that it has played in charting new pathways in a hitherto unknown field of national space legislation.

The NASAct

The first landmark of this unparalleled domestic track record was laid by the United States Congress a year after the launch of Sputnik, and is known as the National Aeronautics and Space Act (NASAct) of 1958,[1] in which the United States pledged that its activities in space would be devoted to peaceful purposes and for the benefit for all mankind.[2] In the same enactment, Congress further declared that space activities were to be the responsibility of a civilian agency exercising control over such activities sponsored by the United States, except that activities associated with the development of weapons systems, military operations, or national defense would be the responsibility of the Department of Defense.[3]

The assigned task of the new agency, known as the National Aeronautics and Space Administration (NASA), has been, *inter alia*, to plan, direct and conduct space activities, arrange for the scientific community's participation and provide for the widest practicable and

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1. Pub. L. No. 85-568, 72 Stat. 426, 42 U.S.C. sec. 2451 *et seq.* (1988)[hereinafter NASAct].
2. *Id.* sec. 102(a).
3. *Id.* sec.102(b).

appropriate dissemination of information concerning its activities and the results thereof.[4]

(a) International Aspects

Apart from its day-to-day functions, NASA has been authorized to engage, under the foreign policy guidance of the President, in a program of international cooperation subject to agreements made by the President with the advice and consent of the Senate.[5]

While our focus is on U.S. domestic law, in order to foreclose any possibly erroneous impression, it should be stressed that the preceding provision, as interpreted by President Eisenhower at the time of his signing of the NASAct, merely recognized that international treaties may be made in the space field and did not preclude, in appropriate cases, less formal arrangements for cooperation.[6] Entirely in line with this clear constitutional understanding which corresponded to longstanding historical practice in other areas, the United States has entered into a series of major international multilateral agreements having relevance to space. Among them are the Limited Test Ban Treaty,[7] the Outer Space Treaty,[8] the Agreement on the Rescue and Return of Astronauts,[9] the Liability Convention,[10] the Registration Convention,[11] the ENMOD

4. *Id.* sec. 203(a).

5. *Id.* sec. 205.

6. 1 UNITED STATES SPACE LAW - NATIONAL AND INTERNATIONAL REGULATION (S. Gorove ed. 1982-1990), sec. I.A.1., at 17 [hereinafter "UNITED STATES SPACE LAW"].

7. Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and Under Water, *done* Aug. 5, 1963, 14 U.S.T. 1313, T.I.A.S. No. 5433, 480 U.N.T.S. 43 [herein "Limited Test Ban Treaty"].

8. Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, *done* Jan. 27, 1967, 18 U.S.T. 2410, T.I.A.S. No. 6347, 610 U.N.T.S. 205 *(entered into force for the United States* Oct. 10, 1967) [hereinafter "Outer Space Treaty"].

9. Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space, *done* Apr. 22, 1968, 19 U.S.T. 7570, T.I.A.S. No. 6599, 672 U.N.T.S. 119 *(entered into force for the United States* Dec. 3, 1968) [herein "Agreement on the Rescue and Return of Astronauts"].

10. Convention on International Liability for Damage Caused by Space Objects, Oct. 9, 1973, 2424 U.S.T. 2389, T.I.A.S. No. 7762, 961 U.N.T.S. 187 *(entered into force for the United States* Oct. 9, 1973) [hereinafter "Liability Convention"].

11. Convention on the Registration of Objects Launched into Outer Space, *opened for signature* Jan. 14, 1975, 28 U.S.T. 695, T.I.A.S. No. 8480, 1023 U.N.T.S. 15 *(entered into force for the United States* Sept. 15, 1976) [herein "Registration Convention"].

Convention,[12] the ITU Conventions,[13] the INTELSAT[14] and INMARSAT Agreements,[15] the Convention Relating to the Distribution of Programme-Carrying Signals Transmitted by Satellite,[16] and the U.S./International Space Station Agreement.[17]

In addition to these major international treaties, the United States is also a party to well over a thousand, mostly bilateral international agreements, memoranda of understanding and exchanges of notes dealing with cooperative projects, reimbursable launchings, tracking and data acquisition facilities, personnel exchanges, defense and other matters. The bulk of these bilaterals do not entail the more formal treaty-making process which requires an affirmative two-thirds majority vote in the U.S. Senate. It should be emphasized that international customary law as well as international treaty law concluded by the United States, is a part of United States law. Under the federal constitution, treaties are the supreme law of the land and no less binding on the courts than federal statutes. Apart from treaty law, the United States has also voted in support of many U.N. resolutions pertaining to outer space and other relevant statements or

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12. Convention on the Prohibition of Military or any other Hostile Use of Environmental Modification Techniques, *done* May 18, 1977; T.I.A.S. No. 9614, 1108 U.N.T.S. 151 *(entered into force for the United States* Jan. 17, 1980) [herein "ENMOD Convention"].

13. International Telecommunications Convention (Malaga-Torremolinos), *done* Oct. 25, 1973, 28 U.S.T. 2495, T.I.A.S. No. 8572 *(entered into force for the United States* Apr. 7, 1976); International Telecommunications Convention (Nairobi), *done* Nov. 6, 1982 *(entered into force for the United States* Jan. 10, 1986) [herein "I.T.U. Conventions"].

14. International Telecommunications Satellite Organization (INTELSAT) Agreement, with Annexes, *done* Aug. 20, 1971, 23 U.S.T. 3813, T.I.A.S. No. 7532 *(entered into force for the United States* Feb. 12, 1973); Operating Agreement relating to the International Telecommunications Satellite Organization (INTELSAT) Aug. 20, 1971, 23 U.S.T. 4091, T.I.A.S. No. 7532 *(entered into force for the United States* Feb. 12, 1973) [hereinafter "INTELSAT Agreements"].

15. Convention on the International Maritime Satellite Organization (INMARSAT), Sept. 3, 1976, 51 U.S.T. 135, T.I.A.S. No. 9605 (*entered into force for the United States* July 16, 1979); Operating Agreement on the International Maritime Satellite Organization (INMARSAT), Sept. 3, 1976, 31 U.S.T. 135, T.I.A.S. No. 9605 (*entered into force for the United States* July 16, 1979) [hereinafter "INMARSAT Conventions"].

16. Convention Relating to the Distribution of Programme-Carrying Signals Transmitted by Satellite, *done* May 21, 1974, 1144 U.N.T.S. 3 *(entered into force for the United States* Mar. 7, 1985) [no T.I.A.S. number is available at this time].

17. Agreement Among the Government of the United States of America, Governments of Member States of the European Space Agency, the Government of Japan, and the Government of Canada on Cooperation in the Detailed Design, Development, Operation, and Utilization of the Permanently Manned Civil Space Station, *signed* Sept. 29, 1988 *(not in force* as of May 1, 1990).

declarations not having international treaty force such as, for instance, the U.N. Principles on Remote Sensing.[18]

(b) Some Definitions

In 1958 the Space Age was only a year old and the time was hardly ripe for laying down definitions or detailed sets of rules pertaining to the novel activities. However, the NASAct described, for instance, "aeronautical and space vehicles" to mean "aircraft, missiles, satellites, and other space vehicles, manned and unmanned, together with related equipment, devices, components, and parts."[19] The NASAct also addressed issues of property rights in inventions and over the years several additions and amendments were made to the original law. For example, in subsequent legislation "aeronautical and space activities" were defined to mean:

> (A) research into, and the solution of, problems of flight within and outside the earth's atmosphere, (B) the development, construction, testing, and operation for research purposes of aeronautical and space vehicles, (C) the operation of a space transportation system, including the Space Shuttle, upper stages, space platforms, and related equipment, and (D) such other activities as may be required for the exploration of space.[21]

The NASAct, in its amended form, also stipulates that the aeronautical and space activities of the United States are to be conducted so as to contribute materially to one or more of the following objectives:

> (1) The expansion of human knowledge of the Earth and of phenomena in the atmosphere and space;
> (2) The improvement of the usefulness, performance, speed, safety, and efficiency of aeronautical and space vehicles;
> (3) The development and operation of vehicles capable of carrying instruments, equipment, supplies, and living organisms through space;
> (4) The establishment of long-range studies of the potential benefits to be gained from, the opportunities for, and the problems involved in the utilization of aeronautical and space activities for peaceful and scientific purposes;
> (5) The preservation of the role of the United States as a leader in aeronautical and space science and technology and

18. U.N. Doc. A/AC.105/370, at 12-15 (1986).
19. NASAct, *supra* note 1, sec. 103(2), 42 U.S.C. sec. 2452 (1982).
20. *Id.* sec. 305, 42 U.S.C. sec. 2457 (1982).
21. *Id.* sec. 103(1), 42 U.S.C. sec. 2452 (1982).

> in the application thereof to the conduct of peaceful activities within and outside the atmosphere;
> (6) The making available to agencies directly concerned with national defense of discoveries that have military value or significance, and the furnishing by such agencies, to the civilian agency established to direct and control nonmilitary aeronautical and space activities, of information as to discoveries which have value or significance to that agency;
> (7) Cooperation by the United States with other nations and groups of nations in work done pursuant to this Act and in the peaceful application of the results thereof.
> (8) The most effective utilization of the scientific and engineering resources of the United States, with close cooperation among all interested agencies of the United States in order to avoid unnecessary duplication of effort, facilities, and equipment; and;
> (9) The preservation of the United States pre-eminent position in aeronautics and space through research and technology development related to associated manufacturing processes.[22]

Additional legislative enactments dealt with liability insurance and indemnification,[23] administrative claims and litigation,[24] NASA's relationship with other federal agencies[25] and many other issues. Limitations of space do not permit even a perfunctory overview of the many important provisions but by way of an example the term "space vehicle" may be singled out which was defined to mean "an object intended for launch, launched or assembled in outer space, including the Space Shuttle and other components of a space transportation system, together with related equipment, devices, components and parts."[26]

Amendments to Older Laws

Some of the already existing laws such as, for instance, the Communications Act of 1934, and its provisions relating to radio, were

22. *Id.* sec. 102 (d), 42 U.S.C. Sec. 2451 (1982). The clause, "of the Earth" was added by the "National Aeronautics and Space Administration Authorization Act, 1985." Pub. L. No. 98-361, sec. 110 (b), 98 Stat. 426, 42 U.S.C. 2451 (1990).
23. *Id.* sec. 308, 42 U.S.C. sec. 2458(b) (1982).
24. 28 U.S.C. sec. 1346 (1982).
25. *See e.g.*, 22 U.S.C. secs. 2575, 2585(c) (1988); 42 U.S.C. sec. 1505,;49 U.S.C. sec. 1349 (1982).
26. NASAct, *supra* note 1, sec. 308(f)(1), 42 U.S.C. sec. 2458(b) (1982).

amended and applied to space telecommunications,[27] much as the Crimes and Criminal Procedure Act of 1948 in an amended form was made applicable, by extension of the special maritime and territorial jurisdiction of the United States,

> to any vehicle used or designed for flight or navigation in space and registered by the United States while that vehicle is in flight, which is from the moment when all external doors are closed on Earth following embarkation until the moment when one such door is opened on Earth for disembarkation or in the case of a forced landing, until the competent authorities take over the responsibility for the vehicle and for persons and property aboard.[28]

In addition, a number of other terrestrially applied laws, such as, for instance, the Uniform Code of Military Justice,[29] are also applicable without specific amendments to outer space since the law in its original form is to apply "in all places."[30]

The Communications Satellite Act of 1962

Because of the recognition of the increasing importance and vital role of space telecommunications, the U.S. Congress took an important step by passing the Communications Satellite Act of 1962.[31] The law defined telecommunications to mean "any transmission, emission or reception of signs, signals, writings, images, and sound or intelligence of any nature by wire, radio, optical, or other electromagnetic systems."[32] The purpose of the law was to establish, as expeditiously as practicable, a commercial communications satellite system as part of an improved global communications network. Such a system was to be responsive to public needs and national objectives, was to serve the communication needs of the United States and other countries and contribute to world peace and understanding. The United States participation in the global system was to be in the form of a private corporation, subject to appropriate governmental regulation. This entity, known as the Communications Satellite Corporation, was deemed to be a common carrier within the meaning of the

27. Communications Act of 1934, as amended, 47 U.S.C. secs. 151, 214 (1982).
28. 18 U.S.C. sec. 7(6) (1988).
29. 10 U.S.C. sec. 802 *et seq.* (1988).
30. *Id.* sec. 805.
31. Pub. L. No. 87-624, 76 Stat. 419, 47 U.S.C. sec. 701 (1982).
32. *Id.* sec. 103(6). This definition is identical with that in Annex II of the International Telecommunication Convention (Malaga-Torremolinos), *supra* note 13.

Communications Act of 1934, as amended.[33] Through the Communications Satellite Corporation, as its sole operating entity, the United States participates in both the INTELSAT[34] and INMARSAT[35] systems.

In recognition of the profound impact of science and technology on society, and the interrelations of scientific, technological, economic, social, political, and institutional factors, Congress enacted the National Science and Technology Policy Organization and Priorities Act of 1976.[36]

Patent and Trademark Laws

Several years later, because of the importance of inventions made in outer space and the issues arising from federally supported research for development and for the purpose of insuring both that the government obtains sufficient rights in federally supported inventions to meet the needs of the government and protect the public against nonuse or unreasonable use of inventions, early in the 1980's, Congress took action by amending extant patent and trademark laws.[37] Most recently, an "inventions in outer space" legislation was passed by Congress dealing with issues associated with the U.S./International Space Station project.[38]

The Land Remote Sensing Commercialization Act of 1984 and the Commercial Space Launch Act of 1984 and its 1988 Amendments

Congress also passed legislation to encourage proper involvement of the private sector by creating a framework for phased commercialization of land remote sensing and assuring continuous data availability to the federal government. To provide for such a transition, from government operation to private, commercial operation, the Land Remote-Sensing Commercialization Act of 1984 was enacted.[39] In so doing Congress acknowledged that land remote-sensing, by the government or private parties of the United States, affects both international commitments and policies as well as national security concerns of the United States.[40]

In recognition of the fact that private applications of space technology have achieved a significant level of commercial and economic

33. Communications Act of 1934, *supra* note 26.
34. INTELSAT Agreements, *supra* note 14.
35. INMARSAT Conventions, *supra* note 15.
36. Pub. L. No. 94-282, 90 Stat. 459, 42 U.S.C. 6601 *et seq.* (1982).
38. H.R. 2946 (S.459) passed the House of Representatives. 136 Cong. Rec. D1427-01 (Oct. 26, 1990). When it becomes law, the "Inventions in Outer Space" legislation will be placed in the U.S. Code at 35 U.S.C. sec. 105.
39. Pub. L. No. 98-365, 98 Stat. 451, 15 U.S.C. sec. 4201; *amended in 1988 by* Pub. L. No. 100-147, 101 Stat. 876, 15 U.S.C. sec. 4201 (1988).
40. 15 U.S.C. sec. 101(4) (1988).

activity and that the private sector in the United States has achieved the capability of developing and providing private satellite launching and associated services, Congress also enacted the Commercial Space Launch Act of 1984,[41] and the Secretary of Transportation was given the responsibility to carry out its provisions.[42] As a follow-up, in order to facilitate the private acquisition of government property and services, further legislation was passed under the title of the Commercial Space Launch Act Amendments of 1988.[43]

Federal Regulations

In pursuance of the foregoing enactments, the respectively authorized departments and agencies of the federal government, including the Department of Transportation, NASA, Department of State, the Federal Communications Commission and others, issue regulations. There are more than 18 federal agencies involved in space-related activities. The rules governing such activities are published in the Code of Federal Regulations and revised from time to time. Among the most notables are NASA's regulations[44] and the Licensing Regulations on Commercial Space Transportation[45] issued by the Department of Transportation.

Also, there are many presidential executive orders, pronouncements, policy statements, directives, and determinations by the President. They include, for instance, the Launch Assurance Policy announced by the President on October 9, 1972, which declared that the United States will provide launch assistance to other countries and international organizations, on a nondiscriminatory, reimbursable basis, for satellite projects which are for peaceful purposes and are consistent with obligations under relevant international arrangements.[46] The Presidential Directive on National Space Policy, dated on June 20, 1978, provided for the establishment of a National Security Council Policy Review Committee to review existing space policy and formulate overall principles to guide space activities.[47] On January 5, 1988, the President approved a revised national space policy[48] and, on February 11, 1988, the President

41. Pub. L. No. 98-575, 98 Stat. 3055, 49 U.S.C. app. sec. 2601 (1982).
42. Sec. 5(a).
43. Pub. L. No. 100-657, 102 Stat. 3900, 49 U.S.C. app. sec. 2601 (1982).
44. 14 C.F.R. ch. V, pts. 1200 to End (1989).
45. *Id.* ch. III.
46. For a text of the President's announcement, see I UNITED STATES SPACE LAW - NATIONAL AND INTERNATIONAL REGULATION, *Supra* note 6, sec. I.A.4., at 5.
47. *Id.* at 5-6.
48. *Id.* at 26.

also announced a comprehensive "Space Policy and Commercial Space Initiative to Begin the Next Century."[49] As recently as September 5, 1990, the President - supplementing the National Space Policy that he approved on November 2, 1989 - also issued a New Space Policy Directive which is to further encourage the growth of U.S. private sector activities.[50]

Cases

Apart from Congressional legislation, including an occasional joint resolution,[51] the executive domain, and the international legal field, there is a growing area involving domestic cases which has increasing importance for the development of space law. A large number of these cases cover proceedings before administrative bodies, such as the Federal Communications Commission, where they most frequently result in memoranda of opinion, reports, orders and authorizations by the Commission with respect to regulatory policies, the establishment of technical standards, as well as licensing and procedural requirements.[52] Occasionally, the Commission may also issue notices of proposed rule making, a procedure which is also followed by other agencies of the federal government. Actual court cases may be brought to the federal judiciary by an appeal from FCC rulings. Also, there have been a handful of cases which touch upon various other issues of space law.

While most of the laws, regulations and cases discussed thus far fall within the federal domain, the possibility of state laws and state court cases having relevance to space activities should not be overlooked. For instance, an early Mississsippi case dealt with issues of liability arising out of damage to nearby land-owners caused by rocket explosion at a Mississippi test facility.[53] In a more recent California case the insurers of the owner of a communications satellite who was the buyer of an upperstage rocket used to boost satellites into orbit sued the seller of the rocket and certain of seller's subcontractors.[54] The insurers sought recovery of payments made to the buyer when the rocket malfunctioned and the satellite did not go into proper orbit. The court barred their recovery from subcontractors of seller of the upperstage rocket for payments made with respect to the lost satellite. The seller and the buyer had executed mutual waivers of liability under which the buyer had waived its rights to

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49. *Id.* at 39.
50. *See* White House, Office of the Press Secretary, Press Release, September 5, 1990. Reproduced in CURRENT DOCUMENTS in this issue of the Journal.
51. *See e.g.*, Joint Resolution of July 17, 1979, Pub. L. No. 96-34, 93 Stat. 38.
52. For a selective compilation of these cases, see 1 UNITED STATES SPACE LAW, *supra* note 6, sec. I.A.5.
53. Pigott v. Boeing Co., 240 So. 2d 63 (Miss. 1970).
54. Appalachian Insurance Co. v. McDonnell Douglas Corp., 214 Cal. App. 3d 1, 2, 262 Cal. Rep. 716, 718 (Cal. App. 4 Dist., Aug. 29, 1989).

proceed against the subcontractors and the insurers were bound by the buyer's waiver. In the legislative field, mention may be made of the recent creation of a spaceport authority in the State of Florida.[55]

This brief overview of United States space laws with an emphasis on domestic regulations would not be complete without at least a brief reference to a series of joint endeavor agreements and agreements for launch and associated services and spacecraft retrieval between the United States and other parties, including private companies.

Department of the Air Force Model Agreement

In looking over the more recent highlights of domestic regulations, mention may be made of a Model Agreement prepared by the Department of the Air Force with respect to the commercial utilization of expendable launch vehicles and entered into between the Department and NASA on February 1, 1983.[56] A revision of the Model Agreement was made on February 12, 1988[57] and - because of the close interrelationship between the domestic and international body of space law and the potential impact of one upon the other - certain definitions in the Agreement may be singled out for a brief comparison.

(a) Meaning of "Launch"

One of the definitions in the Model Agreement relates to the word "launch." The major international space treaties do not define the meaning of "launch." The Liability Convention only states that the term "launching" includes "attempted launching."[58] Under the Model Agreement, the verb "launch" means "to place or attempt to place a launch vehicle and payload, if any, in any sub-orbital trajectory, in Earth orbit in outer space, or otherwise in outer space."[59] At the same time, a "launch vehicle" is defined as "any vehicle constructed for the purpose of operating in, or placing a payload in outer space, and any sub-orbital rocket."[60] These definitions, if taken in the strict sense of the word, would appear to apply

55. Spaceport Florida Authority Act, Fla. Stat 331.301 (1989). For a discussion of the law, see 17 J. SPACE L. 167 (1989).
56. *See* Sen. Comm. Commerce, Science and Transportation, Space Law and Related Documents, 101st Cong., 2d Sess. 547 (Comm. Print, 1990).
57. For a text of the Department of the Air Force, Expendable Launch Vehicle Commercialization, Model Agreement (hereinafter "Model Agreement"), see *id.* at 547-63.
58. Liability Convention, *supra* note 10, art. 1 (b).
59. Model Agreement, *supra* note 57, art. III.
60. A "payload" is described as "an object which a person undertakes to launch into space or place in Earth orbit by means of a launch vehicle, including sub-components of the launch vehicle specifically designed or adapted for that object." *Id.*

not just to rocket launches but also to the ascent of any vehicle which is constructed for the purpose of either operating in or placing a payload in outer space. A vehicle, even if placed in a sub-orbital trajectory, would appear to be covered. The future prototype of the aerospace plane is expected to be constructed to operate at least during part of its flight in a sub-orbital trajectory. However, the aerospace plane may not be launched as a rocket but may take off as a conventional airplane and would return to Earth in the same manner.

In connection with airplanes, we do not speak of a launch but of a take-off and the question arises whether it would be sound policy to make the space laws applicable to space objects also applicable to the aerospace plane.[61] If so, the issues which arise in connection with the aerospace plane regarding the launching State's obligations and liabilities could by definition of the "launch" extend to the aerospace plane, unless some exceptions were made. Acceptance of the definition of "launch" and "launch vehicle" in the above indicated sense would serve the purpose inasmuch as the aerospace plane would be a vehicle constructed for the purpose of operating, at least in part, in outer space.

(b) Meaning of "Damage"

Another noteworthy definition in the Model Agreement relates to the concept of "damage." Under the Model Agreement "damage" includes "bodily injury or death of any person, damage to or loss of any property, real or personal, and loss of revenue or profits or other direct, indirect, or consequential damages therefrom."[62] Such "damage" includes that caused by a release of or exposure to a hazardous substance.[63] Even a perfunctory glance at this definition appears to indicate that it is much broader than that in the Liability Convention of 1972[64] which does not cover indirect or consequential damage or loss of revenue or profits. While international law and domestic law may legitimately differ with respect to the type of damage for which recovery may be had, there would appear to be good reason to recognize international responsibility for damage which is caused by the release of a hazardous substance emanating from a space object. Insofar as responsibility for damage caused by harmful radiation from a nuclear power source in space is concerned, this appears to have been acknowledged in the Cosmos 954 incident.[65]

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61. For a discussion of the alternatives that policy makers will face with the advent of the aerospace plane, see S. Gorove, *Legal and Policy Issues of the Aerospace Plane*, 16 J. SPACE L. 147 (1988).
62. Model Agreement, art. IV. B.1.
63. *Id.*
64. Liability Convention, *supra* note 10, art. 1(a).
65. For a discussion of the COSMOS 954 incident, see 6 J. SPACE L. 107-15 (1978).

NASA Regulations and the Meaning of "Personnel on Board"

Another example of a definitional issue of some significance having relevance to both domestic and international space law may be found in the definition of "personnel on board" in NASA regulations. Such personnel is defined as "those astronauts or other persons (actually in the spacecraft) during any flight phase" of a Space Transportation System (STS) flight "(including any persons who may have transferred from another vehicle) and including any persons performing extravehicular activity associated with the mission."[66] The designation "space flight participants" applies to "all persons whose presence aboard an STS flight is authorized in accordance with the NASA regulations."[67]

From the definitions of "personnel on board" and "space flight participants", it appears that the term "personnel" includes not only career astronauts or members of the crew but also all persons, including space flight participants, if any, found in the spacecraft during any flight phase. Thus a passenger falls under the category of "personnel on board" as does any person, whether an astronaut or not, who transfers to the spacecraft from another vehicle and any person who performs extravehicular activity associated with a space flight mission.

The definition of "personnel on board" appears to lend support to the interpretation of Article VIII of the Outer Space Treaty[68] to the effect that the term "personnel," as used therein, should be understood to include "passengers" on board over whom the State of registry would have jurisdiction and control while in outer space or on a celestial body. If the term "personnel" were interpreted, not in the broad sense of covering "persons" in general, but in the strict sense as applying to persons performing some official function, the provisions on jurisdiction and control would not be applicable to them. There is no evidence that the drafters of the Outer Space Treaty have ever intended such a result. Of course, nothing would seem to prevent the international community from creating separate rules for passengers in the future when their space travel will become a routine occurrence.

Concluding Remarks

In the preceding presentation, an attempt has been made to identify briefly some of the highlights of U.S. legislative, regulatory and judicial developments pertaining to activities associated with the exploration and use of outer space. From among countless sources of domestic regulations, a recent court case, certain definitions encountered in the Department of the Air Force Model Agreement, and some NASA regulations have been

66. 14 C.F.R. ch. V, sec. 1214.701(f)) (1990).
67. *Id.* sec. 1214.1703(a).
68. Outer Space Treaty, *supra* note 8, art. VIII.

singled out to provide a few illustrations of the direction in which domestic law is moving.

The presentation, even in a nutshell form, necessitated by the limitations of time and space, substantiates the observation that the United States has played a unique role of leadership in building up a comprehensive body of national space laws which may well serve for other spacefaring nations as useful tools for study and analysis when they consider drafting their own national regulations.

The law is normally slow to react to societal changes. So far, this apparently has not been the case either in the domestic or the international field of space law. While the tempo is likely to diminish in the future and has already shown some signs of this, there is every expectation that the already voluminous domestic space laws, regulations and cases will continue to multiply in the future with the expected increase of human presence and activities in space.

In addition to entirely new laws and regulations called for by space developments, much of the traditional domestic law as applied in different fields will have to be reviewed and scrutinized to determine their possible applicability with or without modification in the spacial context. Finally, attention will have to be focused on the clarification of uncertainties which may give rise to divergent interpretations and thereby undermine legal stability.

While the limited nature of a bird's eye view of U.S. national space laws and regulations does not permit many specific conclusions, our analysis of a few illustrative definitions appears to re-emphasize that lawyers and policy makers must continually bear in mind the close interrelationship between national and international space laws so that the two areas of law will develop in harmony and will not become a source of potential conflict.

THE STATUS OF RADIO SPACECASTING UNDER SPACE LAW

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In 1990 a new space communications technology appeared before the world community. The technology was called Radio Spacecasting. It enabled, for the first time ever, portable and mobile radio receivers to receive digital audio programming directly from a satellite in high orbit. The key developers of this technology were a U.S. company called Satellite CD Radio ("CD Radio"), an international consortium called AFRISPACE, and a group of national broadcasters known as the European Broadcasting Union ("EBU").

Radio Spacecasting is similar to shortwave radio in that listeners in one country may tune in directly to programming from another country. Radio Spacecasting is similar to Direct Broadcast Satellite (DBS) television in that transmissions are picked up directly from satellites. But Radio Spacecasting is also different from any media yet developed. No specific legal framework currently exists for spacecasting. Hence, this article explores the current legal status of spacecasting, and recommends an appropriate regulatory structure.

Orbit/Spectrum Allocation Status

The upper portion of the 1429-1525 MHz frequency band was targeted for spacecasting by ITU Resolution No. 505, adopted in 1979. Both the CD Radio and AFRISPACE proposals express a strong preference for 1450-1525 MHz region, citing Resolution 505 as precedent. CD Radio is offering 100 channels of compact disc quality radio directly from satellites to car antennas. AFRISPACE is offering dozens of digital channels of satellite programming directly to portable radios in the Third World.

The U.S. Federal Communication Commission, in developing its own position on spacecasting, has recently adopted a finding in favor of the 1493-1525 MHz sub-band.[1] The European Broadcasting Union is also

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1. An Inquiry Relating to Preparation for the International Telecommunication Union World Administrative Radio Conference for Dealing With Frequency Allocation in Certain Parts of the Spectrum, 55 Fed. Reg. 40888, 40889 (1990) (to be codified at 17 C.F.R. pt. 2) (proposed Oct. 5, 1990).

focusing on this sub-band.[2] Although a final decision will be made at the 1992 World Administrative Radio Conference (WARC) in Geneva, it is useful to consider the background for this allocation decision.

The feasibility of broadcasting medium to high quality sound programs from a geostationary satellite directly to the general public using fixed, portable and vehicular receivers has been actively studied within the International Radio Consultative Committee (CCIR). Report 955-2[3] considers both analog and digital encoding and modulation formats with a range of system parameter requirements and preferred operating frequency bands in anticipation of an allocation for the service being made at a World Administrative Radio Conference (WARC).

The ITU Plenipotentiary Conference (Nice, 1989) scheduled this WARC, to be held in early 1992. The Administrative Council meeting of June 1990 established the agenda for this conference in which Agenda item 2.2.3(a) includes consideration of the allocation of a frequency band for spacecasting in the range 500-3000 MHz including accommodation of complementary terrestrial sound broadcasting applications within this allocation and the associated feeder links.

CCIR Report 955-2 contains examples of satellite sound broadcasting systems, employing conventional analog modulation (FM), simple digital and advanced digital coding and modulation concepts. The use of digital systems for sound broadcasting provides the opportunity to employ the various processing and coding techniques both for the source and the channel to obtain high quality and at the same time result in efficient spectrum usage and relatively low satellite power requirements. Diversity techniques can significantly improve the system performance particularly for the most severe case corresponding to vehicular reception in heavily urban areas.[4]

There are three diversity techniques which can be applied to digital systems for the purpose of reducing satellite power requirements, namely:

(a) Frequency Diversity where a number of carriers are spaced in frequency by an amount that equals or exceeds the correlation bandwidth of the channel;

(b) Time Diversity whereby the transmitted digital symbols are scrambled or interleaved in an orderly fashion so that error bursts due to keep channel fading will be decoded as random errors at the output of the descrambler; and

(c) Space Diversity where multiple antennas are used to surmount multi-path and other signal transmission problems.

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2. *Provisional Views of the CEPT, Communications Metereology, Operations Divisional Meeting*, I.C.A.O. Doc. COM/MET/OPS/90-IP/19 (1990).

3. *Satellite Sound Broadcasting with Portable Receivers and Receivers in Automobiles*, C.C.I.R. Rep. 955-2 (1990).

4. Reductions range from 36dB to 26dB, as compared to analog modulation.

Advanced digital sound broadcasting systems can employ one or more of the above diversity techniques to reduce link margins and hence satellite transmit power requirements and at the same time maintain or improve the service quality in the case of reception in automobiles.

The WARC-92 Agenda proposes a frequency range of 0.5-3.0 GHz for a frequency allocation to spacecasting, which is also formally known as Broadcasting Satellite Service (BSS)(Sound).[5] Based on CCIR studies, the most suitable frequency band for a BSS (Sound) system would be in the vicinity of 1 GHz with the lower and upper frequency limits dictated by the following considerations:

(1) Lower limit of approximately 500 MHz. This lower limit is based on man-made noise considerations which is inversely proportional to frequency and the limitation on the practical size for satellite antenna diameters which is also inversely proportional to the frequency.[6]

(2) Upper limit of around 3 GHz. The effective area of the receive antenna which is necessary for such a system diminishes with increasing frequency, this entails an increase in transmit power in proportion to the square of the frequency.[7]

The total spectrum requirements for a BSS (Sound) service and a complementary terrestrial service as addressed in the WARC-92 Agenda is dependent on many factors, many of which are still to be determined. The key factors that will determine spectrum requirements are:

(a) Target service to be provided (*i.e.*, for reception by receivers in automobiles and portable receivers plus fixed receivers), quality of service, monophonic or stereophonic programming, *etc.*[8]

(b) The spectrum re-use factor achievable within a given geographical area.[9]

Very preliminary studies were made to estimate the amount of spectrum required. It has been estimated that between 50 and 100 MHz would be needed, based on the following considerations: use of the Advanced Digital System as specified in Report 955-2 and complementary

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5. *See* Doc. 7042 (CA45-136), Administrative Council Meeting, Geneva, 20 June 1990.
6. For general discussions, see *supra* note 3.
7. *Id.*
8. *See, generally,* The Application of Satellite CD Radio Inc. before the Federal Communications Commission, File Nos. 49/50-DSS-P/LA-90; 58/59-DSS-Amend-90.
9. *Id.*

terrestrial/BSS service with the goal of eventual replacement of existing shortwave broadcasting services plus allowance for future growth.[10]

Further studies are being conducted to narrow down the option being considered as time approaches towards WARC-92.

Nexus With Free and Balanced Flow of Information

The BSS (Sound) technology has a great role to play in furthering the development of a free and balanced flow of information. The technology can be used to disseminate information directly to users, without censorship, on a worldwide basis and with reciprocity. For example, CD Radio channels may be purchased by Middle Eastern interests to deliver their views directly to the U.S. market. Alternatively, Nigerian interests could purchase AFRISPACE channels and spacecast directly to the masses in South Africa.

The oldest guarantee of freedom of international messaging is contained in the Universal Declaration of Human Rights, where it is stated in Article 19:

> Everyone has the right to freedom of opinion and expression; the right includes freedom to hold opinions without interference and to seek, receive and impart information and ideas through any media and regardless of frontiers.[11]

It has also been unanimously declared by the member States of UNESCO that the "free flow of information" must be "wider and better balanced."[12] The "right to seek, receive and impart information of all kinds regardless of frontiers" clearly supports an international regime of free and open dissemination of information.[13]

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10. *Id.*
11. Universal Declaration of Human Rights, art. 19, G.A. Res. 217/3 U.N. GAOR Supp. (No. 1) at 71, U.N. Doc. A/777 (1948).
12. Declaration on Fundamental Principles Governing the Contribution of the Mass Media to the Strengthening of Peace and International Understanding, to the Promotion of Human Rights and to Countering Racialism, Apartheid and Incitement to War, Nov. 22, 1978, art. 1, 19 I.L.M. 263 (1979). The Declaration was adopted at the 20th session of the General Conference of the United Nations Educational, Scientific and Cultural Organization, Paris, France, October 24-November 28, 1978.
13. International Covenant on Civil and Political Rights, *opened for signature* Dec. 19, 1966, 999 U.N.T.S. 171; European Convention for the Protection of Human Rights and Fundamental Freedoms, *signed* Nov. 4, 1950, 213 U.N.T.S. 221; American Convention on Human Rights, O.A.S. Off. Rec. OEA/Ser.K/XVI/1.1, Doc. 65, Rev. 1, Corr. 1 (1969).

Consistency with INTELSAT and INMARSAT

Because systems such as AFRISPACE are a "specialized satellite service" under the INTELSAT Agreement,[14] it raises none of the difficult legal issues that needed to be solved prior to the authorization of separate systems such as PanAmSat and Orion. The INTELSAT Agreement only places technical coordination requirements on international specialized satellite systems.[15] Since the frequency bands for BSS (Sound) are completely different from those of INTELSAT, there is no possibility of unsuccessful technical coordination.

Article 14 (e) of the INTELSAT Agreement provides:

> To the extent that any Party or Signatory or person within the jurisdiction of a party intends to establish, acquire or utilize space segment facilities separate from the INTELSAT space segment facilities to meet its specialized telecommunications services requirements, domestic or international, such Party or Signatory, prior to the establishment, acquisition or utilization to the Assembly of Parties, through the Board of Governors. The Assembly of Parties, taking into account the advice of the Board of Governors, shall express, in the form of recommendations, its findings regarding the technical compatibility of such facilities and their operation with the use of the frequency spectrum and orbital space by the existing or planned INTELSAT space segment. (Emphasis supplied).

Under Article 1(1) of the INTELSAT Agreement:

> "Specialized telecommunications services" means telecommunications services which can be provided by satellite, other than those defined in paragraph (k) [public telecommunications services] of this Article, including, but not limited to, radio navigation services, broadcasting satellite services for reception by the general public, space research services, meteorological services, and earth resources services. (Emphasis supplied).

Since the spacecasting is designed only to provide broadcasting satellite (sound) services direct reception by the general public, it is clear that it is a specialized telecommunications service under the INTELSAT Agreement. As such, there is no policy basis under the INTELSAT Agreement to in any way slow down prompt approval of spacecasting.

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14. International Telecommunications Satellite Organization (INTELSAT) Agreement, With Annexes, art. I, para. 1, *done* Aug. 20, 1971, 23 U.S.T. 3813, T.I.A.S. No. 7532.

15. *Id.* art. III, para. f.

By the same reasoning, as applied to INTELSAT, there is no legal prohibition or policy issue inhibiting the authorization of spacecasting due to the INMARSAT Agreement.[16]

Article 8 of the INMARSAT Agreement provides that its members that intend to launch a satellite system addressing one of the "purposes" of INMARSAT will coordinate with INMARSAT's secretariat with a view to avoiding economic harm to the global maritime system.[17] The purpose of INMARSAT is defined as making provision for the space segment necessary for improving maritime satellite communication, including radio-determination.[18] Clearly, spacecasting does not impinge on the purpose of INMARSAT, and hence, no economic coordination is necessary.

Recently, aeronautical and land mobile satellite services have been added to the agenda of satellite services which INMARSAT is empowered to provide.[19] However, these supplementary types of satellite services do not enjoy the same protection from economic harm as applies to maritime satellite communications services. In any event, spacecasting is neither an aeronautical nor a land mobile satellite service.

Consistency With the ITU Rules and Regulations

The ITU Rules and Regulations[20] contain no frequency allocation rules governing Radio Spacecasting. However, this is not an impediment to approval, for a longstanding principle of international legal practice is that whatever is not prohibited is therefore permissible. The ITU Rules and Regulations contain no prohibition of satellite sound broadcasting service. Therefore, such service is permitted.

ITU Radio Regulation 342 states as follows:

> Administrations of the Members shall not assign to a station any frequency in derogation of either the Table of Frequency Allocations given in this Chapter or the other provisions of these Regulations, except on the express condition that harmful interference shall not be caused to services carried on by stations operating in accordance with the provisions of the Convention and of these Regulations.

16. Convention on the International Maritime Satellite Organization (INMARSAT), With Annex, *done* Sept. 3, 1976, 31 U.S.T. 1, T.I.A.S. No. 9605.
17. *Id.* art. 8.
18. *Id.* art. 3, para. 1.
19. Amendments to the Convention on the International Maritime Satellite Organization (INMARSAT), art. 3. para. 1, INMARSAT Doc. Assembly 6/16, 4, 2, 7 & Annexes IV to XI (1989).
20. International Telecommunication Union Radio Regulations, With Appendices and Final Protocol, *done* Dec. 6, 1979 (T.I.A.S. No. unavailable as of Jan. 1, 1990).

Spacecasting satellites as to which authorization is sought are considered "stations" under the definitions of the ITU. Accordingly, they cannot be "in derogation" of the Table of Frequency Allocations except on the express condition of not causing harmful interference to services operating in accordance with the Table of Frequency Allocations. In any event, as discussed above, an appropriate allocation is expected at the WARC-92 Conference.

While it is true that ITU Regulation 728 does forbid satellite television broadcasting over other countries unnecessarily, this provision was adopted to ensure maximum orbit/spectrum efficiency. It was not intended to apply to audio direct spacecasting. Nor could it so apply, without flagrant violation of freedom of information and international sound broadcasting practice for over 50 years. Spacecasting is the shortwave radio service of the satellite age.

Analysis of Space Law Treaties

International spacecasting must also be considered under the relevant provisions of specific space law treaties: the Outer Space Treaty of 1967,[21] the Liability Convention of 1972,[22] the Registration Convention,[23] the Rescue and Return Agreement[24] and the Moon Treaty.[25] Of these expressions of global consensus on the use of outer space, including satellites in earth orbit, only the Outer Space, Liability and Registration Treaties have relevance to spacecasting.

The Registration Convention requires registration with the United Nations of a spacecasting satellite to a specific country.[26] Ordinarily, this country would exercise jurisdiction and control over the use of the direct audio broadcasting spacecraft. To determine which country should register a satellite, the Registration Convention asks which country launched or procured the launch of it. AFRISPACE, for example, is under the jurisdiction and control of the U.S. (Federal Communications

21. Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, *done* Jan. 27, 1967, 18 U.S.T. 2410, T.I.A.S. No. 6347, 610 U.N.T.S. 205 [hereinafter "Outer Space Treaty"].
22. Convention on International Liability for Damage Caused by Space Objects, *done* Mar. 29, 1972, 24 U.S.T. 2389, T.I.A.S. No. 7762, 961 U.N.T.S. 187 [hereinafter "Liability Convention"].
23. Convention on the Registration of Objects Launched into Outer Space, *opened for signature* Jan. 14, 1975, 28 U.S.T. 695, T.I.A.S. No. 8480, 1023 U.N.T.S. 15 [hereinafter "Registration Convention"].
24. Agreement on the Rescue of Astronauts, the Return of Astronauts, and the Return of Objects Launched Into Outer Space, *done* Apr. 22, 1968, 19 U.S.T. 7570, T.I.A.S. No. 6599, 672 U.N.T.S. 119.
25. Agreement Governing the Activities of States on the Moon and other Celestial Bodies, G.A. Res. 34/68, 34 U.N. GAOR Supp. (No. 46) at 77, U.N. Doc. A/34/46 (1979).
26. Registration Convention, *supra* note 23, at art. IV.

Commission) because a United States company procured the launch of the AFRISPACE satellite. It is not relevant under international law that the primary beneficiaries of AFRISPACE services are some 70 different African and Middle Eastern countries. In any event, it would not be practical to have so many countries exercising "jurisdiction and control."

The Liability Convention provides that the countries that launched, procured the launch, or from whose territory was launched, the spacecasting satellite would bear international absolute liability for any harm caused on earth by the launch.[27] It is conceivable that a country could file a legal claim for damage if it felt it was "harmed" in a measurable way by the spacecasts. In the United States, for example, it is possible to win large monetary awards for certain types of harm caused by broadcast. Far from such damages being issued under a theory of absolute liability, it may be necessary to prove both falsity, negligence and a reckless disregard for the truth. Since the Liability Convention only provides for damages under an absolute theory of liability for harm caused on the earth, it is unlikely that such liability can be extended to slander, where truth is always a defense and reckless negligence is usually a concomitant of guilt. Furthermore, the legislative history of the Liability Convention makes it clear that it was intended to provide a basis for compensation to innocent persons suffering unintended consequences from the unusually hazardous activity of rocket launches.[28] Spacecasting is not the type of dangerous activity intended to be covered by the Liability Convention.

The Outer Space Treaty of 1967 specifically approves of activities such as spacecasting. Article I of the Outer Space Treaty says that space is to be used for the benefit for all mankind. Consider the various means by which spacecasting systems such as AFRISPACE, described above, benefit humanity:

- They enhance regional socio-economic integration by fostering a common market for news, information and entertainment programming.

- They expand the dissemination of vital public health information to rural developing areas, with great cost effectiveness, on a continent-wide basis.

- They improve the quality of people's lives by providing all persons - even those out-of-reach from urban radio stations - with equitable level of access to radio program diversity.

Information disseminated by an AFRISPACE-type spacecasting system can help save millions of lives, and improve economic growth by

27. Liability Convention, *supra* note 22, at art. I, para. c & art. II.

28. *See generally Report of the Committee on the Peaceful Uses of Outer Space*, 34 U.N. GAOR Supp. (No. 20) at 1, U.N. Doc. A/8420 (1979).

billions of dollars. As such, it is obvious that spacecasting falls squarely within the Outer Space Treaty mandate to use space for the benefit for all mankind.

Free and Balanced Flow of Space-Based Information

In recent years, proponents of a New World Information Order (NWIO) have propounded the view that global communication, especially via satellite must be "balanced" to be truly "free." For example, if only large countries can afford the cost of launch satellites for broadcasting to smaller countries, then the small countries view may not get heard. This situation is contrary to the goals of freedom of communication, which favor "robust debate".

Spacecasting systems such as AFRISPACE are supportive of the New World Information Order because they reduce the cost of accessing a satellite broadcasting capability from around $100 million -- the almost unaffordable cost of a satellite -- to as little as $1 million per year, the price of a direct-to-portable radio audio spacecast channel.

Hence, with systems such as AFRISPACE, even small countries can spacecast directly to other countries, thereby enabling free and balanced global flow of information that is the hallmark of a global democratic society.[29]

Conclusion

Spacecasting is a new 1990's technology enabling direct digital audio transmissions from satellites to portable radios.[30] Companies have formed to implement this technology, including a consortium called AFRISPACE which intends to offer spacecasting on an intercontinental basis.

Spacecasting raises several issues under international space law. These issues encompass orbit-frequency allocations, DBS prior consent, liability for satellite slander, and freedom of space information. An analysis of these space law aspects of international spacecasting indicates

29. The AFRISPACE Consortium intends to launch a satellite with three footprint beams covering Arabia, North-West Africa, and South-East Africa. AFRISPACE radios will be lightweight, solar powered, and capable of receiving up to 100 channels. The channels will be filled with radio programming delivered to the AFRISPACE satellite uplink center from international broadcasters (*e.g.*, Radio Accra, Radio Nairobi) and specialized programmers (*e.g.*, CNN Radio News, American Music). Programming will be delivered to the AFRISPACE uplink center via INTELSAT or regional, *i.e.*, Rascom, satellite systems.

30. H. Donald Messer, *Studies for an Audio Direct Broadcast Satellite,* 40th Congress of the International Astronautical Federation, IAF-89-532, October 1989, Malaga, Spain.

clearly that there are no impediments to authorization of this revolutionary service. In fact, spacecasting is wholly consistent with space law.

INTERNATIONAL SPACE PLANS AND POLICIES: FUTURE ROLES OF INTERNATIONAL ORGANIZATIONS+

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Introduction

Mankind's progress in space, whether through national, regional or global space programs, depends in large degree on the quality and continuity of organizations involved. The financial resources, physical facilities, cadres of specially qualified experts, and the capacity to sustain work over years of endeavor, are essential elements of any space program. In the first 30 years of human spaceflight activity, a wide variety of institutional forms have appeared to undertake management of space programs. These institutions shape, and are centrally involved in, the execution of space programs, policies, and practices.

Institutions involved in various relevant roles today include national, regional and global organizations. Among the national institutions are: civil governmental regulatory and operational agencies; civil governmental research/developmental agencies; defense agencies of the government; privately and publicly owned corporations; and professional associations and societies.

The regional organizations include: governmental cooperative operating agencies; privately and publicly owned corporations; and research and development centers.

Finally, the global institutions encompass: UNO regulatory institutions (specialized agencies); the UN General Assembly and the UN Secretariat; scientific and technical organizations and associations of a governmental nature; and intergovernmental operating global systems.

The future conduct of space activities will involve all of these and other, yet to be created, entities in various roles. International cooperation and coordination are essential to successful and safe spaceflight operations. This paper explores the potential roles of extant and possible new international organizations. It addresses in detail the roles that are becoming clearly appropriate for coordination and

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+ This article is an elaboration of the author's presentation at a symposium on "International Space Plans and Policies of the International Academy of Astronautics" during the 39th Congress of the International Astronautical Federation, October 8-15, 1988, in Bangalore, India.

monitoring by a possible new agency within the structure of the United Nations.

Classification of Organizations Affecting Space Activities

Today, space activities are conducted by a varied complex of autonomous and interrelated national, regional, and global organizations.[1] Some organizations are governmental, some are quasigovernmental, others are nongovernmental business ventures. A general classification of organizations involved in space activities is surprisingly large when significant distinguishing characteristics are analyzed. One possible classification relates to the functional roles being performed which cover research and development; manufacture, test and logistic support; operational system management; lease and sublease of services; legislation and regulation; insurance of facilities and activities; information collection and dissemination; flight safety monitoring and control; and specialized finite studies and projects. Manufacturing, test and logistic support are performed today by national or regional cooperative entities only. There are no known global institutions (*i.e.*, with membership open to all nations) that engage in manufacturing, test and logistic support of space hardware.

National Organizations Affecting Space Activities

In the 1950s, and for much of the 1960s, national organizations dominated the conduct of space operational activities. Gradually, national and international organizations built up legislative and regulatory frameworks to constrain certain classes of activities, especially military activities, and to monitor, record, or authorize other spaceflight activities. Many of these organizations did not exist before October 1957,[2] but some of them are modified, prior-existing organizations, supplemented or restructured to deal with space activities.

One can identify the many entities by generic types such as "regulatory agencies," "advisory committees," or "corporations." There are many organizations in these categories today and a substantial commercial market exists for publications containing directories and descriptive information on aerospace agencies, aerospace companies, manufacturing and service suppliers for aerospace systems, consultants, technical

1. *See, e.g.*, organizational roles described in UNITED NATIONS, SPACE ACTIVITIES OF THE UNITED NATIONS AND INTERNATIONAL ORGANIZATIONS, U.N. Doc. No. A/AC.105/358 (1986) [hereinafter "SPACE ACTIVITIES"].
2. October 4, 1957 was the launch date of the first orbiting of a manmade satellite.

documentation sources, and other information services.[3] At the national level, in countries like Australia, Brazil, Canada, France, Germany, India, Japan, the United Kingdom, the USSR and the United States, there are extensive governmental structures, businesses, consultants, and service organizations, totally dedicated to the aerospace market sector. The examples of U.S. organizations affecting space activities could be substantially repeated for ten or more nations, developed and developing, around the globe. These national institutional infrastructures are multiplying as national and international space programs increase in number and complexity.

Regional Organizations Affecting Space Activities

National organizations like the U.S.'s NASA, France's CNES, Japan's NASDA, India's Department of Space and ISRO, the Soviet Union's Academy of Sciences, and many others, conduct some programs and participate in numerous international programs involved in, conducting, or promoting spaceflight activities. In addition, regional space organizations are formed on the basis of varied criteria. In some cases the dominant criterion may be geographical contiguity (European Space Agency - ESA); in another, the dominant criterion may be socio-political affiliation or commonality of language (ARABSAT); in still others there may be a mix of social, cultural and linguistic or economic interests that bring nations together in a regional collaborative effort in spaceflight activity (PEACESAT). Regional cooperative ventures may be created for economic reasons, political reasons, operational reasons, or any of a wide variety of other common interests among nations, or for a combination of several or many reasons.

One can also identify a variety of regional organizations which promote, facilitate, or engage in some form of regional exploitation or use of space. The total number of relevant regional entities is many tens, and may now exceed one hundred. In addition to "regional" entities, many national entities, also contribute to regional activities. A list of organizations active in Outer Space Affairs is included in the Annex at the conclusion of this article.

3. *See, e.g.*, AVIATION WEEK AND SPACE TECHNOLOGY 1988 BUYING GUIDE (1988); THE 1988 SATELLITE DIRECTORY (10TH ED. 1988); I & II WORLD AVIATION DIRECTORY (1986); DMS MARKET INTELLIGENCE REPORT (includes volumes devoted to Missiles, Strategic Defense Initiative, Space Systems, Aerospace Companies, and Aerospace Agencies); and AVIATION INFORMATION SERVICE, LTD., SPACE STATISTICS REVIEW (1988).

Global Organizations Affecting Space Activities

Global organizations affecting space activities existed prior to the first launch of a manmade satellite into orbit, but these prior-existing organizations, like the United Nations, the International Telecommunication Union (ITU) and UNESCO, as examples, had to adjust their structures, or modify their staff organizations and skill bases, in order to deal with spaceflight activities. In most cases, such adjustments were accomplished expeditiously and effectively.[4]

As the exploration and use of space expanded during the 1960s, new organizations emerged involving wholly new forms of cooperation and collaboration. One significant early institutional structure, created through multilateral action of nations, was the International Telecommunications Satellite Organization (INTELSAT), which was established under interim arrangements in 1964, and was brought under definitive arrangements in 1971.[5] In the 1970s, other global organizations for satellite communication services were formed, including INTERSPUTNIK and INMARSAT.[6]

The United Nations General Assembly took action in the late 1950s to establish an *ad hoc* Committee on the Peaceful Uses of Outer Space (COPUOS), which was soon converted to a permanent committee of the

4. SPACE ACTIVITIES, *supra*, note 1.

5. An excellent monograph on the negotiating history and issues involved in the creation of INTELSAT's definitive organization is contained in Colino, *The INTELSAT Definitive Arrangements: Ushering in a New Era in Satellite Telecommunications*, Mono. No. 9, EBU, Geneva, Switzerland (1973). *See also* Doyle, *Permanent Arrangements for the Global Commercial Communication Satellite System of INTELSAT*, 6 INT'L LAW. 248 (1972).

6. Analyses of the formative stages and characteristics of these organizations can be found in: Doyle, *Analysis of the Socialist States' Proposal for INTERSPUTNIK: An International Communication Satellite System*, 15 VILL. L. REV. 83 (1969); Doyle, *INMARSAT: The International Maritime Satellite Organization - Origins and Structure*, 5 J. SPACE L. 45 (1977).

General Assembly.[7] Major conferences and changes began to appear under auspices of the ITU, IMCO, and the WMO. Major new programs, activities and organizational structures were initiated to cope with and to use the resources provided by space activities. Few laymen, who are not students of the subject, appreciate how many global institutions exist today that are directly involved in or dependent upon space activities. The list in the Annex contains a representative sampling of global organizations which either monitor and regulate, own and operate, or depend in part or completely on spaceflight activities in the normal discharge of their functions and duties.

Commonly the International Council of Scientific Unions (ICSU) and its Committee on Space Research (COSPAR) are described as "nongovernmental" organizations.[8] However, when one examines the sources of operating revenue, and the identity and sponsorship of many participants involved in the work of the ICSU and COSPAR, it appears a more accurate classification to treat ICSU as a mixed governmental and nongovernmental organization. If all direct government sponsored financial support for these organs were to be removed precipitously, it is doubtful that they could survive. They may be considered nongovernmental in the nature and roles of the participants in the Union's work, but there is an undeniably large and steady infusion of governmental funding into the work of ICSU and COSPAR. Consequently, it appears more appropriate to treat these organizations as "mixed" in nature rather than "nongovernmental." Opinions in this regard may differ.

Perhaps the most striking aspect of the global organizations is the absence of entries for nongovernmental organizations conducting research

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7. See the excellent recapitulation of the formation and work of the *ad hoc* committee in Galloway, *The United Nations Ad Hoc Committee on the Peaceful Uses of Outer Space Accomplishments and Implications for Legal Problems*, 2 PROC. COLLOQ. L. OUTER SPACE 30 (1960); the article may also be found in LEGAL PROBLEMS OF SPACE EXPLORATION - A SYMPOSIUM (prepared for the Senate Committee on Aeronautical and Space Sciences), 87th Cong., 1st Sess., Doc. No. 26, at 613 (1961). The report of the *ad hoc* committee, U.N. Doc. A/4141 (1959), is included in the same Senate symposium at 1246. On the creation and initial work of the permanent committee, see Galloway, *The United Nations Ad Hoc Committee on the Peaceful Uses of Outer Space*, 5 COLLOQ. L OUTER SPACE un-paginated (1963). The activities and accomplishments of the U.N. COPUOS during its first decade are well documented in Reis, *United Nations Committee on the Peaceful Uses of Outer Space and Its Legal Subcommittee* in INTERNATIONAL COOPERATION IN OUTER SPACE - A SYMPOSIUM (prepared for the Senate Committee on Aeronautical and Space Sciences), 92d Cong., 1st Sess., Doc. No. 57 (1971) [hereinafter "INTERNATIONAL COOPERATION"], at 247; and Frutkin & Anderson, *The Scientific and Technical Subcommittee of the United Nations Committee on the Peaceful Uses of Outer Space* in INTERNATIONAL COOPERATION, *supra*, at 261.

8. *See, e.g.*, Porter, *International Scientific Community: International Council of Scientific Unions and COSPAR* in INTERNATIONAL COOPERATION, *supra* note 7, at 527.

and development, manufacturing and operating space systems on a global basis. Characteristics of space programs, such as cost, complexity, duration and control contribute to the absence of private global institutional structures conducting research and development, system operations and manufacturing. Private enterprises exist and conduct these functions on regional and national bases, but as yet, not on a global basis.

Identification of Future Needs

The existing complex of international and national organizations involved in spaceflight activity is extensive. Activities being conducted today are registered, regulated, reported and restrained in accordance with various treaties, conventions, agreements and national laws. The pace of expansion of spaceflight activity does not slacken. New entrants approach the threshold of launching nations soon to be capable of consistent, effective placement of manmade objects into space. As we move outward from the Earth, first to low Earth orbit, then to higher orbits, to the Moon, to the planets, their moons, and beyond, more and more functions will require globally centralized and standardized monitoring, coordination, reporting, regulation and control.

(1) Standardization of Astronautic Cartography. Today there are many standards applied to and central phenomena and events. There are standards for astronomical disseminating procedures for astronomical cartographs and charts. As humanity becomes more active and expands it scope of activity, the preparation of travel plans and operational locations for extraterrestrial activities will require a new standard form of cartography and cartographics for astronautical (as distinguished from astronomical) events. Technical language, symbols, multilingual equivalencies, and systems of units measure must be standardized and uniformly practiced to achieve effective communication and reliable charts and cartographs for use by spacefarers coming from different nations and different organizations.

(2) Standardization of Mission Safety Practices. The expanding spaceflight capability available to multinational, regional, and national entities already requires significant terracentric regulatory activity including:

- radio use coordination through the ITU,
- aeronautical coordination through ICAO, and
- maritime coordination through IMO,

in order to insure safe and compatible operations in all of the terrestrial spheres likely to be affected by spaceflight activities. When flight operations begin to originate on orbit, to originate from the Moon on more than an infrequent basis, or to involve missions with capability to tarry in one space location, move to another, tarry, then again move on, and thus create multiple "missions," some central traffic coordinating role will be

required by some institution. For example, how will we ensure that transiting vehicles do not jettison debris into the path of another vehicle transiting the same locale at a later time? Similarly, how are we to keep transiting vehicles from interfering with or occluding the operation of highly sensitive scientific systems like the Hubble Space Telescope? How can we ensure, for example, protection of the immediate environment of such systems from pollution by exhausts? If pre-mission notification, global coordination, cislunar space coordination, and eventually translunar mission clearances are to be obtained, there must be a competent, central authority in place to function.

That new authority will require specialized expertise, extensive and complex analytical techniques and devices, probably computer capabilities far beyond what is realizable today. Launch, recovery, and in-transit operational standards and procedures for flight activities away from the Earth are required. In addition, controls are required on the generation of space debris, abandonment of artifacts, salvage operations, space object recoveries, crew rescue operations, and methods of emergency marking, lighting and communications. Once universal standards and procedures are in place, training and certification of spaceflight personnel will be required. It is not too early to begin to define the appropriate entity to do these things, its scope, its nature, its locale, and many of its attributes, such as staffing, funding, facilities, and construction.

(3) Standardized Health and Contamination Controls. We have universally accepted, for a long time, the notion that aeronautical flight crews should have health validations of their capacity to function during flight, and the likelihood of their surviving flight operations. In most countries, licensed commercial flight crews are routinely required to undergo periodic health examinations. The demands of spaceflight on the human organism are substantially greater than those of aeronautical flight, and the deleterious effects of long duration space missions on humans is a matter of concern and continuing study. At some point, a general system of health monitoring and crew health standard definitions will be required.

Individual countries sponsoring and conducting manned missions in space today pay a great deal of attention to physical conditioning, pre-flight training, and in-flight health monitoring. An extraordinary degree of cooperation and collaboration in crew health and human biological effects analysis has characterized U.S./USSR relations in the space arena for many years. The first major joint scientific publication in their respective languages by the U.S. and the USSR was a compendium of information on the human biological aspects of crew flight in space.[9] But unilateral practices and bilateral collaboration in this area will not be sufficient in the twenty-first century.

The decontamination or sterilization of artifacts launched into space intended to land on or otherwise contact other celestial bodies has been a matter of unilateral administration for the last 30 years. As

9. Calvin, & Gazenko, I, II & III FOUNDATIONS OF SPACE BIOLOGY AND MEDICINE (1975).

interplanetary flight increases, concerns about contamination of the Earth's ecosystem, will increase. The establishment of recognized and enforceable standards in this arena will require more than voluntary national action.

In both crew qualification and contamination control areas, new centrally formulated and administered standards will be required. This is a complex area, like cartography and safety, requiring special expertise, analyses, substantial information base consolidation, and effective central world administration. Despite current attitudes and practices, no single nation is likely to know all that is needed in these areas.

(4) The Definition and Policing of Criminal Activity. Although the need may be substantially further in the future than some of the foregoing subject areas, considering the human propensity to seek to abridge, ignore or violate rules of conduct, it will become necessary in due course to manage the space environment to control and deter criminal action. If it is generally accepted that without law there is no crime, then it is not too early to begin serious analysis of the legal requirements for maintenance of order and harmony in space. Commentators have already addressed a range of topical areas which will require some form of definition, declaration and enforcement.[10] It is clear that some central authority should serve as the focal point for study, analysis, drafting and ultimately promulgation of a code to deal with crimes in space. The administration of that code, its enforcement, and the judicial processes by which it will be administered must be agreed. A great deal of work is necessary in this area to begin subject definitions and to contemplate appropriate mechanisms for promulgation, enforcement, and administration.

(5) Personal Status and Nationality Issues. A combination of issues that do not arise in current spaceflight activity will arise early in the next century in the presence of permanently manned space stations, possible lunar settlement, or other permanently settled space locales. A form of central registry now exists for space missions, and personal

10. *See, e.g.*, discussion in A.G. HALEY, SPACE LAW AND GOVERNMENT 296-97 (1963); also analysis of jurisdiction, including criminal jurisdiction, in C.Q. CHRISTOL, INTERNATIONAL LAW STUDIES 1962: THE INTERNATIONAL LAW OF OUTER SPACE 418 (1962). *See also* Delmas Saint-Hilaire, *Réflexions sur le droit pénal aérien et de l'espace* (Reflections on Penal Air and Space Law), 28 REVUE GÉNÉRALE DE. L'AIR 84 (1965); S. Gorove, *Criminal Jurisdiction in Outer Space* in BASSIONNI AND NANDA, A TREATISE ON INTERNATIONAL CRIMINAL LAW 48 (1973); Haughney, *Criminal Responsibility in Outer Space* in PROC. CONF. SPACE SCIENCE & L. 146 (Schwartz ed. 1963); *Claims Relating to Jurisdiction Over Space Activities and Spacecraft* in MCDOUGAL, LASSWELL & VLASIC, LAW AND PUBLIC ORDER IN SPACE 695 (1963); Fasan & Gross, *Zivil und Strafrecht in Weltraum* (Civil and Penal Law in Outer Space), 10 ZEITSCHRIFT FÜR LUFTRECHT UND WELTRAUMRECHTSFRAGEN 106 (1961); and Lay & Taubenfeld, *Jurisdiction of the United States over 'Crimes' and Certain Other Acts in Outer Space* (An American Bar Foundation Study) in THE LAW RELATING TO ACTIVITIES OF MAN IN SPACE 210 (1970).

information on individuals is recorded in national registers (births, deaths, marriages, and divorces). In due course, there may emerge issues of dealing with denationalized personnel - people who may disavow national citizenship or nationality, who may thereby become stateless persons.[11] How will the marriage, childbearing and death of such individuals be recorded? Who will maintain and validate such records? Spaceflight regulation up to this time has been largely terracentric, focused on aspects of missions related to the Earth, or their effects upon activities on or near the Earth. Some future operations will be far less Earth oriented, or totally extraterrestrial.

As spaceflight activities are undertaken by individuals away from the Earth for long periods of time, it will be essential to have a body of law and regulations that deal with anthropocentric aspects of law - man-centered issues - in addition to those dealing with nations and institutions. Organizational concerns have been the primary focus of most space law up to this time. Development of extraterrestrial regulations must give more attention to the individual than to the institution because the individual in space is entirely vulnerable and potentially subject to institutional malaise or bureaucratic complacency. Law should serve the governed and not become a yoke on them. Before we create the situations that will involve individuals in legally undefined, extraterrestrial situations and environments, we should begin a centrally managed, internationally collaborative study on the natures and dimensions of the problems involved, and begin to consider solutions that can be generally effective and acceptable.

(6) Management of Resource Exploitation. Under the existing regulatory regimes of national governments there are very few constraints on extraterrestrial resource exploitation. There are numerous possible resource exploitation practices that have been conceived. They include: propellant production from lunar resources, extraction of rare or exotic materials from lunar soil, reduction of metals from asteroids or lunar materials, extraction of useful chemicals from lunar materials, establishment of material mining or processing facilities in space or on celestial bodies, and conduct of any of the foregoing activities on planets or moons of other planets in the solar system.

Recent experience in attempts to establish resource exploitation regimes have not met with general success or wide acceptance.[12] It is

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11. This prospect was first raised by Vladimir Mandl in V. MANDL, WELTRAUM RECHT: EIN PROBLEM DER RAUMFAHRT (SPACE LAW: A PROBLEM OF SPACEFLIGHT) (1932). The issue is further explored in multiple dimensions in G.S. ROBINSON, LIVING IN OUTER SPACE (1975) and in G.S. ROBINSON & H.M. WHITE, ENVOYS OF MANKIND (1986).

12. A survey of commentators' opinions on the relationships between law of the sea experience since 1960 and the prospects of resource use and management in outer space is presented at 28 PROC. COLLOQ. L. OUTER SPACE 118 (1986). This theme session of the IISL Colloquium focused on *Comparison Between Sea and Space Law Especially in View of Exploration and Exploitation Activities.*

clear that nations of the world, collectively, have a substantial way to go to reach mutually acceptable, effective management provisions for extraterrestrial resource exploitation. That work should be begun soon, within a global discussion context in order that timely progress can be made toward a viable solution.

Perceived Needs Suggest An Organizational Response

Selected topic areas of future needs include: standardization of astronautic cartography; standardization of mission safety practices; standardized health and contamination controls; definition and policing of criminal activity; personal status and nationality issues; and management of resource exploitation. This list is not a comprehensive register of work needed to be done, but it is a substantial example of emerging needs. Aerospace system management teaches no discipline so profoundly or so repeatedly as it teaches that the future cannot be foreseen fully and not all future contingencies can be provided for. But the future of any aerospace venture is made more manageable and less surprise generating when future problem anticipation and contingency planning are done. Often, national governments, like operational entities, are so focused on immediate problems that they put off or fully ignore future needs. The progress in astronautics by mankind now requires that the global community organize an institutional structure to begin consistent and sustained analysis of and formulation of approaches to identifiable future problems.

The United Nations would appear to be the logical focal point for the establishment of a world space agency to begin to address such issues. The creation of such an agency will have to be in stages and correlated with the needs of the global community. Among the first requirements will be the need for an agreed mission statement and the definition of an organizational structure.

A Proposed World Space Agency

(a) Mission. The mission of this new agency would be to centralize information on spaceflight activities by nations, regional and global organizations, and private enterprise. The Secretary General of the United Nations could assess the extent and nature of current involvement of the UN Secretariat in managing and implementing provisions of the outer space treaties today, and recommend to the UNGA, which, if any, of the current Secretariat functions should be considered for transfer to the new space organization, once it is established. The collection, maintenance and appropriate dissemination of space activity information would be provided. Coordination with extant international and specialized organizations would be undertaken. The new organization would expedite the planning and convening of specialist conferences or meetings to address space issues. The organization could recommend questions or matters to be considered by the UN Committee on the Peaceful Uses of Outer Space. The world space

agency would serve as a clearinghouse and a central repository for technical, scientific, economic and operational information on past, current and future space activities. Eventually, when adequately staffed and qualified, the organization might provide a framework to develop and recommend standards in areas such as: astronautic cartography and cartographics; the decontamination and sterilization of interplanetary spacecraft; appropriate and necessary flight safety procedures, markings, flight registration and notifications; the definition of and recommendations for enforcement of criminal law concerning extraterrestrial activities; recommendations for handling issues of legal personality and status and record maintenance of significant events such as births, deaths, marriages and other interpersonal transactions in extraterrestrial areas; and the formulation and enforcement of regulations involving protection of particular environments, ecosystems, or resource exploitation projects. The list of appropriate subject areas for the attention of this new organization cannot be fully defined in advance of actual experience in space. New needs will emerge as the kinds and numbers of spaceflight missions expand. The constitutional charter of the organization should be flexible enough to permit internationally agreed adjustments in the organization's roles and mission over time in light of future events.

(b) Organizational Structure. The structure of the new organization suggests itself to some extent. Considering the nature and functions of the several UN specialized agencies that exist today, it appears that such an organization, in concept, would require four main elements: (1) a directorate; (2) an advisory/support staff; (3) a resource staff; and (4) appropriate functional staff, depending upon the nature of roles and functions the organization is assigned.

The agency directorate would include the office of the Director General, the Deputy Director General and their immediate staff support. The advisory/support staff would include: (1) legal counsel, (2) a political affairs office, (3) an office of interagency affairs, and (4) a planning office. The resource staff of the organization would be composed of: (1) personnel and administration, (2) information resources management, (3) controller, and (4) research and library services.

The distinctions in missions or functions between the proposed Information Resources Management (IRM) staff and the proposed Research and Library Services (RLS) staff are not readily apparent to observers who have not ever been involved in one or the other of these functions. Generally, a competent and efficient RLS staff provides data and information on request within a reasonable time, without making known or visible to the management personnel requesting the data or information, the procedures, processes and mechanisms employed in the collection, compilation, analysis, validation, production and delivery of the data requested. The skills, knowledge and staff required for these functions are specialized, rather sophisticated, and require both professional and institutional training.

The providers of IRM, on the other hand, generally know little of libraries, research techniques, data bank contents, information collection

procedures, analytical methods, research validation procedures or document production. The IRM staff knows the computer systems on line within an organization, how to operate and interconnect them, how to network communication and data retrieval systems, how to program system executive logic and system functional activities, and how to install, verify, operate, maintain and troubleshoot the computers, their modems and communication links. Thus, the Information Resources Management staff is totally different in personality, competence, and technical language from that staff that uses the resources which the IRM staff installs and maintains. Increasingly, institutions within and outside of the government are coming to understand the necessity of having these two staffs, and to recognize that the staff skills are very different in the two departments. Neither should be subordinated to the other, if both are to be effective and responsive staffs.

Finally, concerning organization, the ultimate makeup of the functional elements will be directly related to the organizational charter and the organizational missions.

(c) Funding. There are two key questions involved with the funding of any organization: (1) What is the size of the budget that is required for the organization? and (2) How will the funds to meet this budget be obtained?

(1) The Budget Requirements. For purposes of quantifying a budget, the planning, physical establishment, and staffing of a new international organization can be defined in incremental phases. Budgetary Phase I will involve studies and definition of the organization desired based upon the charter of missions contemplated. This phase would be conducted in a series of organizational meetings sponsored through the UN Organization by individual nations. Basic costs in Phase I will be administrative and secretariat costs. These costs could be met through the UN general budget as an agreed special assessment for participating nations. The costs of national participation and representation would be borne by the respective sponsoring governments. This phase should be less than three years.

Budgetary Phase II would involve the expenditure of facility acquisition capital, or rent and capital, to obtain offices and appropriate furnishings, equipment, computers and library. This phase would involve expenditures over time, but the initial facilities will be required about the final year of Budgetary Phase I, and they will grow over time in response to the needs of the organization.

Budgetary Phase III would involve the acquisition of permanent staff and management personnel, and the expenditure of operational funds to discharge the duties of the organization. Funding for this phase begins last and continues over the duration of the operation of the organization.

The initial phase of studies would have relatively modest cost. The establishment of facilities and establishment of computer and library resources will make Phase II costs considerably higher than Phase I. It must be borne in mind that costs will be driven by organizational size and missions. The costs will necessarily relate to the organization defined as

changes in size, or roles and missions of the organization will significantly influence costs.

(2) Obtaining Revenue. The new organization will be established pursuant to an international agreement that will serve as the charter of the organization. Various funding methods could be considered and will be studied by the organizing meetings.

The first funding method that suggests itself is an allocation of costs among member nations in proportion to each nation's allocated portion of the UN General Budget. The justification for use of the UN scale of contributions is that the scope of the new agency is global in concern, it is global in representation and global in effect. Every nation, active in spaceflight or not, will be influenced or affected, directly or indirectly, by the actions and standards of the new agency.

An alternative funding scheme, possibly made applicable to a portion of the total budget, could be based upon the total tonnage launched per year or per annual quarter by the signatory nations. The rationale of this approach is that those nations conducting launches and placing objects in space create the need for the new agency and in at least some measure, possibly half of the total budget, they should have organizational costs in proportion to their total weight of payloads placed in outer space. A variation on this approach would be to assess budgetary costs to payload owners, rather than launching nations, and obtain proportional contributions to the budget in relation to the percentage of ownership by a nation held in a given payload. The payload would be assessed initially by weight and the allocation of assigned contribution would be distributed among owners in proportion to their investment in or in proportion to derivation of revenue from a given payload. It would be possible to allocate by weight alone on scientific, research, or exploratory missions, and by weight distributed among owners in proportion to revenue share for those applications missions that generate revenues.

The question will not likely be solved simply, and some time will be needed to study options, consider alternatives, and to arrive at a generally accepted compromise solution. The sooner the roles and missions of a new agency can be defined, the sooner discussion of appropriate funding alternatives can begin. Putting these matters off will not make them easier to resolve.

Conclusion

With an increase occurring in the number of nations capable of launching objects into space, and a steady expansion of national, regional, and global space program activity, the time is rapidly approaching when effective global management and standardization of important aspects of spaceflight activities must occur.

It is time to begin the serious and necessary work of defining the needs, the functions, and the structure of a new global space agency, to be created as a specialized agency of the United Nations. This need is being

increasingly recognized.[13] The longer the problem is put off the more difficult the solutions are likely to become. This paper proposes an approach. Others may be more practical or feasible. The issue is no longer whether or not we need an agency. The question now is: When will it be established? All things considered, the answer is: The sooner the better.

Annex

Organizations Active in Outer Space Affairs

AAS	American Astronautical Society
AIAA	American Institute of Aeronautics & Astronautics
ARABSAT	Arab Corporation for Space Communications
ARINC	Aeronautical Radio, Inc. (US)
ARRSTC	Asian Regional Remote Sensing Training Center
ARSP	African Regional Remote Sensing Program
ATU	Asian Telecommunication Union
CCIR	International Consultative Committee on Radio (ITU)
CCITT	International Consultative Committee on Telegraph & Telephone (ITU)
CEPT	Conference of European Postal & Telecommunications Administrations
CITEL	Conference on International Telecommunications (OAS)
CNES	Centre National d'Études Spatiales (National Center for Space Studies, France)
COPUOS	Committee on Peaceful Uses of Outer Space (UN), also referred to as UNCOPUOS
COSPAR	Committee on Space Research (ICSU)
DoC	Department of Commerce (US)
DoD	Department of Defense (US)
DoS	Department of State (US)
DoT	Department of Transportation (US)
EBU	European Broadcasting Union
ECA	Economic Commission for Africa
EOSAT	Earth Observation Satellite Corporation (US)
ESA	European Space Agency
ESTEC	European Space Research & Technology Center (ESA)
EUMETSAT	European Meteorological Satellite Organization
EUTELSAT	European Telecommunication Satellite Organization
FAO	Food and Agriculture Organization
GARP	Global Atmospheric Research Program (ICSU/WMO)
GEMS	Global Environmental Monitoring System (UNEP)
IAA	International Academy of Astronautics (IAF)
IAF	International Astronautical Federation
ICAO	International Civil Aviation Organization

13. A recent article following up on a USSR initiative in this regard is Piradov, *Creating a World Space Organization*, 4 SPACE POL'Y 112 (1988).

ICSU	International Council of Scientific Unions
IFRB	International Frequency Registration Board (ITU)
IISL	International Institute of Space Law (IAF)
IMO	International Maritime Organization
INMARSAT	International Maritime Satellite Organization
INTELSAT	International Telecommunications Satellite Organization
INTERCOSMOS	Council on International Cooperation in the Study & Use of Outer Space
INTERSPUTNIK	International Organization of Space Communications
ISRO	Indian Space Research Organization
ITU	International Telecommunication Union
NASA	National Aeronautics and Space Administration (US)
NASDA	National Space Development Agency (Japan)
NOAA	National Oceanic & Atmospheric Administration (US)
NORDSAT	Nordic Countries Satellite System
OECD	Organization for Economic Cooperation and Development
OIRT	International Radio and Television Organization
PEACESAT	Pan Pacific Education & Communication Experiment by Satellite
RRSP	Region Remote Sensing Program
UN, UNO	United Nations, United Nations Organization
UNDC	United Nations Disarmament Commission
UNDP	United Nations Development Program
UNDRO	United Nations Disaster Relief Organization
UNEP	United Nations Environmental Program
UNESCO	United Nations Educational, Scientific & Cultural Organization
UNGA	United Nations General Assembly
UNIDIR	United Nations Institute for Disarmament Research
WARC	World Administrative Radio Conference (ITU)
WIPO	World Intellectual Property Organization
WMO	World Meteorological Organization
WWW	World Weather Watch (WMO)

EVENTS OF INTEREST

A. PAST EVENTS

Reports

Developments in Arms Control Negotiations: The Proposed Defense and Space Treaty

Ambassador David J. Smith made the following statement before the Geneva Conference on Disarmament earlier this year:

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I

. . . Throughout the five-year history of the Defense and Space Talks the United States has had a consistent objective. We seek to facilitate a cooperative transition to a more stable deterrence which relies increasingly on nonnuclear defenses against strategic ballistic missiles, should they prove feasible. Today's strategic balance relies almost exclusively on nuclear offensive weapons. Advances in nonnuclear technologies now make it likely that greater reliance on advanced defenses can be combined with stabilizing reductions in strategic offenses to reduce further the risk of war.

To achieve these goals, the United States has a forward-looking approach in the Defense and Space Talks. We seek to assure full testing rights for advanced defensive technologies, as allowed in the 1972 Anti-Ballistic Missile, or ABM Treaty. We seek to free space-based ABM radars and their substitutes from outdated ABM Treaty limits. U.S. proposals would require serious and thorough discussions with the Soviet Union on specific measures for a cooperative transition prior to either Party's future deployment of advanced defenses beyond current ABM Treaty limits. U.S. proposals would also assure deployment rights after those talks. Finally, the United States seeks, through predictability - that is, confidence-building - measures, to avert future technological surprises by encouraging greater openness in both sides' activities in the field of strategic ballistic missile defense.

II

The centerpiece of the U.S. approach is our proposed Defense and Space Treaty, aimed at facilitating a cooperative

transition. The U.S. draft, updated last December, retains key understandings reached at the 1987 Washington Summit and takes into account the outcome of the September 1989 Wyoming meeting of Secretary Baker and Foreign Minister Shevardnadze. At that session the Soviet Union dropped its demand for agreement on a period of nonwithdrawal from the ABM Treaty. The Soviet Union also dropped its linkage between signature and implementation of a START Treaty and reaching a new agreement on Defense and Space. The United States welcomed this step.

The U.S. draft Treaty provides for procedures whereby either Party may declare its intent to deploy strategic defenses by giving notice and proposing specific measures for implementing a cooperative transition. The Parties would be required to conduct three years of intensive discussions of the proposed specific measures and the implications for strategic stability. Subsequently, unless agreed otherwise, if a Party decided to commence deployments beyond those allowed by the ABM Treaty, it would have to give a further six months' notice.

This proposed mechanism offers a more stable path for deploying advanced defenses than the current alternative, which is to exercise the supreme interest withdrawal provision of the ABM Treaty. The ABM Treaty permits a Party to withdraw and deploy after only six months' notice. Our proposed new mechanism would help to ensure a meaningful and timely dialogue on how to achieve a stable, cooperative transition.

The revised U.S. draft Treaty also reflects the full rights of the Parties under the ABM Treaty to develop and test advanced space-based ABM systems and components. To build confidence and prevent misperceptions about such testing, the United States offered a Space Testing Assurance in October 1988. It assures the Soviet Union that U.S. space-based ABM testing which is permitted by the ABM Treaty could not constitute a prohibited deployment of defenses. The United States pledged that only from a limited number of ABM Test Satellites would it conduct testing of a component of an ABM system based on other physical principles and capable of substituting for an ABM interceptor missile. Such testing would be to counter a strategic ballistic missile or its elements in flight trajectory. The number of U.S. ABM Test Satellites in orbit simultaneously will not exceed a number well short of that associated with any realistic deployed capability. To build confidence further, the United States has proposed as a predictability measure notification for launches, tests, changes of orbits, and deorbits of ABM Test Satellites.

The United States has also proposed that both sides be permitted to develop, test, or deploy space-based ABM radars and their substitutes without restriction. This would avoid future definitional and verification problems likely to arise because of advancing space-based technology, and it would encourage the evolution of stabilizing space-based sensors.

Another major concept in the U.S. draft Treaty is ensuring predictability in the development of the U.S.-Soviet strategic relationship in order to reduce the risk of nuclear war. This objective was agreed at the 1987 Washington Summit. In 1988 the United States proposed predictability measures to implement this objective. These measures include annual exchanges of programmatic data, meetings of experts, briefings, visits to laboratories, and observations of tests in the field of strategic ballistic missle defense. These measures would be carried out on a voluntary, reciprocal, and comparable basis. Their purpose is to create a better understanding of each side's ballistic missile defense activities as early as the research stage - years before the appearance of advanced defenses in the field.

At the Wyoming ministerial, Secretary of State Baker began an effort to see whether the areas of agreement on predictability measures could be expanded to become a point of mutual advantage. To stimulate our Soviet colleagues' understanding of the U.S. predictability measure for "visits to laboratories," Secretary Baker offered a first-hand, practical demonstration. He invited a group of Soviet experts to visit two U.S. laboratories conducting SDI research. The visit took place last December and was very successful. Ambassador Youri Nazarkin, who led the group, described the visit as a useful confidence-building measure. The Soviet experts received briefings, saw hardware first-hand, and had an opportunity to ask numerous questions of U.S. scientists conducting the research. The visit was designed both to foster transparency and to stimulate the negotiations on predictability measures. Subsequent to the visit, we were pleased when the Soviet Union accepted the concept of visits to laboratories as a predictability measure.

At the meeting between Secretary Baker and Foreign Minister Shevardnadze in Washington earlier this month, the United States proposed that the two sides agree on predictability measures in the form of a free-standing agreement - not linked to the ABM Treaty. The U.S. draft agreement calls on the Parties to implement the predictability measures outlined above.

To illustrate how such an agreement might work and to inform our negotiations, last month in Geneva the United States proposed reciprocal pilot implementation of the U.S. predictability measures for a single project on each side. The U.S. chose as its project the Infrared Background Signature Survey. We have asked the Soviet Union to select a Soviet project for pilot implementation. The U.S. idea is that the sides should conduct a "try-out" before implementing the free-standing predictability agreement. In this respect the initiative is similar to "try-outs" in other negotiations - the Joint Verification Experiment in the U.S.-Soviet Nuclear Testing Talks, the Verification and Stability Measures in the START negotiations, and the Bilateral Data Exchange and Verification Experiment in the U.S.-Soviet chemical weapons bilateral discussions.

There has been recent and important progress on predictability measures. The sides agree that they should expand and strengthen it. On the remaining issues in our negotiations, much remains to be done to achieve a Defense and Space Treaty that provides for greater stability in the years ahead as new technologies open the way for reducing the threat posed by ballistic missiles. Attaining this goal would contribute to greater security for the entire international community, and be the first cooperative transition in the history of a U.S.-Soviet strategic relations.

III

Having spoken about our diplomatic efforts to achieve a cooperative transition to greater reliance on strategic ballistic missile defenses, I thought it would be useful to discuss briefly the U.S. commitment to such defenses and the contributions they could make. On February 7 at the Lawrence Livermore National Laboratory, President Bush stated, "In the 1990's, strategic defense makes much more sense than ever before . . ." He added later that day in San Francisco, "Let's be clear: this purely defensive concept doesn't threaten a single person anywhere in the world. God forbid, if it ever had to be used, it would be used against missiles, not against people."

The President's emphasis on the value of defenses is best understood in terms of how they can contribute to international security for the balance of this century and into the next. There are four main reasons why effective defenses can bring about a safer world.

First, preventing nuclear war must remain a fundamental goal. Survivable and effective strategic

defenses would strengthen deterrence and reduce the risk of war by significantly complicating the planning and execution of a first strike with strategic offensive forces.

Second, as the United States and the Soviet Union reduce substantially their strategic offensive arms, advanced defenses can play a growing role in ensuring against the consequences of potential abrogation, breakout, and cheating in connection with such reductions.

Third, new threats are emerging against which effective nonnuclear defenses can provide substantial protection. As more countries develop ballistic missiles, along with chemical, biological, and nuclear weapons, threats to the international community will increase.

Fourth, effective defenses can provide protection against accidental or unauthorized launches of ballistic missiles. If such a catastrophic event were ever to occur, the value of defenses in human lives saved would be incalculable.

Taking into account these purposes and their relevance now, the United States is determined to preserve the option to develop and deploy effective, advanced defenses when they are ready, at a measured place and in a cooperative way. This is our goal in the Defense and Space Talks.*

Workshop on Space Debris Held at the COSPAR Congress

A workshop on space debris was held at the Twenty-Eighth Plenary Meeting of the Committee on Space Research (COSPAR) on 28 June 1990 in The Hague, The Netherlands. It was one of the series of workshops held on that subject every two years at the COSPAR Congresses bringing together recent results on scientific and technical aspects of one of the undesirable byproducts of space activities. The chairman of the program committee was *D.J. Kessler*.

The Chairman of the morning session, *W. Flury*, introduced the session by pointing out two recent highlights: the return of the NASA Long Duration Exposure Facility's Micro Abrasion Package after 68 months in space, and the fact that no fragmentation of a space object occurred in the last two years.

A.E. Potter reported on the AIAA/NASA/DOD Orbital Debris Conference, held in Baltimore in April 1990. The conference reviewed the measurements, modeling, implications and control of debris. It showed that eliminating explosions of space objects is an important, but only short term, solution. In the long term, the only control over random collisions is

* Taken from Cong. Rec. S5675-76 (May 3, 1990).

to minimize the accumulation of mass (*i.e.*, the number and size) of debris in orbit. There is a need to establish a central data bank which would provide data for disciplines, such as modeling of the debris environment, measurements of debris, spacecraft design and operations.

K. Uesugi presented a retrospective overview of studies made at the Institute of Space and Aeronautical Sciences in Kanagawa, Japan. Among other interesting points, it appeared that the concept of Space Traffic Control, which received attention at the IISL Colloquium mainly from 1982 onwards, was introduced as early as 1971.

R.C. Reynolds discussed the future orbital debris environment. A conclusion, of particular importance for the Space Station, was that a high volume of traffic at low altitudes might not greatly impact on any other use of space, even though a large amount of material would be placed in orbit. However, a similar development at high altitudes may lead to an instability of the debris environment.

P.D. Maley investigated in detail a flash which appeared on a photograph of the Moon as a bright point near the lunar terminator. There seems to be no doubt that the bright point is due to an artificial space object. A flash from an orbiting satellite is far more likely a cause than a direct lunar impact.

There is a substantial mass of radioactive material in nuclear reactors or radioisotope thermal generators in orbit. In assessing the reentry of this material, *P.D. Anz-Meador* noted that the orbital lifetimes of current Nuclear Power Sources varied from several hundred to one thousand years. He concluded that an impact sufficient to totally fragment an NPS fuel core will likely occur between one and four centuries from today. On-orbit fragmentations will tend to pollute vast volumes of space at low Earth orbits with radionuclides. The current disposal options offer at best a short term advantage; therefore, it is necessary to select carefully orbital elements of storage orbits of future NPS and to develop capabilities for retrieval of NPS at the end of their service time.

H. Klinkard informed the audience of the ESA's data-base and Information System Characterizing Objects in Space (DISCOS), presently under installation at ESOC in Darmstadt. The data on space objects are being compiled from major sources, such as the USSPACECOM Two-Line Elements, NASA Satellite Situation Report, RAE Table of Earth Satellites and Teledyne-Brown Engineering Tables of Satellite Fragmentations. The system will be accessible to ESA members and to NASA. The user authorization and the level of granted access rights is still under consideration. In the discussion of the paper it was pointed out that additional sources of information on space objects are the United Nations Register and the International Telecommunication Union IFRB (International Frequency Registration Board) Circulars.

In the afternoon session, chaired by *R. Reynolds*, a paper by *D. Rex* and his colleagues gave an overview of the important and extensive work on space debris carried out at the Technical University of Braunschweig. Among others, an interesting idea concerning shielding of spacecraft was brought forward. A surplus structure, such as a spent upper stage, can be

used as a collision protection in front of active modules. Directly behind the protective structure are very safe areas that could be used as rescue zones in case of emergency. However, large manned structures may not be sufficiently protected by shielding alone. Consequently, collision warning and avoidance manoeuvres may become necessary as a protection against larger debris particles and objects. But only if the debris population can be reduced then it will be feasible, by the combined use of shielding and collision avoidance, to cope with the risk of collision with debris in space.

D.J. Kessler discussed in detail the instability of the debris population. Once a critical density of objects in orbit has been reached, the rate of fragment production from random collisions exceeds the rate of removal by atmospheric drag and the debris population will increase even without placing any more objects into orbit. A region of space where this occurs is called unstable. It appears that the current population above 1400 km is well into the unstable region, while the region around 1000 km is marginally stable. When the population of large objects is sufficiently reduced, either by active removal or by fragmentation, the region may revert to stability. The density of small debris may make it hostile for future space use. If the current population above 800 km were to double - and this happened in the last 9 years between 900 and 1000 km - the region of instability would expand and the breakup rate would increase to one every 2.5 to 5 years. Engineering measures, such as reentering upper stages that have restart capability, should begin now because there is little doubt that such measures will be required in the future.

The situation in the geostationary orbit is also alarming because pollution by orbital debris could render this unique region in space useless, according to *W. Flury*. The population in the geostationary ring is steadily increasing and there is no natural cleaning mechanism such as air-drag. The present probability of 1 in 1000 of at least one collision by the year 2000 may not be acceptable, as the number of debris would be significantly increased. Therefore, no mission-related debris should be created. Also an explosion of an upper stage -- and there are over 100 such stages in the vicinity of the geostationary ring -- could change the situation significantly. The ultimate measure for operators is to return all objects to Earth or to low orbit. Currently, the only practical spacecraft disposition is reorbiting at the end of life into a disposal orbit, at least 400-600 km beyond the geostationary ring. An agreed policy for debris management in the geostationary region should be discussed among space operators.

Shin-yi Su reported about observations of reentering orbital debris with the Meteor Echo Detection and Collection System at the Chung-Li VHF facility in Taiwan. Of the 400 trails plotted, three fell around the minimum orbital velocity of 7.8 km/s and four fell below the Earth escape velocity of 11.1 km/s, indicating that those objects were previously in Earth orbit.

A paper by *Yu.I. Portnyagin* and his colleagues from the Institute of Experimental Meteorology at Obninsk and from other institutes in the Soviet Union reported about results of simulation of the impact of man-

made dust particles on space vehicles and their construction materials. The experiments used particle acceleration by means of explosive generators. The modelled fluxes have a very complex structure with solid, liquid and gaseous components.

Laboratory Simulation of Micrometeorites and Orbital Debris was the subject of a paper by *V.A. Alexandrov* and his colleagues from the Research Institute of Applied Mechanics and Electrodynamics of the Moscow Aviation Institute. The construction of an experimental complex attaining very high impact velocities was described.

Several papers presented in this Workshop and in the Workshop on Space Dust Particles by *J.A.M. McDonnell, D. Olsson-Steel, J.C. Mandeville* and others, dealt with the collection of traces by dust particles on the Long Duration Exposure Facility and on the MIR space station. The experiments brought highly interesting results on the frequency of impacts and on preferential directions of impacting particles. These data can be used for determining the amount of shielding most appropriate for each of the surfaces of a manned spacecraft.

During a concluding panel discussion, many participants commented on the importance of studying models of explosions of space objects, on the instability regions, on the relation between radar cross-section and size and mass of debris and on the analysis of returned material. Also possible problems posed by debris generated during the deployment and testing of large numbers of "brillant pebbles" were touched upon. *A. Potter* remarked that no studies of the end-of-life disposal of the space station have as yet been performed although it may pose serious problems. *I.H. Ph. Diederiks-Verschoor* asked whether a definition of space debris had been adopted; participants did not seem to see much need for a definition. The term space debris may apply to any non-active object in space. A second question of *Mrs. Diederiks-Verschoor* about the opinion on disposal of debris by remote action such as a powerful laser beam caused a discussion about two problems. The first was the necessity to have a very powerful laser; the second was the difficulty to locate debris. Finally there was a discussion about the desirability of a forum of and agreements between the nations actively involved in outer space activities and the impact this would have on other States. One of the observations was that even between space nations consensus may be difficult.

In the opinion of the authors, the Workshop has shown that the question of space debris has been recognized by the scientific and technical community as an important issue. Many theoretical questions remain to be resolved and observations of small debris are urgently needed, but some salient features of the space debris population have been established beyond doubt and have been known for some time.

Space debris are dangerous for space activities and may become a grave hazard if not checked. The subject is ripe for discussion in the inter-

national community. Any delay in starting these discussions will have to be paid for by increased costs and decreased safety of space operations.

I.H. Ph. Diederiks-Verschoor[*] and
Lubos Perek[**]

Mobile Satellite Communications: Issues For the 1990's

"Mobile Satellite Communications: Issues for the 1990's" was the topic of discussion during the Aerospace Law Committee International Law Section meeting of the American Bar Association held in Chicago on August 6, 1990. *Milton L. Smith,* Chief of Space Law at the Headquarters of the U.S Air Force in Washington, D.C., introduced the speakers and the issues surrounding mobile satellite communication. These systems are for communication via satellite with a station on earth that is mobile (ships, aircraft, cars, trucks, portable phones, *etc.).* They have the capability of cellular phones of today but since the satellite "footprint" (coverage) is very large, you don't have to worry about driving out of range.

There are many commercial opportunities in this field, and many companies want to offer mobile satcom service. The main problems they face relate to frequency allocation by the International Telecommunication Union (ITU) and frequency assignment by the FCC. There is much more projected demand than there is a supply of available frequencies. This has led to heated competition for the scarce frequencies. The speakers on this panel represent some of the key interests competing against each other. If regulatory problems can be overcome, mobile satcom will offer significant commercial opportunities in the U.S., Europe, and world-wide.

The Department of Defense (DoD) is one of the largest users of mobile satcom. It has terminals on ships and aircraft all over the globe. DoD is currently one of the largest users of INMARSAT for administrative traffic. It has an interest in seeing a commercially successful mobile satcom system established since it would likely be a large user of any such system.

The first speaker, *Ms. Cecily C. Holiday,* of the Federal Communications Commission, discussed the FCC's role in licensing and regulating the new commercial mobile satellite services that have developed over the last several years. Since the early 1980's when satellites provided mainly fixed (point-to-point), mainly telephone-related services, there has been an explosion of technology that has led to the development of new, previously uncontemplated satellite services. The FCC's major role is to create an environment that permits these services to be made available to the public as fast and efficiently as possible.

The views expressed were her personal views only, and did not represent FCC views or possible action by the FCC on any issue before it.

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In addition, her participation in the meeting was limited by FCC *ex parte* rules and she left the meeting after speaking.

The FCC has authorized two new mobile satellite services, a generic mobile satellite service (MSS) -- which is to provide data and voice services to land, maritime, and aeronautical users -- and a radiodetermination satellite service (RDSS) -- which is a data service providing position location information to users. Applications have also proposed three additional types of mobile satellite services: a service that would use low earth orbiting satellites; a service that would provide compact disc-quality radio programming to users; and a digital mobile satellite system that would provide a wide range of data services to users. The FCC has also authorized mobile data service via existing, licensed fixed-satellites on a non-interference basis and interim RDSS service over fixed-satellites as well. The public can enjoy the benefits of these new, innovative services without the necessary delay involved in allocating spectrum and constructing and launching dedicated mobile satellites. The lines between some of these services are fuzzy.

The primary FCC functions involved in getting a new service to the public are to allocate frequencies for the service for U.S. domestic use, to develop regulatory policies for the new service, and to license commercial entities to construct and operate facilities to provide the service.

The FCC allocates frequencies for the service to ensure that various services do not interfere with each other and provide a framework for efficient radio spectrum use.

Most MSS applicants have asked to operate in bands not currently allocated for that service. Because there really is not any freely available spectrum left, finding spectrum that can be shared among services already assigned to a portion of the spectrum as well as the proposed new service -- and that has the necessary transmission characteristics -- is difficult and often controversial. Some applicants negotiate with current users of their proposed frequencies before they apply to the Commission. Any agreements that can be worked out among the affected entities make the FCC's job a lot easier. Other factors in reallocating frequencies include how intensively the frequencies are being used by current service providers, the types of services they are providing, whether the technology to be used in the new service can be made compatible with the existing service, the perceived need for service, and opposition of current users.

The allocation decision for the generic MSS was certainly one of the most difficult ever confronting the FCC. The FCC decided to allocate 28 MHz of spectrum in the L-band for land, air, and maritime mobile satellite communications. This bandwidth was allocated for aeronautical safety communications, such as air traffic control, even though it was not being used to provide those services at the time. The FCC, therefore, has allowed mobile satellite service and aeronautical safety communications to preempt. The parties are developing technical standards for the MSS system sharing arrangement.

In general, U.S. domestic allocations follow international allocations to facilitate compatible world-wide communications; satellite

transmissions may spill over into neighbouring countries. International allocations are overseen by the International Telecommunication Union (ITU). Periodic world administrative radio conferences--or WARCs--make these allocation decisions. At the 1987 Mobile WARC Conference, separate allocations were made for land mobile satellite service, maritime mobile satellite service, and aeronautical mobile satellite service, which differs from the U.S. allocation concept of generic MSS. However, each country is free, when making domestic allocations, to allow non-conforming uses of spectrum provided that it does not cause harmful interference. The FCC believes that is the case with MSS.

The next WARC will be held in Spain in 1992. Each of the 166 members of the ITU has its own opinion about allocations. Generally, countries that propose specific allocations must demonstrate that sharing between existing services and the new service is possible. If sharing is not feasible, the proponent of an allocation must come up with alternate frequencies where an existing service or services can be moved. A major issue will be to find enough spectrum, internationally, for the various mobile satellite services. It is likely the the U.S. will continue support for generic MSS allocations, and that the U.S. will propose allocations to support low-earth orbit satellite systems. The 1992 WARC also includes a proposed allocation for satellite sound broadcasting service which will involve difficulties with frequency sharing.

Once frequencies have been allocated for a service, the FCC can license entities to provide that service. Regulatory requirements are often proposed and developed before the allocation proceeding is completed. The FCC has often conducted these proceedings simultaneously. Parallel processing permits grant of a license as soon as the allocation is made.

Ms. Holiday then described the development of licensing procedures. Licensing procedures involve decisions about how many systems should be authorized, what sorts of services should be provided, technical standards for the service, and licensee qualifications. In the RDSS proceeding, several applicants demonstrated that multiple non-voice RDSS systems could operate simultaneously over the proposed frequencies by using distinct coding techniques. The FCC thus proposed and ultimately adopted a baseline technology for these systems that permitted multiple entry. These policies permitted licensing of four RDSS systems in 1987, although three have since relinquished their licenses.

The MSS proceeding was complicated by the limited spectrum, the need for coordination with the aeronautical safety industry, the possibility of coordinating U.S. and Canadian systems, and the fact that no pending application had proposed a technology that would permit the frequencies to be shared. The FCC decided to license only one MSS system. Because it had 12 applications for various types of MSS systems, after long deliberations, it instructed applicants to form a consortium that would be the licensee for a generic mobile satellite service, with each applicant's ownership share proportional to its contribution. Two years later, the American Mobile Satellite Company was formed, and it is currently building an MSS system.

The FCC takes a hands-off approach to setting technical requirements for facilities in a particular service when possible. The industry is in the best position to balance competing factors; the FCC leaves it to the licensees to develop the technical details of systems, provided that they comport with general licensing requirements.

Ms. Holiday also mentioned two systems currently providing mobile satellite services. Both Geostar and a company called Qualcomm are currently providing mobile services in the fixed-satellite bands via currently operating fixed-satellites. Geostar's system provides interim RDSS service using spectrum allocated for RDSS for earth-to-space transmissions and spectrum allocated for fixed-satellite service for space-to-earth transmissions. It has a temporary authorization until a dedicated RDSS satellite can be launched. Qualcomm's system is a general land mobile data satellite service operating, as do all satellite facilities, under a 10-year license term. Both Geostar and Qualcomm must cease operations if they interfere with any fixed-satellite service, which is primary in these bands. Further, neither Geostar nor Qualcomm can complain if it is interfered with by fixed-satellites, but their operations are virtually identical to that of fixed-satellites, and interference is unlikely. This demonstrates the FCC's flexibility in permitting new services that do not quite fit within the existing regulatory framework, when public interest benefits are apparent.

She said that the FCC's role in authorizing new mobile satellite services, with attendant regulatory dilemmas, have made for an exciting few years, with what seems to be a constant stream of new, innovative proposals. The FCC has tried to develop a framework that permits authorizing these services as expeditiously as possible without imposing any unnecessary regulatory hurdles.

Mr. Lon C. Levin, a partner with the law firm Gurman, Kurtis, Black and Friedman in Washington, D.C., undertook to provide an overview of the regulatory structure for the Mobile Satellite Service (MSS) in the United States. First, he briefly described the regulatory process in general. Second, he discussed the regulation of MSS in the US in two parts: (1) allocations of spectrum and (2) rules and regulation, including service. Third, he addressed interim service for the MSS until the full system is operational. His focus was on MSS and how the American Mobile Satellite Corporation, the (AMSC), the US MSS licensee, will be regulated.

The FCC regulates non-government uses of the frequency spectrum. The process of getting an application through the FCC has many steps; these include:

1. An outside entity files a Petition for Rulemaking for a new service.
2. The FCC reviews the petition and puts out a public notice.
3. Comments and reply comments are provided to the FCC.
4. The FCC issues a Notice of Proposed Rulemaking, proposing rules, regulations, licensing structure and allocations, as well as parameters for the new service.

5. Comments and reply comments are again provided to the FCC.
6. The FCC, if it goes forward, comes out with a Report and Order establishing the rules and regulations, and the same, or another, order for allocations. The FCC then invites applications.
7. Applications are filed. Petitions to Deny or Comments are filed with responses.
8. At this point, the FCC rules on the applications. The Final Orders can be challenged with Petitions for Reconsideration, and appeals through the judicial system may be filed.

Mr. Levin then described the MSS point of view. In 1982 NASA filed a Petition for MSS service. The FCC issued a Notice of Proposed Rulemaking in 1985. The FCC issued an L-band allocation in 1986, but there was reconsideration in 1987, and further reconsideration in 1989. The FCC established the MSS industry structure in 1987, and it requested an application from a consortium. In 1988, AMSC filed its MSS application. In 1989, the Industry Structure order was approved on reconsideration, and the FCC awarded a license to AMSC. Thus, the FCC has spent the last decade devising the MSS regulatory structure.

The FCC gave a license to AMSC to construct, launch and operate three satellites using L-band frequencies for mobile links and Ku-band frequencies for feeder links. The orbital locations assigned to AMSC are:

(i) 101 W.L. for the central satellite
(ii) 62 W.L. for the eastern satellite
(iii) 139 W.L. for the western satellite

The FCC allocated 28 MHz of L-band spectrum for mobile links; specifically, 1545-1559.0 and 1646.5-1660.5. Rather than a rigid segmentation plan, the allocation permits all MSS services to be provided across 27 MHz of the allocation. Due to sharing constraints with radio astronomy, the remaining 1 MHz is limited to aviation safety service and certain one-way services.

Feeder links are considered a fixed satellite service. Accordingly, the FCC assigned a portion of the Ku-band for AMSC feeder links. The Ku-band is used traditionally by domestic satellites (domsats). The FCC assigned AMSC that portion of the Ku-band not being used by the domsats, specifically, 100 MHz at two polarizations of the 11/13 GHz band for the central satellite at 101 (10.7-10,95 downlink/13.0-13.15 and 13.2-13.25 uplink). This is a segment of the U.S. expansion band allocation made at the 1988 ITU WARC-ORB. 100 MHz at two polarizations of the 12/24 GHz band were allocated for the eastern and western satellites. These slots were going unused.

Through an MSS Supplemental Band Rulemaking in February 1990, the Commission adopted a Notice of Proposed Rulemaking proposing to

reallocate another portion of the L-band for domestic generic MSS. The bands are 1530.0-1544 MHz and 1626.5-1645.5 MHz. AMSC is seeking to have an assignment in these bands that would not have a priority requirement. Furthermore, AMSC is active in the U.S. preparations for the upcoming 1992 World Administrative Radio Conference.

In establishing the MSS industry structure, due to technical and economic considerations, the FCC decided to license one system in the MSS bands. The FCC decided that, due to the high risk and cost of the system, it should be shared by a consortium of applicants. The AMSC consortium will provide space segment on a common carrier basis, providing open access to carriers, resellers and end users to establish private networks.

The ground segment will be authorized separately. Fixed earth stations accessing the system will be licensed individually. Mobile units will be authorized under blanket licenses. Aeronautical mobile earth terminals may be licensed individually. The FCC just issued a Notice of Proposed Rulemaking on June 14, to establish standards for aircraft mobile earth terminals. The Notice proposes standards for output power, modulation, authorized bandwidths, emission limits, and frequency stability.

AMSC is licensed to provide the full range of land, maritime, and aeronautical services. Fixed and transportable services may be provided on a non-interference basis to segments of the population where few alternatives exist. AMSC is required to provide coverage of the entire U.S. domestic market including Alaska. AMSC is authorized to construct its satellites to cover Canada and Mexico. This was, in part, to recognize the special relationship between Telesat Mobile, Inc. and AMSC, and was for mutual backup and restoration. Nevertheless, authority to operate in Canada and Mexico must be obtained by separate application. Appropriate arrangements are to be made with the respective governments.

The first AMSC satellite is scheduled to be launched in 1993. In the interim, AMSC has proposed using INMARSAT satellites.

Mr. Warren Y. Zeger, Vice President (Law), World Systems Division, Communications Satellite Corporation, began his remarks with a summary of what he considers the four key trends for the 1990s. First is the continued growth of fiber-optic cable networks. Second is the development of Direct Broadcast Satellite (DBS) systems including the provision of HDTV. Third is the development of telecommunication infrastructure in Eastern Europe and the Soviet Union. The last is an increase in mobile communication services, particularly mobile satellite service (MSS), which is already a multi-billion dollar industry.

Mr. Zeger then discussed the history of COMSAT in the mobile satcom area. COMSAT developed the first "Marisat" and recognized that the system had to be international to be viable. This was the impetus for INMARSAT. When Marisat started in 1976, there were no satellite-equipped ships for this service. There are now over 10,000 ships equipped for the INMARSAT system. Marisat satellites are still used by INMARSAT for back-up capacity. One Marisat has been leased by AMSC, but Geostar is opposing this action.

Regarding the Land Mobile Satellite Service (LMSS), *Mr. Zeger* stressed that COMSAT has the capability and satellite coverage to provide LMSS in the US, but the FCC is preventing it. The FCC has many factors to weigh, including competition and fostering entrepreneurial activity. The band that AMSC wants to use is the band that 10,000 ships depend on for INMARSAT communication. An international treaty (the ITU Radio Regulations) establishes this regulatory system and the US has a treaty obligation to INMARSAT. The Coast Guard opposed the AMSC application on safety and distress grounds.

Motorola, with its Iridium system, proposes placing many satellites in low earth orbit to provide all sorts of MSS communication. Motorola has proposed the use of spectrum used by INMARSAT and by AMSC. Motorola, in essence, wants it all. This will further heat-up the "spectrum wars" mentioned in a recent article in "Business Week."

Air mobile satellite communication is also an area with growth potential. Aircraft are currently out of communication over large sections of the ocean. Satellite communication will be tremendous for cockpit and passenger communications. INMARSAT has modified its Convention to authorize provision of this service. This was resisted by ARINC in the US. COMSAT could provide this service for aircraft through INMARSAT satellites, but FCC rules have prevented it.

Mr. James G. Ennis, a partner in the law firm Fletcher, Heald and Hildreth of Washington, D.C., began his remarks by reviewing the three commercial MSS services the FCC has either created or whose creation the FCC is considering. The Radio Determination Satellite Service (RDSS) is a position location service. It uses satellites to determine the location of a vehicle and provides that information to both the vehicle and a central station. The system has a small two-way ancillary message capability (100 characters). Two such systems are being implemented, one by Geostar Positioning Corporation in the US, the other by Locstar in Europe. An interim RDSS service has been provided in the US since 1988. Most of the legal issues surrounding the regulation of RDSS have been resolved. The Mobile Satellite Service (MSS) will provide generic two-way voice and data communications from mobile vehicles to central stations and other mobile vehicles in the L-band. One such system has been authorized in the US, that of AMSC. Geostar Messaging Corporation has proposed a competitive system. Although basic policy has been established, a large number of legal issues have been raised in connection with the detailed implementation of MSS service. The Satellite Sound Broadcasting service will broadcast commercial radio signals via satellite to vehicles. Two applications have recently been filed to provide such service. The legal issues surrounding the establishment of such a service have not yet even been identified, much less resolved.

There are several domestic issues surrounding MSS that warrant discussion. First, should competitive MSS space-segment be authorized? The answer is clear and compelling. Competitive domestic MSS services should be authorized, for several reasons:

1. In general, competition, not monopoly, best serves the public in terms of price, quality of service, and stimulation of technical innovation.
2. A major FCC regulatory objective since 1970 has been to establish competition in the provision of satellite services.
3. The arguments which have been presented for the establishment of a domestic monopoly in the provision of MSS space-segment are:
   a. There is not enough demand to support two services;
   b. The single entity that has been authorized will need more spectrum to provide a viable service;
   c. The FCC already resolved the issue in its previous decisions.

However, these arguments do not withstand close analysis.

The second issue involves interim service. Interim domestic space segment can only be provided using INMARSAT satellites. There is only a limited amount of interim INMARSAT capacity available. The issue is how the FCC should apportion such capacity among competitors for permanent capacity. A related issue is the role of AMSC as middleman. Should AMSC receive all the interim INMARSAT space segment capacity that is available and then resell it to other end-service providers? Or should the limited capacity be apportioned in some equitable fashion between competing entities? The answer is self-evident. A way must be found to apportion scarce satellite capacity among all entities that seek to provide a permanent domestic MSS service. This would permit all competitors for permanent capacity to have an equal opportunity to build market share before permanent systems are established. Further, there is no good reason why any entity interested in providing service should have to go through AMSC to get capacity provided by COMSAT. AMSC will mark up the price but add nothing of value to the capacity used by other entities.

There are also international issues surrounding MSS. Should the U.S. continue to allocate spectrum in the upper half of the L-band to a generic MSS service, in contrast to the international allocation of this band into discrete blocks for aeronautical and land mobile service? This issue is now before the U.S. Court of Appeals. The 1992 WARC will address the issue of whether the international allocation should be modified to conform to the view expressed by the U.S. The U.S. position in this issue is sound and should not be revisited.

Another international issue is whether the U.S. should allocate spectrum in the lower half of the L-band, which is currently allocated for use by INMARSAT for the provision of maritime mobile service, for generic MSS service. This issue is currently the subject of a rulemaking proceeding before the FCC.

In the view of *Mr. Ennis*, the generic MSS proposal for the lower-half of the MSS band should be adopted. Because current INMARSAT satellites are power-limited, they cannot fully utilize the lower half of the band for maritime service. Moreover, the demand for maritime services can be satisfied with more spectrum-efficient satellites without fully using the maritime band. The demand is not as great as COMSAT projects, and the demand can be met with more spectrum-efficient satellites (*i.e.*, spot beams).

A final international issue is whether additional spectrum should be allocated for MSS, including low-earth orbit MSS, at 1992 WARC. *Mr. Ennis* believed the answer to this question was yes.

In summary, *Mr. Ennis* considers that the U.S. should establish competition in the provision of domestic MSS service by permitting generic MSS service in the lower half of the L-band and authorizing a second entity to use this band to provide MSS service.

Until additional MSS satellites are launched, the only satellites available are INMARSAT assets. AMSC wants to take all of the capacity offered by COMSAT and serve as the middleman. But Geostar wants direct access to the INMARSAT satellites.

A discussion followed the speakers' presentations.

Milton L. Smith
Chairman, ABA Aerospace Law Committee

The New Space Law Database of the Institute of Air and Space Law in Cologne

Introduction

Since *Vladimir Mandl* wrote what was probably the first juridical study on space in 1932,[1] space law took a tremendous development. This development is now reflected by a countless number of publications on the subject of space law and closely related topics, that are published all around the world. That is why space lawyers, when doing research on a specific issue, are often confronted by the problem of finding relevant documents, articles, books, and judgments in a timely manner.

Although the very useful space law bibliographies of *Kou Lee Li*[2] provide a list of most published documents related to space law, specific research based on such bibliographies is not easy to perform and will take considerable time. For example, a search for all documents on the commercial use of space stations published after 1986 in the English language will be very time-consuming because all listed documents on the

1. V. MANDL, DAS WELTRAUMRECHT - EIN PROBLEM DER RAUMFAHRT (1932).

2 LI, K.L.,WORLD WIDE SPACE LAW BIBLIORAPHY, VOL. I. 1978 (1978); VOL.II, 1977-1987 (1987); update 1987 (1988).

topics "space stations" and "commercial use of outer space" as well as other related topics, must be reviewed. Since updates of printed bibliographies can only be published in certain intervals, the most recent publications after the date when the manuscript is finished can not be recorded and, thus, must be found by supplementary research.

These difficulties of legal research are, of course, not restricted to space law, but have led to the development of technically more advanced methods in other fields of law.

The Database Project

Being aware of the problem that printed bibliographies on space law become outdated quickly and can not meet all the various demands of potential users, the Cologne Institute of Air and Space Law decided in late 1987 to establish a computerized database on all documents relevant to space law that are available at its library.

The Institute is the only research institution in Germany and, besides the Leyden Institute, the only European institution specialized on space law with the largest library on space law related documents. Because it is the aim of the Institute's library to collect all relevant published material on space law, the library contains most of the documents published on space law from around the world. It was the intention of the Institute not only to establish a computerized database to make all this literature at the Institute's library more easily accessible and exploitable for the Institute's work but also for visitors to the Institute's library. With the financial support of the Northrhine-Westfalian Ministry of Science and Research the necessary hard- and software was purchased in early 1988 and the database project of the Institute started.

The Design of the Database

The database operates on a customary IBM PS/2 computer with software specially-designed for the fast retrieval of bibliographic data. The space law database, as a whole, consists of three individual sub-databases, the most important of which contains the proper data on individual books, articles, judgments, or documents on space law. In addition, there are two auxiliary databases. One deals with the abbreviations and meanings as used in the main database, and the other subordinate database consists of an index of terms relevant for space law and gives hints regarding the question, under which keyword the user may find the material dealing with the term in question. To facilitate the use of the databases for international users, all standardized bibliographical information, as well as the keywords to describe the contents of a publication, are completely in English. The main database contains twelve

datalines.[3] Line one gives the numerical order of the documents; this numerical order is necessary for an immediate identification of individual documents and for seeing the number of documents of the database as a whole. Line two provides the names of the authors or editors of the publication in question. Line three shows the original title of the publication dealt with in the respective document. In line four, the document is classified under a controlled variety of types of publications, *e.g.*, monograph, article, conference report, document, internal study. Line five distinguishes between "independent" and "integrated" publications; this can be of use for the printing of a document. Line six refers to integrated documents and gives the journal or book, where an article or a document is to be found, and lists the relevant pages. Line seven refers to independent publications and gives the place and year of publication, as well as the number of pages. Line eight shows the language or languages of a publication. Line nine gives the date of publication or of the last amendment. Line ten regarding the "topicality" of a publication had to be included to make possible a display of documents in inverted chronological order. This might, in fact, be of special importance, as space law is a field of law subject to rapid development. Line eleven shows the code where the publication in question can be found in the library of the Cologne Institute. Finally, line twelve contains a generally unlimited number of controlled keywords describing the content of the respective publication.

The retrieval of data can be carried out by using a single data field or an unlimited combination of all datafields in any logical association imaginable. That is why a research on all publications, *e.g.*, bearing the keywords "space station" and "commercial use" published in English later than 1986, will lead immediately to a sufficient result for the user.

Keywords allocated to the documents are designated to give the easiest access to the documents stored in the database. That is why the system of keywords is based on a philosophy of precise retrieval. The variety and quantity of keywords is limited to the minimum necessary for sufficient precise retrieval, on the one hand, and to keep the whole system user-friendly, on the other hand.

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3. The following is an example of a print-out:

Document Number	4286
Author/Editor(s)	Gorove
Title	Legal and Policy Issues of the Aerospace Plane
Type of Public	Ar
Character	int
Found in Place/Date/Pages	J. SPACE L. 1988, p. 147-156
Language(s)	E
Date of Publ/ Upd	1988
Topicality	12
Library Code	ZL IV 37
Keywords	NASA, Chicago Convention, freedom of outer space, RRA personnel, astronaut, LC, RC, space object, jurisdiction and control

So far, about 370 keywords have been established to precisely describe the contents of the various documents and give easy access to them.[4] Of course, new keywords can and will be included according to the future development of space activities and space law. New terms like "aerospace plane" that suddenly arose in legal discussion, will also appear in the future and must be included in the keyword system to keep the database up-to-date and suitable for the demands of the users.

The format and structure of displaying or printing the documents is variable and takes into consideration the various requirements and ideas of individual users.

With this design, the database tries to meet all the various needs of the users and provides a powerful tool for research on all space law related material available at the Institute's library.

The Present State of the Project

So far about 5000 documents have been stored in the database. These documents consist of books, judgments, articles, legal documents, and proceedings of colloquia on space law, as well as some interdisciplinary publications relevant to space activities, such as publications on political and economic aspects. Individual space law related publications in journals not available at the Institute's library are copied to make them available for the library as well as the database, in

4. The keywords are designed to give the user the easiest access to the data stored in the database. Since the amount of keywords may cause problems for untrained users, a separate database exists, that provides - besides the keyword-definitions - an index of terms relevant to space law and so gives hints regarding the question, under which keywords the user may find material dealing with the terms in question.

A partial list of the present keywords of the Cologne Space Law Data Base in alphabetical order includes the following:

ABM-Treaty, ADIZ, AEROSTAT, aerospace vehicles, Africa, African Remote Sensing Council, aggressive use, air law, air law analogy, airspace, airspace above High Seas, ALADA, antarctic law analogy, Antarctic Treaty, APOLLO, Arabia, ARABSAT, arbitration, Argentina, ASAT Treaty project, asteroids, astronaut, astronautics, Australia, Austria;

Belgium, bibliograpy, BMD, BMFT, Bogota-Declaration, Brazil, broadcasting, Brussels Conference, Brussels Convention 1974, Bulgaria, Burma;

Canada, celestial bodies, CEPT, CETS, Ceylon, Chicago Convention, CINA, civilian space technology and programs, collision with space debris, Colombia, COLUMBUS, commercial competition, commercial space law, Common Clauses, Common Heritage of Mankind, COMSAT, conflict of laws, consultation, contiguus zone above territorial airspace, contract law, COSMOS 954, COSPAR, criminal law, CSCE, customary international law, Czechoslovakia;

damages, DBS, DBS - prior consent, DBS - programme content, Denmark, developing countries, DFVLR, DGLR, dispute settlement, domestic jurisdiction, DTB, due regards, DVIR;

...

order to achieve the Institute's goal to make all relevant material accessible for the users. Keywords have been allocated already to most of the 5000 documents so that a precise retrieval of material can already be guaranteed.

Availability of the Database

The Institute provides access to the database to all visitors of the Institute's library, who can, at present, use the database free of charge for their reasearch work at the Institute. Thus, the literature on space law available at the Institute is more easily accessible to visitors.

An online-dissemination of data from the Institute itself is not envisaged for the near future, but all of the data from the Institute's database will be loaded into the online-database ESALEX of the European Centre for Space Law (ECSL).[5] Since the Institute's data provided to ESALEX will be updated regularly, all members of ECSL will have access to the Institute's database. This will not only give ECSL members an overview on the documents available at the Cologne Institute, but will help them on literature research in their respective homecountries.

Outlook for the Future Development of the Database

In the future, the database can be extended to include further information on the documents. For example, abstracts on the contents of documents can be attached, as well as the full text of documents, can be stored in the database by using a scanner. All these and other possible expansions of the database remain technically feasible, although they require more financial support not available at the moment.

Conclusion

The new space law database at the Institute of Air and Space Law in Cologne offers a powerful tool for researchers as well as practitioners. It helps to make the literature on space law more easily accessible and exploitable.

*Professor Karl-Heinz Böckstiegel**
*and Knut Focke***

5. On ECSL, see Focke, *Grundungsversammlung des European Centre for Space Law* (ECSL), 38 ZEITSCHRIFT FÜR LUFT- UND WELTRAUMRECHT 236 (1989). ECSL is also described in Madders, ESALEX and the ECSL User, I ECSLNEWS 2-3 (1989).

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Steady Progress for United Nations Space Activities in 1990

The United Nations Committee on Peaceful Uses of Outer Space (COPUOS) held its thirty-third session from 5 to 15 June 1990.[1] At the COPUOS meeting, the 53 Member States addressed four main areas: ways and means of maintaining outer space for peaceful purposes; the Scientific and Technical Sub-Committee; the Legal Sub-Committee; and spin-off benefits of space technology. Also, as part of its discussion of other matters, the Committee considered the competence required for permanent observer status to COPUOS.

COPUOS Meeting

In opening this COPUOS session, the Chairman, *Peter Jankowitsch* of Austria, noted the improved East-West relations and the potential for enhanced international cooperation in the peaceful exploration and use of outer space. During their exchange of views, other delegates also stressed the importance of international cooperation. Some emphasized, however, that the improvements in East-West relations should not be at the expense of assistance and cooperation between developed and developing countries in their North-South relations.

The Committee first addressed the item, ways of maintaining outer space for peaceful purposes, which was in accordance with the General Assembly resolution 44/46 that the Committee give priority to consideration to this item. During the debate on this item, delegates held divergent points of view. Some delegates particularly from Chile, with the support of Argentina and Brazil, proposed that the Committee develop a link with the Conference on Disarmament to foster an exchange of information on the issue of militarization of outer space. For these delegates, closer cooperation between the two international bodies would contribute to preventing an arms race in space. Other delegates, particularly from the United States, considered the proposal beyond the scope of the Committee because it did not have a mandate to deliberate the questions of disarmament.

The Committee agreed, however, that any interactions between the bodies should be carried out on the basis of a consensus decision of the whole Committee and after the Secretariat researched the availability of documents from the Conference. Also, the Committee agreed that the best way to ensure peaceful uses of outer space is through promoting international cooperative programs, including proposals for a world space organization, for bans on the use of force in outer space, for a system for monitoring space activities, and even for a "Mission to Planet Mars" with a possible role for the United Nations.

1. U.N. Doc. A./45/20.

The Scientific and Technical Sub-Committee

In continuing its discussion on international cooperation in space, the Committee reviewed the report of the Scientific and Technical Sub-Committee[2] and considered, *inter alia*, the work on the agenda items concerning the recommendations of the Second United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE 82), nuclear power sources, space transportation systems, remote sensing and the International Space Year (ISY).

During the Committee's review of the efforts to implement the UNISPACE 82 recommendations, some countries expressed their disappointment at the meager financial resources that Member States have contributed to execute those recommendations. The Committee as a whole, however, appreciated the cost-effective work of the United Nations Programme on Space Applications, particularly in the area of remote sensing. Also, the Committee expressed its appreciation to governments, including Austria, Brazil, China, and the Soviet Union, as well as to the European Space Agency (ESA), that offered long-term fellowships for in-depth training in space applications. In addition, the Committee noted United Nations technical advisory services for the Indian Ocean Marine Cooperation (IOMAC), for the Economic Commission for Africa (ECA) and for the Government of Costa Rica for preparation of the Space Conference of the Americas: Prospects of Co-operation for Development. The Committee noted that these programs were particularly important for strengthening regional and interregional cooperation mechanisms.

The Committee expressed satisfaction with the Sub-Committee's work on the technical aspects, particularly the safe use of nuclear power sources (NPS) in outer space. The Sub-Committee's recommendations provided the basis for the Legal Sub-Committee's draft of the legal principle for the guidelines and criteria for safe use.

Delegates also continued consideration of national and cooperative programs in space transportation systems. They noted in particular the nascent Sonda program of Brazil, the recent commercial launching of China's Long March rocket and Japan's launch of its lunar probe. The Soviet Union's space flight program, particularly its cosmonauts' long duration experience on the Mir space station and the United States international cooperation for the development of space station Freedom were also noted.

During their review of earth observation by remote sensing satellites, delegates remarked on the importance of continuing international cooperative efforts, particularly for developing countries. They also took note of the Soviet Union's working papers for multinational space laboratories for earth observation.[3] The Committee recalled the United Nations adoption of Principles on Remote Sensing and agreed to continue discussion on remote sensing activities.

2. U.N. Doc. A/AC.105/456.
3. U.N. Docs. A/AC.105/L.186, A/AC.105/L.187, A/AC.105/C.1/L.165.

The Committee noted the General Assembly resolution 44/46 that endorsed the initiative of international scientific organizations and bodies to designate 1992 as International Space Year (ISY). In addition to the United Nations activities, the Committee reviewed the programs of other national and international activities, including those of the Space Agency Forum for International Space Year (SAFISY), the plans of the Committee on Space Research (COSPAR) and the International Astronomer Federation (IAF) for the World Space Congress in Washington, D.C. Also, the Committee members proposed that a special session of COPUOS be held during the General Assembly in 1992 to commemorate ISY. In addition, the Committee endorsed the Scientific and Technical Sub-Committee's recommendation that Member States consider ways to complement ISY earth monitoring activities with the 1992 Conference on Environment and Development to be held in Brazil.

Also, on the issue of the environment, the Committee noted that more attention needs to be paid to preservation of the outer space environment and that the problem of space debris was a concern of all nations. Some members of COPUOS suggested that space debris become a new agenda item.

Also, delegates noted their satisfaction with United Nations collaboration with IAF including the programme on electrojet and related phenomena during COSPAR's 1990 plenary meeting at The Hague, Space and Forest Management during the IAF Congress in Dresden and the planned workshop on the benefits of space technology for developing countries for the 1991 IAF Congress in Montreal. With regard to the 1991 Scientific and Technical Sub-Committee, the Committee endorsed the recommendation that COSPAR and IAF arrange a symposium on application of airborne and satellite remote sensing for prospecting mineral and ground water resources and for monitoring and managing biological resources with an emphasis on agriculture, taking into particular account of developing countries' needs.

In conclusion of their review of the Sub-Committee's work, the delegates expressed their sincere gratitude to *Professor John Carver* for completion of 20 years of dedicated leadership as Chairman of the Scientific and Technical Sub-Committee.

Legal Sub-Committee

In their review of the Legal Sub-Committee report,[4] delegates expressed their support for the achievement in the elaboration of draft principles relevant to the use of nuclear power sources (NPS) and their appreciation of the working papers[5] submitted for the drafting of Principle 3 guidelines and criteria for safe use. The Committee also noted the progress of the Sub-Committee in drafting Principles 9 and 12 that deal with compensation and revision, respectively. Also, as a result of informal

4. U.N. Doc. A/AC.105/457.
5. U.N. Docs. A/AC.105/C.2/L.177, A/AC.105/C.2/L.154/Rev.6.

consultations during the Sub-Committee, the Committee was able to review the possible draft of Principle 8 on responsibility and the deletion of draft Principle 11. During the discussion of this item, the Soviet Union delegate argued for more openness and "transparency" in space activities and, as an example of his country's support for this, he informed the Committee that the Soviet Union would support draft Principle 4 on safety assessment and would publish its results of safety assessment prior to launch.

On the item concerning the Legal Sub-Committee's efforts on definition and delimitation of air space and utilization of the GSO, some delegates expressed some frustration with the continuing deadlock on the item. For some delegates, principally from developing countries, defining outer space and means of utilizing the GSO remains an important step for developing a legal regime to govern commercial exploitation of space and for ensuring that developing countries also benefit from space exploration. In contrast, however, some delegates, particularly those from the United States, held that the lack of defining and delimiting outer space does not create any problems with respect to the progressive peaceful use of outer space.

During the exchange of views on consideration of the legal aspects of the principle that exploration and utilization of outer space should benefit all States, delegates pointed to the significance of the item in elaborating the goals of the Outer Space Treaty and the concepts of benefit of space exploration and the interests of all mankind. Some delegates expressed the view that an objective of this item should be to institutionalize international cooperation in space to ensure non-discriminatory access to space technology. The Committee recommended that the Legal Sub-Committee continue discussion on this item.

Spin-off Benefits

The delegates then considered the question of spin-off benefits of space technology. As an example of international cooperation and benefits of space activities, the Chairman of the Committee congratulated India on the successful launch of the INSAT 1D satellite from the United States Kennedy Space Center. India pointed out that one of the objectives of its space program was to diffuse the benefits and techniques of space technologies to other economic sectors as well as to promote international cooperation with other countries. The Committee noted the growing importance of spin-off benefits in medicine, in the field of safety, in manufacturing and construction and in the areas of art preservation, environmental protection and agriculture. Some delegates felt that a mechanism, perhaps through the United Nations, should be established to disseminate the benefits of space technology.

In its discussion of other matters, the Committee considered observer status to COPUOS. At the request of the International Law Association and the International Society for Photogrammetry and Remote Sensing, the Committee granted them permanent observer status. The Committee agreed that, in the future, any non-governmental organization

requesting observer status should have consultative status with the United Nations Economic and Social Council.

In a general exchange of views, members of the Committee debated the venue and duration of the Legal Sub-Committee meeting. Currently, the venue of the Legal Sub-Committee alternates between New York and Geneva, and the duration of the meeting is three weeks. Some delegates would prefer that the venue should be New York and that the duration be reduced to two weeks. The next session of the Legal Sub-Committee is scheduled to take place in New York and the delegates agreed to continue their discussion at that time.

At the round-up of the thirty-third session of COPUOS, the Member States approved their report to the United Nations General Assembly and emphasized the Committee's responsibility for strengthening the international basis for peaceful exploration and uses of outer space. The Committee chairman noted the progress that it made during the year, particularly in the area of NPS and urged, however, that Member States reconcile their divergent views in order that COPUOS could make even further achievements in the forthcoming year.

At the closing of this session, the Chairman reminded the delegates of the Government of Austria's invitation to hold the thirty-fourth session in Graz, Austria.

General Assembly, 45th Session

During its 45th session, the United Nations General Assembly endorsed the report of the thirty-third session of the Committee on the Peaceful Uses of Outer Space. In its resolution on outer space, the General Assembly recommended, *inter alia*, that States take steps to ensure that all countries benefit from space exploration and technology, providing in particular the opportunity to use techniques resulting from medical studies in space, the expansion of national and regional data bases and the establishment of an international space information service. Other provisions of the resolution call for United Nations support for the creation of regional training centers, linked, when possible, to institutions implementing space programs and space technology or applications for developing country graduates. In addition, the General Assembly recommended that Member States pay more attention to preserving the space environment and continue their research on the question of space debris. The resolution also urges States with major space capabilities to contribute to preventing an arms race in outer space and to adhere to the international treaties governing the use of outer space. Finally, the General Assembly recommended that the Legal and Scientific and Technical Sub-Committees continue their consideration of their respective items, giving particular attention to the needs of developing countries.

Yvonne Lodico
U.N. Outer Space Affairs Division

The 33rd Colloquium on the Law of Outer Space, Dresden, October 8-13, 1990.

The Colloquium took place during the 41st Congress of the International Astronautical Federation. The sessions of the Colloquium were held in the Cultural Palace. The four official subjects were the following: 1. Legal implications of space commercialization; 2. Space activities and the legal aspects of protection of the global environment; 3. Recent developments in space law; 4. Other legal subjects.

The President welcomed the participants and commemorated IISL Director, *Dr. E. Ploman,* who passed away September 1990 and who had contributed so much to the field of telecommunications.

The first session was chaired by *Dr. R. Müller* (Germany), with *Dr. H.L. van Traa-Engelman* (The Netherlands) acting as rapporteur. The session dealt with the subject "Legal implications of space commercialization." *Prof. K.-H. Böckstiegel* (Germany), who opened the line of speakers, presented a paper on "Reconsideration of the legal framework for commercial space activities." After an introduction in which he stressed the need for clarifying the existing legal framework for commercial space activities, he discussed the variety of provisions dealing with "exploration and use" and, subsequently, commercial activities by states, private enterprises and institutional organizations. With regard to future developments, *Prof. Böckstiegel* emphasized the need to check carefully actual commercial space activities in order to bring existing space law regulations in line with the requirements of space practice. In relation to this, he mentioned the task of applying the regulations of international business law when private enterprise will become more "normal" requiring solutions by such law, for instance, in the field of intellectual property and antitrust issues, and the settlement of disputes.

The next speaker, *Mr. D.J. Burnett* (USA), presented a paper entitled "Amendment of COCOM rules and the commercialization of space." He explained the practice of the Coordinating Committee for Multilateral Export Controls in relation to Eastern European countries. *Mr. Burnett* highlighted recent revisions, including the lifting of the export embargo of communication satellite systems as a result of democratic and economic changes in these countries. He foresaw further scrutiny of the structure of COCOM stemming from the harmonization of national export control laws of E.E.C. member states, a development which might even challenge the very existence of COCOM. As regards remaining restrictions, the speaker pointed to the existence of substantial barriers to commercialization projects in particular in the field of space segment equipment. A realization of such projects would at least require further liberalization of COCOM rules.

Mr. D.E. Cassidy (USA) described the significant variation in liability allocation for loss and damage to property and injury to persons associated with space launch operations among governmental and private sector participants depending on their role as payload owner, launch provider, contractor or subcontractor to the government or to a private

party. He indicated the continuing change in U.S. government regulations and practice, affecting issues, such as insurance, government indemnification and crosswaiver provisions, applicable to space launch participants. *Mr. Cassidy* emphasized the need for participants to understand their status and responsibilities in each particular case in order to assess exposure to loss and insurance requirements.

The next speaker, *Prof. O. Fernandez Brital* (Argentina), who dealt with the subject "Legal problems of commercial space transportation," focused on individual enterprises. Problems concerning authorization and control and issues such as space traffic and fares were discussed. Finally, attention was paid to a future agency dealing with the problems of transportation in outer space.

Prof. Dr. He-Qizhi (China) presented a paper on "The legal aspects of commercialization of space activities" in which he examined the relevant existing regulations in space law against the background of progressive space commercialization. Privatization, legality of commercial space activities, international responsibility and liability, intellectual property right and space product liability represented the major issues of examination. While concluding that in the future existing rules may not be sufficient to deal with the developing area of space commercialization, he urged that new rules be added in a fashion similar to what occurred in maritime and air law.

Mr. P.A. Potter (USA) elaborated on "The legal and policy implications of a commercial launch vehicle based on the SS-20 missile." The joint development of such a commercial launch vehicle by a U.S. and USSR corporation causes, in his opinion, fundamental conflicts in the U.S. space policy. While private space launch business is being promoted by the U.S. government, the same institution still seems to favor the prevention of dissemination of missile technology to the Third World and satellite technology to the East. He concluded with the observation that the conflict situation will be mainly concentrated on the issue of space trade affecting the placing of telecommunications satellites in orbit, potentially influencing cost and access to telephone services all over the world.

Mr. D.E. Reibel (USA) dealt with the question "Maintaining space for peaceful purpose" while placing space commerce in the context of military power. He addressed the issue of the relationship between space commerce and military activities in space in various fields of space applications. In conclusion, the speaker contended that although space commerce and military power in space should be exercised to serve different short-term aims and functions, they should both remain subject to democratic political control in order to insure long term human interests.

Dr. B. Reijnen (Netherlands) dealt with the subject "International law and business in space - in Europe." After elaborating on the common interest principle, she treated international conventions as well as international custom applicable to business in space. She concluded that, as far as Europe is concerned where private enterprise is a relatively new phenomenon in the field of commercial space activities, the prerequisite

for the existence of international custom - a general, uniformly consistent practice - does not seem to be fulfilled. However, development toward a common European space market might facilitate, in the future, a uniformly consistent practice by private enterprise as well, potentially enhancing the equal sharing of benefits to be derived from outer space.

Mr. N.A. Samara (USA) focused on the topic "Space law and the development of international business: Implementing a satellite sound broadcasting service." After analyzing the past and future role of space law, he recommended a specific legal regime for the development and implementation of satellite sound broadcasting services. In his view, the AFRISPACE proposal appears to overcome the problems of present shortwave services by implementation of satellite sound broadcasting systems to supplement existing shortwave systems to broadcasters in African and Middle Eastern countries. Realization of such a system should, however, necessitate a relaxation of the restrictions of the broadcasting satellite service regime by making a distinction between sound and television broadcasting by satellite, hence enhancing the usefulness of the latter.

Dr. B. Schmidt-Tedd (Germany) spoke on the subject "Current industrialization agreements in microgravity research: Japanese contribution to D-2/TEXUS and trends in space business." His first remarks concerned the definition and position of industrialization and commercialization. Since in his view the notion "commercialization" frequently gives rise to mistaken expectations, he preferred to use the term "industrialization" as long as no independent market potential is available. After discussing different commercialization concepts in Europe and the USA, the speaker focused on the above mentioned agreements in microgravity research. In this field of fundamental research, governmental sponsorship appeared to him the dominant characteristic. *Dr. Schmidt-Tedd* concluded, however, on the basis of the concept of industrialization as provided by the relating contracts, that an adequate approach for involving private activities does exist in the area where presently an independent market potential is not yet available.

Mr. W.B. Wirin (USA) discussed in his paper "The U.S. restrictions on space commerce." Existing restrictions in the U.S. and the West impede, in particular, Soviet marketing of space goods and services. In addition to existing U.S. laws, recent legislation facilitates even more restrictive measures on export licenses until U.S. policy can be further explored. With regards to the COCOM approach, the speaker noted continuing disagreement between the U.S. and its allies on appropriate changes. Nevertheless, he voiced his optimism for a change of U.S. policy by observing the U.S. need to recognize the evolutionary character of technology while stressing U.S. and Western interests in the exchange of ideas and products between nations in order to promote the development of resources and potential uses of space.

Finally, *Mrs. P.L. Meredith* (USA) presented a paper with the title "Implementing a telecommunications satellite business concept: Overview and relative timing of legal actions." Under the subtitle legal actions and

considerations, she dealt with the following subjects: consistency with international space law, national authorization, registration by the ITU coordination with INTELSAT, *etc.*, risk management considerations, satellite procurement contract, launch service agreement and satellite insurance. With the use of slides, she gave a clear impression of the procedures to be followed to complete all the necessary steps to implement a telecommunication satellite business concept. Due to the limited time available for this first session, and the considerable number of speakers, there was no time left for discussion. However, this did not reduce the value of the information and considerations offered by the participants.

The second session of the Colloquium, chaired by *Prof. Dr. S. Gorove* (USA) with *Dr. M. Hosková* as rapporteur, dealt with the topic "Space activities and the legal aspects of protection of the global environment."

Mrs. S. Courteix (France) presented the first paper, entitled "Towards an international satellite monitoring system of the environment," in which she tackled the different legal and institutional problems raised by such an international undertaking. Emanating from the present practice of various programmes, she voiced the need for an international integrated satellite research program based on general continuous long term observations of the Earth. As to the international legal framework, she pointed to the principles contained in UNGA Resolution 41/65 of 1986, which - applying to the whole of the "sensing community" - asks for a system of international cooperation between sensing and sensed states. Due to the differentiation in access between primary and processed data, on the one hand, and analyzed information, on the other hand, *Mrs. Courteix* foresees an international integrated system of a global network of scientific information being of a hybrid character. The two challenges faced will be, in the first place, the establishment and operation of a world-wide satellite monitoring system of the Earth and, secondly, the creation of the infrastructure for the exploitation of data thus obtained. The success of such an undertaking, however, will depend on the political will of the parties concerned.

The second speaker, *Prof. A.A. Cocca* (Argentina), brought his paper totally in line with the subject and title of the session. Noting the "global" nature of the issue, he stressed the importance of space law in analyzing the legal problems of environmental protection. Due to the lack of compulsory systems for the settlement of disputes in international law, he advanced the adoption of a new procedure. Since space law is the law of mankind and mankind has possessed since November 1989 a declaration of its own rights, *Prof. Cocca* proposed the protection of the global environment based on ethics, prevention and space law. However, to understand in a juridical fashion the expression "interest of mankind" and other related principles it is, in his view, necessary to recognize mankind as a legal subject of space law.

The next participant, *Dr. N. Jasentuliyana* (Sri Lanka), dealt with the subject of "Space activities and international environmental protection: Perspectives on the United Nations role." His paper outlined the U.N. work

relating to space and the environment as being protection of both space and terrestrial environments from damage caused by space activities, and programs monitoring the terrestrial environment by using satellite observations. He mentioned the importance of the International Space Year as a focal point of monitoring activity through which developing countries should benefit. In conclusion, *Dr. Jasentuliyana* noted the U.N.'s interest in promoting international cooperation in the use of environmental space technology through the various U.N. space treaties and principles on remote sensing.

Ms. K. Gorove (USA) approached the issue by delivering a speech with the title "International responsibility for endangering the 'space commons': Focus on a hypothetical case." Her presentation purported to identify the relevant *lex specialis* and *lex generalis* and, finally, to assess desirable changes in the existing legal framework. Lacunae in this framework, particularly, in relation to liability for damage to the space environment call for a concerted plan of action to assure environmental protection in the areas of the "space commons." *Mr. M. Rothblatt* (USA) concentrated on "Legal rights to dispose of hazardous waste in space." Addressing the issue of nuclear waste and its disposal, he covered many aspects of this subject, including the problem of liability for environmental damage.

The next speaker, *Dr. H.L. van Traa-Engelman* (Netherlands), presented a paper entitled "Protection of the global environment against hazards connected with space activities," in which she gave a survey of the relating instruments of international law to be applied against the background of various circumstances. Due to the progressive development of space activities and our increasing knowledge of environmental effects, priorities should be set to fill lacunae in the legal protection of the environment against the hazardous effects of space endeavor. She noted the recent efforts of the Space Law Committee of the International Law Association (ILA) to elaborate an international instrument whose principles and guide-lines would include: a general obligation for environmental risk cooperation and negotiation in good faith; liability for environmental damage from space activities; a particular obligation on cooperation, consultation and the exchange of information to minimize and prevent space debris; and an obligation for amicable and prompt dispute settlement, or binding and final settlement through arbitration or adjudication.

Dr. M.L. Smith (USA) closed the line of speakers with his presentation "Space debris: a role for lawyers?" in which he reviewed the current status of the situation. He elucidated with the help of graphics the historical growth of space debris, which showed a linear growth rate as opposed to a growth trend in terms of percentages. Although considering this linear growth rate of 240 trackable objects per year as serious, *Dr. Smith* did not believe that immediate action was warranted, because this would impair launch and operational costs. Moreover, he did not consider it opportune to establish an international multilateral treaty but favored adoption of technical standards to prevent a threatening debris situation.

During discussion, the first speaker, *Dr. L. Perek* (Czechoslovakia). stressed that the problem of space debris needs to be dealt with urgently. Debris could cause great damage and mankind cannot wait to solve this problem. The next commentator, *Dr. D. Popescu,* noted how important it was to awaken interest in environmental problems caused by the activities of satellites not only in outer space but also on earth. *Dr. A.D. Terekhov* (USSR and United Nations) commented on the paper of *Mr. Rothblatt,* dealing with nuclear powered satellites. In the case of the falling down of the USSR satellite with nuclear power charge, there never was any mention of liability. The Liability Convention is not applicable to such cases.

Prof. H.A. Wassenbergh (Netherlands) raised the question of whether it is legally possible to send the debris into deep space. The debris problem is not only the problem of space countries. *Prof. Wassenbergh* also asked the question if it would be necessary to have a uniform legislation for supervision of space activities. In the opinion of *Prof. K. Böckstiegel* (Germany), it was not necessary to have uniform legislation for supervision of space activities. He felt that it would be advisable to leave it to national legislation. Also, *Prof. Böckstiegel* stressed the importance of the question of space debris. He felt that we should not postpone the drafting of some document.

Mr. Potter (USA) elaborated on the connection between military and commercial use of outer space. Another speaker, *Dr. W.B. Wirin* (USA), stressed the need for lawyers to focus on a draft on space debris. *Prof. S. Gorove* (USA) mentioned that there already exists a customary rule that states are responsible to report on hazardous waste. *Mr. D.E. Reibel* (USA) remarked that waste should not be sent to deep space. *Prof. I.H. Ph. Diederiks-Verschoor* (Netherlands) recalled that *Dr. L. Perek* and she assisted at a workshop on debris during the COSPAR Congress in June of this year. It was clear that a big gap existed between the scientists-technicians and the lawyers on the desirability of a definition for debris, the lawyers being generally in favor of such a definition whereas the technicians did not see its use. Finally, *Prof. S. Gorove* (USA) gave his view that man-made space debris is a space object or part of a space object and, therefore, the Liability Convention would also apply to damage caused by space debris.

The third session chaired by *Dr. G. Gál* (Hungary) dealt with "Recent developments in space law." *Mr. W.W.C. de Vries* (Netherlands) acted as rapporteur. The first speaker in this session, *Mr. Knut Focke* (Germany), questioned the desirability of an international legal framework for international cooperation. While the term is used in several space treaties, it is not a legally binding principle. Since future space missions can hardly be financed by one nation, international cooperation will become a necessity. However, this should not be laid down in an international treaty. Rights and obligations resulting from such cooperation should rather be regulated in multilateral agreements like the Intergovernmental Agreement on the Space Station.

Dr. G. Gál gave some thoughts on several issues which remained unsolved for many years in the law-making process of space activities.

With regard to the delimitation of outer space, he agreed with the USSR proposal to set a boundary at 110 km. He continued with setting forth the conditions for the admissibility of non-aggressive military space activities. Finally, *Dr. Gál* ended with the optimistic dream that, as already can be seen in the space treaties, international law might be converted in the next millenium into a legal order of mankind.

After this, *Dr. S. Gorove* reviewed the highlights of U.S. national legislation governing the activities associated with the exploration and use of outer space. In this respect, he gave an analysis of the definitions of "launch," "damage," and "personnel" on board. Especially the latter may give rise to future problems when space travel will become a common place. For instance, if "passengers" do not fall under the category of "personnel" on board then, in *Dr. Gorove's* opinion, the provisions of Article VIII of the Outer Space Treaty on jurisdiction and control would not be applicable to them.

A legal regime for the future aerospace plane was proposed by *Mr. M. Hintz* (Germany). After an in depth analysis, he concluded that the aerospace plane should be governed by one regime. Within this regime the aerospace plane should be regarded and registered as an aircraft during flights solely in the airspace or during intercontinental flights affecting outer space. It should, however, be classified as a space object during shuttle missions from earth to orbit since it then "utilizes" outer space.

Dr. M. Hosková (Czechoslovakia) analyzed legal consequences resulting from the convergence of telecommunications technologies. After examining the legal telecommunication regime as laid down in the International Telecommunication Convention and its Annexes, she advocated an adjustment of the legal regime of space communications. Due to new technological developments, the basis on which the present regime is predicated has in certain areas become obsolete.

Dealing with the liability issues with the regard to the U.S. Air Force's NAVSTAR Global Positioning System (GPS), *Mr. K.K. Spralding* (USA) outlined the potential sources of liability as well as the scope of such liability which might be incurred by the U.S. government as a result of its deployment of the GPS. In his examination, *Mr. Spralding* not only took into account the international rules of liability but also U.S. law.

The next speaker, *Prof. Dr. V. Kopal* (Czechoslovakia), analyzed the involvement of the United Nations in the creation of a new set of principles and rules with regard to the use of nuclear power sources in outer space. There still remain some problems such as compensation for damage caused by space objects with nuclear power sources on board; he expects that these soon will be solved. In his estimation, the new rules will be contained in a resolution like the Principles on Remote Sensing.

A joint paper of *Prof. Dr. R. Müller, Dr. M. Müller* and *Dr. J. Schöne* (Germany) examined the different regimes beyond national jurisdiction, *e.g.*, Antarctica, Deep-Sea Bed and Outer Space. This is done against the background of the request of developing countries to take into consideration their specific needs. The Law of the Sea Convention and the Antarctica Treaty System did not succeed in this task, since many

developing countries feel themselves excluded due to the creation of contractual regulations among the industrialized countries themselves. With regard to outer space activities, international cooperation among all interested countries should be promoted.

Dr. B. Suess (Germany) gave an overview of the present state in the development of a legal regime in order to guarantee effective protection and normal functioning of objects which undertake peaceful space activities. In this regime she favored an immunity of space objects.

Mr. K. Tatsuzawa (Japan), analyzing the problem of jurisdiction and control within the Intergovernmental Agreement on the Space Station, stressed that especially the introduction of the concept of genuine partnership raised some obscurities in the attribution of ownership and jurisdiction and control. Due to different interpretation of this concept, problems may arise in the field of criminal jurisdiction and intellectual property rights.

Prof. Dr. V.S. Vereshchetin (USSR) unfolded his views on the concept of "open skies." After having given the developments which resulted in the proposal of setting up an International Space Monitoring Agency, he proposed the functions of this Agency. The fulfilment of its tasks should lead to a regime of "open skies." These "open skies" should, however, not be based on bipolarity but on globality.

The last speaker before the discussion was *Dr. E. Konstantinov* (Bulgaria). He analyzed the new development of the "common good" concept. The growing interest in this norm is spurred by the acceptance of a new item on the agenda of COPUOS which requires a "consideration of the legal aspects related to the application of the principle that the exploration and utilization of outer space should be carried out for the benefit and in the interests of all states taking into particular account the needs of developing countries." He argues that the common good principle is not yet recognized as such but indicates the peremptory character of the norm.

During a short but vivid discussion, the main subject was the paper of *Dr. S. Gorove* (USA) on the question of whether passengers should fall under the term "personnel." In a reaction, *Mr. F. von der Dunk* (Netherlands) argued that, in a first stage, it would not be necessary to deal with this question since a passenger would always fall under the jurisdiction of the country of the jurisdiction of the space object. And when a passenger goes from one space object to another, there will be, at the same time, a change in jurisdiction. *Dr. E. Galloway* (USA) reacted on this that in the future with the moon projects, man will really step out of the space objects, and thus no regime will be applicable to him. *Dr. S. Gorove* said that Article VIII, at the time of its drafting, was obviously not devised with such people as passengers in mind but in consideration of astronauts going up into space. At the same time, there is no indication that the drafters would have wished to see future passengers taken out of the jurisdiction and control of the state of registry.

With regard to the paper of *Mr. M. Hintz* (Germany), *Dr. I. Kuskuvelis* (Greece) stressed the fact that in any case the aerospace plane

is, on purpose, designated to go into (low) orbit. The aerospace plane is once more a justification for the theory of *Prof. N.M. Matte* (Canada) to speak about aerospace law. *Dr. S. Gorove's* reaction to this was that two more questions had to be answered in order to develop a regime for this transportation vehicle, namely, the delimitation between air and outer space and the definition of a space object but, ultimately, the issue of the applicable regime was a policy question.

Dr. D. Popescu (Romania) gave some general remarks on the question whether the "common heritage" concept has the same meaning as "common interest." With regard to the open sky policy, she wondered how control would be implemented. Would it be on a national or international level? If on a national level, smaller countries would not have the possibility to control their skies because of lack of funds.

The fourth and final session of the Colloquium, chaired by *Dr. N.M. Matte* (Canada) with *Prof. Sybesma Knol* acting as rapporteur, was devoted to "other legal subjects," covering various and divergent aspects of space law, from ethics, the Rights of Mankind, and other legal principles, to more technical subjects, such as the "right" of passage into outer space, and the possible revision of the Moon Treaty.

After the introductory statement by *Dr. N.M. Matte*, the session was opened by *Prof. Hamilton DeSaussure* (USA), who pointed out the increasingly private law nature of the law of outer space. This is a necessary development since the public law as set forth in the major outer space treaties is no longer adequate to cover the growth of industry and trade in and through outer space. There is a (logical) parallel with the law of the oceans which has also developed into two distinct subjects of law: the law of the sea and maritime law. We should be prepared to deal with the risks involved with this development of space law by the creation of an international space authority with global power to legislate for outer space. This will be the only means by which a truly global public space law may be achieved, and the only means to prevent splintering of public international space law into widely divergent regional or even national space law systems. National developments of a private body of space law, on the contrary, will grow to accommodate commercial interests which will insist on uniformity, harmony and compliance.

Prof. Dr. A.A. Cocca (Argentina), taking as his point of departure the Buenos Aires Declaration on the XII Tables of the Rights of Mankind (11 November 1989), elaborated on the applicability of this Declaration to man's activities in space. It is with the appearance of space law that the formal recognition of the rights of mankind began. It belongs to space law to complete the study of these rights.

Dr. Stephen E. Doyle traced the history of the development of the international law of cooperation as opposed to the classic international law of coexistence of states. The political and industrial revolutions of the 19th and 20th centuries have forced us to create international frameworks of cooperation in a multitude of disciplines. He calls this technology-driven process of accommodating political action as "technopolity": the politics of technology manifest in international cooperation. Its main

characteristics are: acceptability, affordability, durability, military neutrality of purpose, public safety, universality, and utility. Numerous examples exist, such as the European river commissions, the organization of the law of aviation (ICAO), ITU and, more recently, INMARSAT, INTELSAT, *etc.* The author concludes that, with the rapidly increasing number of space nations, and the growing sophistication and complexity of space programs, the establishment of a world astronautics agency, as a specialized agency of the U.N., is imperative. It is time to begin defining the needs, the functions and the structures of such an agency.

After an interesting contribution by *Dr. F. von der Dunk* (Leiden) on the question of the legal status (and thus the liability) of European national space agencies, *Dr. E. Galloway* (USA) addressed the question of "Law, Science and Technology for the Moon/Mars missions." She pointed out that, whereas there are a number of space law principles applicable to the Moon and other celestial bodies, the Moon Agreement (1984) has been ratified by only seven States and contains controversial provisions concerning the common heritage concept and the proposed international regime. She advocates in-depth studies of the various problems with a view to the possible review of the Treaty by the U.N. General Assembly scheduled for 1994. Science and Technology for the exploration and exploitation of the celestial bodies are still being developed. Therefore, *Mrs. Galloway*, apart from suggestions for studies with regard to the review of the Moon Treaty, recommends that the Scientific-Legal Liaison Committee of the IISL, and the International Academy of Astronautics, should select for its 1992 symposium the subject of "Exploration and Uses of the Moon and Other Celestial Bodies," including an analysis of the Moon Agreement.

The question of the review of the Moon Agreement was also dealt with by *Mr. Andrei Terekhov* (USSR and U.N. Office of Legal Affairs). He described several possible scenarios in the General Assembly, including the adoption of a short resolution reaffirming the existing treaty system or a resolution calling for a major revision. Other possibilities are the adoption of an additional protocol or of an "agreed understanding" of the Agreement. The question of which state is to be considered the "launching state," and thus internationally liable for the consequences of the use of nuclear power sources in outer space, was addressed by *Dr. W. Hampe* (Halle, Germany). He expressly advocates channeling the respective obligations to the state where the object is registered, or which exercises or plans to exercise jurisdiction and control over it.

Two other papers addressed the legal aspects of military uses of outer space: "Satellite Verification and Arms Control in Europe" *(Dr. W. von Kries,* Germany), and "Military Space Observation as Customary International Law" *(Dr. J. Kuskuvelis,* Greece). The question of who, or which agency, will be in charge of European satellite verification is not easy to answer. At this point, the European Community does not seem to provide the legal framework. On the other hand, in 1983 ESA stated that "the European countries can, if they so wish, carry out a programme for the technical development and production of a (verification) satellite system

within the framework of ESA. Such a programme is fully compatible with cooperation for peaceful purposes in the space field."

Toward the end of the session, *Prof. N. Sybesma-Knol* (Belgium) pointed out that in listening to the various contributions, she had noted that, where space law is now rapidly adapting to very pragmatic and practical problems, there still seems to be an apparent uncertainty over the fundamental concepts of the law of outer space. The legal significance of notions such as common good, interest, mankind, jurisdiction and control, exploitation, use, personnel on board, launch, damage, space object, had been addressed by a number of speakers, but the overall impression had remained one of uncertainty. She asked for an IISL effort towards a "restatement of the law of outer space," to work toward a consensus with regard to the definition of some of the basic concepts in the various space law treaties.

The last speaker, *Mr. Mark Williamson* (USA), stressed the intimate relationship between space law and space technology, and the importance of increasing interaction between space lawyers and space technologists. In this respect, a definition of terms is of the essence. The very fact that there is no internationally agreed upon definition of the term "outer space" exemplifies the problem. The presented paper offers a logical framework for definitions of the most common space law terms.

In the discussion following the presentations of papers, *Stephen Doyle* (USA) pointed out that, when IISL began its work, seven working groups were established with the very purpose of collecting the views of lawyers from different parts of the world on some of the basic issues of space law. These views were then to be brought before the General Assembly of the IISL. However, as it turned out, this system worked as a divergent rather than a convergent influence: IISL became "a digesting collection of divergent ideas" whose task it is not to collect and consolidate. In the opinion of the speaker, this approach should not be changed. As to the question of the quest for definition, he wanted to draw attention to a Permanent Committee of the International Astronautical Society, where lawyers are invited to participate.

Following comments by *Prof. S. Gorove* on the outstanding contributions to the Colloquium, *Prof. Vereshchetin* pointed out that the question of definitions will be addressed at next year's Colloquium in Montreal. Furthermore, he answered *Mr. Kuskuvelis*'s paper, by saying that in his opinion spying is not permitted under international law, but that the concept of "open skies" will provide the solution to this question. In conclusion, the President expressed her thanks to all participants and attendees for their valuable presentations and interest which has again made the annual Colloquium a real success.

I.H. Ph. Diederiks-Verschoor
President, International Institute of Space Law (IAF)

Comments

Space Debris and the United Nations

Over the last few years, space debris has become a matter of increasing concern and has been identified as a serious threat to man's exploration and utilization of outer space. This has been indicated in various studies conducted at both the national and international level. Recent studies have been made in the Federal Republic of Germany, in the United States by a Government Interagency Group co-chaired by NASA and the Department of Defense, by the European Space Agency, by COSPAR, the Committee of Space Research of the International Council of Scientific Unions, and the IAF, the International Astronautical Federation.

The term "space debris" is somewhat vague. It is normally understood to mean both various mission-related objects that are left in outer space, such as spent rocket stages, shrouds, covers, non-operational payloads, *i.e.*, inactive satellites, as well as fragments from explosions and possibly collisions. It is this last category - debris from satellite break-ups - which is the largest and fastest growing part of the population of space debris. It represents close to 50 percent of all trackable objects which is currently more than 7000. The untrackable population, which is believed to be somewhere between 30,000 and 70,000 objects, is almost entirely made up of fragmentation debris. More than 95 percent of the total space debris population - larger than 1 cm - is estimated to originate from explosions.

Of the 7000 trackable objects, only a few hundred, or some 5 percent, are active satellites, while the rest do not perform any useful function. The primary source of information on space debris is NASA and the North American Aerospace Defense Command (NORAD). NORAD's operational system, using ground-based radars, can detect objects with diameters of between 4 cm and 10 cm in low earth orbits. Objects down to 1 cm diameter can be tracked on a non-operational basis by optical telescopes.

The most prolific source of space debris is explosions and other break-ups. The first in-orbit fragmentation of a satellite occurred in 1961 when an Ablestar rocket upper stage exploded two hours after launch. The explosion generated more than 270 tracked fragments. Since then, some 90 explosions and break-ups have been recorded. The worst single case of a break-up in history was when the Ariane V16 rocket exploded in November 1986, producing about 460 trackable fragments at orbital altitudes from 430 to 1350 km.

While explosions are the primary source of debris today, there is evidence that high-speed impacts between two satellites or other objects may create up to 10 times as many debris fragments as an explosion. Most of the fragments from hypervelocity impacts are too small to be observed.

Collisions and secondary collisions in an escalating chain reaction might, in the worst case scenario, create an ever increasing amount of

debris in low earth orbit, which could then pose a major threat to manned as well as unmanned space missions.

There is no strong evidence that fragmentation due to hypervelocity impacts has already occurred. According to the ESA report referred to, the self-sustained debris production by collision is a long-term concern. In the words of the report, "it is however the most far-reaching threat which could terminate all space activities." The report concludes that this matter requires further careful study.

The U.S. Interagency Report on space debris concludes that, left unchecked, the growth of debris could threaten the safe and reliable operation of manned and unmanned spacecraft in the next century. A major finding of the report is that not enough is known about the extent of the problem posed by small debris in the orbital environment. The report underlines that the limited ability to detect and track the much greater number of small debris objects creates high uncertainty in the debris environment models that have been constructed by scientists. The conclusion is that this makes it difficult to assess the true risk posed to spacecraft by orbiting debris.

Despite these uncertainties scientists have tried to make calculations of collision probabilities. The results indicate that the collision probability is relatively low for normal satellites; it has been calculated to be well under 1 percent for a 10-year mission of a single manned module. For larger objects, however, impact probabilities appear not to be negligible. For a 10-year mission of a space station there is an estimated 3 to 5 percent probability of a collision with objects larger than 1 cm.

The collision danger seems to be increasing. In fact it is likely to increase in the future even if the level of space activities remains approximately the same. The reason is, of course, that new debris is generated in any collision of two objects. Because of the extremely high speed between a piece of debris and the target, the impact of even a very small object may cause considerable fragmentation of a satellite.

Space debris will also have a negative influence on astronomical observations. Astronomical satellites, such as the Hubble Space Telescope, will suffer from the light reflected from space junk, which can damage or degrade the detectors in the Telescope's spectrograph. Calculations show that there is approximately a 1 percent chance that the Hubble Space Telescope during its projected 17-year lifetime will be destroyed by a collision with a large piece of space junk.

What then can be done to combat the increasing pollution in outer space? As the ESA report points out, the objective should be to minimize the consequences of the existence of space debris and to minimize the creation of additional space debris.

Little can be done about debris which is already in orbit. Man-made cleaning actions are essentially beyond present capabilities. It is, however, worth recalling that the U.S. Space Shuttle recently carried out a very impressive retrieval of an old satellite.

Various preventive measures have been proposed:

1. Improvement in the design of rockets and satellites, which could reduce the amount of mission-related debris produced during launching and operation phases. One obvious measure would be to provide spacecraft with improved shielding. The U.S. Interagency Report recommends that debris minimization be made a design consideration for all future civil, military and commercial launch vehicles, upper stages, satellites, space tests and missions.

It has been suggested that the avoidance of intentional explosions, and prevention of accidental explosions would cut the number of debris objects in half. The ESA report cites experiments designed to destroy other objects in space, such as the Strategic Defense Initiative or Soviet anti-satellite experiments, as the most undesirable cases from a space environmental point of view.

2. Speeding up of the decay of non-functional objects and payloads after they have terminated their active function. Because of natural orbital decay, more than 11,000 space debris objects have so far re-entered the earth's atmosphere. The vast majority of them burned up before impact. One way of speeding up orbital decay could be to increase the atmospheric drag, *e.g.*, by using balloons that would inflate at the end of the active life of a spacecraft.

3. Removal of inactive satellites at high orbits, where space objects have a long residence time, and placing them into disposal orbits at altitudes which are not used for active missions. This method has been used for quite a few satellites in the geostationary orbit.

Turning to some of the legal aspects of space pollution, it appears that the body of international law relevant to the impact of space activities on the environment provides only general norms of behavior rather than specific rules and standards.

The 1967 Outer Space Treaty lays down a broad principle establishing a general international obligation not to undertake activities that would adversely affect the space environment.

Article IX of the Outer Space Treaty obliges States Parties to the Treaty (i) to conduct all their activities in outer space and on celestial bodies with due regard to the corresponding interest of all other parties, (ii) to conduct exploration of space and celestial bodies with appropriate measures to avoid either harmful contamination of outer space or adverse changes in the environment of the earth resulting from the introduction of extraterrestrial matter, (iii) to undertake consultations if such activities would cause potentially harmful interference with activities of other parties. If a State Party has reason to believe that planned activities by

another State Party would cause potentially harmful interference with its peaceful activities in outer space, it may request consultation concerning such activity.

The Liability Convention of 1972 covers damage from activities that relate to the space environment. In the case of damage to a space object of one State by the space object of another State, the latter State is liable if the damage is due to its fault or the fault of persons for whom it is responsible.

The problem is, of course, that claims for damage caused by small pieces of space debris would have to be substantiated. In most cases, it would probably be difficult to establish the identity of the launching State and, therefore, to invoke the Liability Convention.

The Registration Convention of 1976 requires States Parties to register their launchings with the United Nations but it does not require notification if the launched object explodes or fragments.

The question arises as to what should be the role of the United Nations in dealing with the problem of space debris?

It is clear that the major spacefaring nations will have to assume a special responsibility in addressing the problem. They are also the ones that are most immediately affected by the growing amount of space debris.

But it is equally clear that this problem cannot be solved by one or two nations alone. The U.S. Interagency Report underlines that the United States cannot address the debris issue alone without the cooperation of other governments. It recalls that several other nations and organizations have contributed to the debris environment through their space activities and refers to the Soviet Union as the largest generator of new space debris. In the words of the report, "responsibility for space debris also extends to all nations and organizations that operate launchers and satellites."

Space debris is a global concern, which requires the attention and active involvement of the international community. Pollution of the space environment and the increasing risks of collisions between space debris and spacecraft reduce the accessibility of space for all countries.

The Outer Space Treaty lays down that the exploration and use of outer space shall be the province of all mankind. The common interest of all mankind in the progress of the exploration and use of outer space for peaceful purposes is equally well established.

The appropriate international forum to discuss this serious and growing problem is the United Nations and, more particularly, its Committee on the Peaceful Uses of Outer Space.

For the time being the United Nations can do very little about space debris for the simple reason that it is not included on the agenda of the organization. The question of space debris has been raised within the context of the Outer Space Committee, but it has not been recognized as an independent item on the agenda of the Committee or its two Sub-Committees - the Scientific and Technical Sub-Committee and the Legal Sub-Committee. This is indeed regrettable, because it means that space debris does not get the international attention that it deserves.

At the 1989 session of the Outer Space Committee, Sweden together with Australia, Belgium, Canada, the Federal Republic of Germany, the Netherlands and Nigeria proposed that the issue of space debris be put on the agenda of the Scientific and Technical Sub-Committee (U.N. Doc. A/AC/105/L.179). The purpose was to initiate an exchange of views and information of a technical nature, thereby sensitizing member States to the problem. There was no consensus on this proposal. Both the United States and France were of the opinion that it was premature to include space debris on the Sub-Committee's agenda.

Despite the divergent views, the Outer Space Committee agreed that space debris is an issue of concern to all nations. The Committee also considered it essential that more attention be paid by member States to the problem of space debris and other aspects of space debris. The Committee called for the continuation of national research on this question.

This language was incorporated into the U.N. General Assembly Resolution on International Cooperation in the Peaceful Uses of Outer Space which was adopted in December last year (Res. 44/46). This is the annual resolution which gives the Outer Space Committee and its two sub-committees their mandate. The resolution also recommended that more attention should be paid to all aspects related to the protection and the preservation of the outer space environment, especially those potentially affecting the Earth's environment.

That was the first time that the General Assembly has pronounced itself on the question of outer space environment and space debris. This in itself is an encouraging development that no doubt reflects the growing awareness of the problems relating to space environment.

Sweden shares the view expressed in the U.S. interagency study and the ESA report that more knowledge is needed, particularly concerning smaller space debris. That is why this issue needs to be considered in a scientific and technical context. Sweden does not hold the view that the United Nations should start working out regulations or elaborating legal principles regarding space debris. This would be premature. What is needed is a better scientific and technical understanding of the problem, not only among the major spacefaring nations but in the international community as a whole.

There is no disagreement about the potential threat and seriousness of space debris. The United States has contributed enormously to the knowledge and understanding of the problem. In fact, no other nation is probably more affected by the threat of space debris than the United States.

But Sweden does not share the view that it would be premature to bring the issue of outer space environment to the attention of the United Nations. On the contrary, it is only through the active involvement of the international community that this issue can be effectively addressed.

It is our firm conviction that the United Nations must continue to plan an important role in international space cooperation. The vitality of the work of the United Nations in the field of outer space very much depends on the ability and will of member States to raise and deal with the

real issues in an open and pragmatic way. If the important problems are dealt with elsewhere, then there is a risk that the role of the United Nations in the field of outer space will be gradually eroded.

Such a development would appear paradoxical at a time of extraordinary improvements in the international climate and when the conditions for international cooperation have not appeared more favorable in many years.

Stefan Noreén
Counsellor, Permanent Mission of Sweden to the UN

Short Accounts

National Space Outlook Conference

This conference - sponsored by the National Space Club, June 18-20, 1990, Tyson's Corner, Virginia - the tenth in an annual series, heard survey papers and critical panels evaluating the United States' national space program outlook. The conference traditionally devotes one day to civil space programs, one day to defense space programs, and also includes Congressional, senior OMB, academic, and press representation in panels which assess and comment on current programs and future prospects in the space arena.

The conference opened on Monday evening, June 18, with a panel that was in essence a keynote session. The panel's topic was "The Rebirth of America's Space Program," an allusion to the post-Challenger disaster recovery. Fiscal constraints on federally funded programs were raised early in the program and were repeatedly discussed during the three days. Other critical questions that arose early, and were often repeated, were:

- Can the United States afford an expanding space program?
- Should money be spent on space activities when so many terrestrial problems cry out for solutions, problems such as federal deficits, AIDS, drugs, gang wars, education, and other social needs?
- Why do we need to rush to return to the Moon and go to Mars? Is the Space Exploration Initiative timely, appropriate, and justifiable?
- Is all the investment in space assets and space technology by the Department of Defense needed or appropriate in the changing conditions of world politics?
- Why continue investing in expensive strategic space assets when peace is breaking out?

The thrust and content of the presentations by civil and defense program officials during the three days either directly, or by implication, addressed and proffered answers to these questions.

A major attraction of this annual Space Club program is the Club's ability to obtain participation by the highest level officials in the involved

agencies. The Administrator of NASA and the key Associate Administrators present well-illustrated, authoritative, and documented overviews of their respective program areas of responsibility. In defense program presentations, the Club involves Commanders of the Space Commands of the three services, as well as the integrated National Space Command leadership, senior officials of DARPA, the Office of the Secretary of Defense, and key Assistant Secretaries or their Deputies, to present defense program policies and overviews. Key Congressional Staff members, as well as occasional Representatives and Senators, take the time to contribute effectively to the conference program.

In their presentations, the civil program officials used terms like "optimistic," "bullish," "excited," and "stimulated" to describe their own attitudes toward the future of the civil programs they discussed. The defense area spokesmen referred consistently to their programs as "exciting," "challenging," and "holding great potential." But all speakers noted the current stress of the Congressional funding gauntlet, and bemoaned openly the excessive level of Congressional micromanagement in civil and defense areas.

One of the senior military speakers addressed himself to the management of the National Space Club and the organizers of this annual conference, saying:

> This is an excellent forum for presenting the strengths and merits of our national programs, but sometimes I think we talk too much to ourselves. You need to expand the audience of this program and reach a broader segment of the public than just the agency employees and contractor organizations represented here.

This was a rhetorical exhortation, and there was no immediate response by Space Club officials, but it would not be surprising to find the Space Club moving its annual Outlook Conference to a larger forum, expanding the agenda to include commercial space activities, and seeking to reach a broader audience.

Publication of the proceedings of the conference is restricted to the registered participants. It is unfortunate that the Space Club does not see its way clear to publish some number of the proceedings for inventory so that other interested parties might gain access to the information presented. There are very few well documented and officially presented overviews that are as complete, authoritative and stimulating, with reference to national policy issue debates as are the proceedings of this annual conference. The Space Club should find ways to make this material more broadly available. The Club might also provide a very valuable service if it could transcribe the substance of the exchanges and debates that take place during the interesting and provocative panel sessions.

A consistent theme that pervaded all of the program presentations was optimism looking toward a dynamic and exciting future. Although speakers allowed that there would be problems convincing a beleaguered

Congress that each program presented should be fully funded, each speaker seemed to believe that his or hers was the exceptional program that deserved to be saved from necessary spending controls and budget cuts. One has to wonder whether or not the speakers really believed what they were saying, or if they were just posturing their programs in the best possible light to present them before Congress.

In the final analysis, the reality of the budget will drive the necessary choices to be made and priorities to be established. It seems unfortunate that in this manner, the choices wind up being made by legislators who are very busy and poorly informed on the details and consequences of their choices. They would probably prefer that the officials in the agencies involved should set priorities and make hard choices. But, as we all know, such is not the habit of a bureaucracy.

Stephen E. Doyle
Aerojet Propulsion Division
Sacramento, California

64th Conference of the International Law Association, Queensland, Australia

From 19 to 25 August 1990, the International Law Association (ILA) held its 64th Conference in Queensland, Australia. During the Conference the ILA Space Law Committee held a well attended public session. At this session, it was welcome news that the ILA and its Space Law Committee had recently been granted the status of Permanent Observer in the United Nations Committee on the Peaceful Uses of Outer Space (COPUOS).

The discussion that took place during the session was a further step in the work of the ILA Space Law Committee on "Environmental Aspects of Activities in Outer Space." In view of the fact that, as reported by technical experts, by now some 70,000 pieces of space debris create a growing risk for space activities and, especially, nuclear power sources in space create an increasing risk for life on the surface of the Earth, the ILA had decided at its 1986 conference in Seoul that the Space Law Committee should study the respective legal aspects. This had been done through communication between members of the Space Law Committee as well as by a number of meetings such as those of the International Institute of Space Law and, especially, the interdisciplinary international colloquium organized by the Institute of Air and Space Law of Cologne University in 1988 which brought together leading technical and legal experts. On the basis of a further mandate which the Warsaw Conference of the ILA in 1988 had given to the Space Law Committee, an international exchange of views and information was started in order to clarify the present status of the law and identify possible options and suggestions for the future.

On the basis of the respective report presented before the Conference by the Rapporteur of the Committee, *Prof. Maureen Williams* (Argentina), as well as on the basis of the discussion at the session in

Australia, there was agreement about the need to elaborate new rules and also on certain "principles and guidelines" regarding relevant obligations of States. Consensus was further reached that, on the basis of the work done so far, the ILA Space Law Committee should now start work on drafting an international instrument. It was not finally decided what the character of this instrument should be, especially whether it should be a treaty, a protocol or merely a set of recommended practices. This result was included in a Resolution which, on the basis of the Space Law Session, was passed by the General Conference of the ILA during its final session.[1] In the meantime, the relevant work of the ILA Space Law Committee has already started by further exchange of views among Committee Members supported by two leading international technical experts in the field: *Prof. Rex* (Braunschweig) and *Prof. Perek* (Prague).

Karl-Heinz Böckstiegel
Chairman of the ILA Space Law Committee

"Law and Outer Space," Second Annual Symposium

The Second Annual Symposium on the Law of Outer Space was held on September 14-15, 1990, at the Georgetown University Law Center in Washington, D.C. *John T. Stewart, Jr.*, a partner with the law firm of Zuckert, Scoutt and Rasenburger served as program director.

Following *Mr. Stewart's* opening remarks, *N. Jasentuliyana*, Director of the U.N. Outer Space Affairs Division, gave the keynote address on "Space Commerce on a Global Scale." In it, he reviewed briefly the role of the United Nations in establishing principles and rules for the international community to govern space activities. He stressed that the making of international space law remains an open and evolving process with much work yet to be done. He noted that the use of satellites for telecommunications is commercially the most significant and rapidly growing space activity.

Jasentuliyana drew attention to national and international communications satellite networks and elaborated on the role that the International Telecommunication Union plays in the international coordination of communication satellites. He highlighted some of the compromises reached at the 1985 and 1988 World Administrative Radio Conferences. He also dwelt on issues pertaining to competition among satellite launch service providers and pointed out that there have been concerns expressed that government bureaucracy could be a significant impediment to the development of private launch services. He felt that high insurance costs could be reduced if the international market for launchings could be opened up. In conclusion, he emphasized that expert legal advice was also needed by the users of space technology, especially insofar as it concerned questions of intellectual property rights.

1. For a text of the Resolution, see CURRENT DOCUMENTS in this issue of the Journal of Space Law.

E. Tazewell Ellett, a partner in the law firm of Hogan and Hartson, moderated the first panel discussion on legal issues encountered by the satellite provider. The participants included: *Joel S. Winnik*, a partner with the law firm of Hogan and Hartson; *Leslie A.L. Borden*, General Counsel of the American Mobile Satellite Corporation; and *Samuel J. Wilson*, Vice President and General Counsel of GTE Spacenet Corporation who elaborated on business and legal issues facing the satellite provider and discussed risk allocation. The second panel was chaired by *S. Neil Hosenball*, a partner with the law firm of Davis, Graham and Stubbs, and was devoted to satellite service business and legal issues. The panelists consisted of: *Martin Rothblatt*, President of MARCOR, Inc.; *David Aylward*, a consultant with Columbia Communications, Inc.; and *Philip Schneider*, President of Geostar Inc., Messaging Corp.

The third panel, moderated by *Irene Elizabeth Howie*, Assistant Chief Counsel of the FAA, addressed transnational issues with the participation of: *Eduard Marissens*, of Marissens, Colpaert and Partners; *Bruce Kraselski*, of Davis, Wright and Tremaine; and *Stephanie Lessard*, of Ogelvy and Renault. *Marissens* highlighted European Community issues relating to the area of commercial satellites by giving two examples (F.R.G. and Belgium) of national regulatory circumstances. He elaborated on the future Community law toward Europe-wide systems and services and on the relevancy of the E.C. Commission's own directives on competition in the market for telecommunications terminals and services. *Lessard's* presentation concentrated on the history and overview of satellite applications in Canada and various aspects of satellite telecommunications, remote sensing and materials processing in space in Canada.

The fourth panel was moderated by *Paul G. Dembling*, a partner with the law firm of Schnader, Harrison, Segal and Lewis. It included *William K. Coulter*, Vice President, Government Affairs, COMSAT, and *Rachel B. Trinder*, a partner with Zuckert, Scoutt and Rasenberger. *Coulter* spoke on regulatory developments raising the question of how can non-market economies be regulated in places where there is no cost-based pricing and no uniform policy regarding asset evaluation. *Rachel B. Trinder* highlighted recent developments in environmental and contractual issues as well as issues of sovereign immunity arising in recent litigations.

The Symposium also included presentations of selected student papers on various space law topics before a panel of three judges consisting of *Professors Stephen Gorove, Paul Larsen and Francis Lyall.*

Stephen Gorove
Director of Space Law and Policy Studies
University of Mississippi Law Center

Space Debris: Scientific and Legal Round Table

The IAA/ IISL Scientific/Legal Round Table held on October 11, 1990, during the annual IAF Congress addressed some of the many issues presented by the increasing amount of space debris. The Round Table

Discussion commenced with *Dr. Lubos Perek*, from the Czechoslovak Academy of Sciences, presenting a paper on the "Technical Aspects of the Control of Space Debris." In his paper, he touched on possible measures available for preventing and dealing with space debris, and concluded that "the political will necessary for a decisive action on the problem of space debris has not yet emerged." He began his speech with the stipulation that the term "space object" includes "space debris," rendering the Liability Convention applicable. He then documented that the number of catalogued space objects grew between 1975 and 1990, except for two periods of decreasing numbers of space objects: from 1978-1980, and from 1988-1990. He explained that the lifetime of debris at altitudes above 1000 km would be about 2000 years, from 900 km to 700 km would be measured in centuries, and from 700 km to 600 km would be measured in decades. As a result, at altitudes below 600 km, the solar cycle plays a more important role in the dissolution of space debris, with the rate of the decay depending on the level of solar activity. He also mentioned that debris smaller than 4 cm at lower earth orbits or below 10 cm at an altitude of 1000 km cannot be detected by present day observing devices. Nevertheless, he estimated that the number of non-trackable debris exceeds the number of trackable objects by 800 percent.

With this technical background, *Dr. Perek* mentioned four measures that could be taken to prevent debris: solving the problem from a design perspective, because most of the debris is connected with the separation of stages and with removing parts which served their purposes during the initial phases of the mission; averting unintentional explosions; prohibiting intentional explosions via international agreement; and cutting down on the number of space missions, by looking at their merits as well as their possible impact to the environment (for example, reassess the nuclear power reactors in space and analyze carefully the proposals to dump nuclear waste in space). Also suggested were measures to remove debris already in space and methods to improve the flow of information and to avoid collisions.

The next speaker was *Mr. Joseph Loftus, Jr.*, Assistant Director of the Lyndon B. Johnson Space Center. He presented a paper on "United States Studies in Orbital Debris: Prevention and Mitigation," co-authored with *Andrew E. Potter*. *Mr. Loftus* noted that one-half of fragmentation debris comes from intentional explosions (with the U.S. and U.S.S.R. contributing most of that amount) and that there had been four significant break-ups a year. He highlighted the fact that NASA has begun a series of informal agreements with a number of countries including Japan, Canada, U.S.S.R., Germany, Australia, India, China, as well as with ESA and CNES. *Mr. Loftus* then discussed in detail the different actions that could be taken to remove objects from space.

The third speaker, *Mr. Stephen Doyle* from Aerojet Propulsion Division, Sacramento, addressed possible institutional solutions to the regulation of space debris in his paper entitled "Regulating Space Debris: What Can be Done About It?" In analyzing the different fora available for dealing with man-made space debris, *Mr. Doyle* concluded that the

International Telecommunications Union (ITU) offered more of the desirable characteristics as a forum if one were to choose from the currently existing fora. His reasoning was that: (1) the ITU has an interest in managing the potential impact of debris for the effective operation of space telecommunication systems; (2) the ITU has in place an organizational structure and a system for study and developing recommendations, agreed procedures, or regulations; (3) the ITU is a specialized agency of the UN and, as such, coordinates its work with UNCOPUOS; and (4) the ITU has access to the world's leading experts.

Mr. Doyle noted that COPUOS could also deal with debris issues, but pointed out that there was not yet enough support to place the issues on the Committee's agenda and that the Committee normally takes years to complete a final product in its consensus procedure. He also referred briefly to the proposals to create a new international organization for space issues, but noted that once again there was not yet enough support for this proposal. *Mr. Doyle* continued by summarizing the various actions which could be taken to ameliorate the debris problem and concluded by mentioning other legal issues that need to be resolved to handle the debris situation more effectively.

Prof. Dr. Ing. Dietrich Rex, from the Institute for Space-Flight Engineering and Nuclear Reactor Technology at the Technical University of Braunschweig (FRG), served as the commentator for the Round Table. He questioned *Mr. Doyle's* proposal to have the ITU deal with issues of space debris. He also suggested that the launching state should remain responsible for its objects forever. In agreeing with *Dr. Perek's* paper, *Dr. Rex* pointed out that the area from 500 km to 1000 km has the most particles, but that the risks are not too large today, because of the self-cleaning effect in this realm. He stressed, however, that the area from 1000 km through the Geostationary Orbit was most sensitive to permanent overcrowding, because there objects had infinite lifespans. Consequently, he suggested that there be different rules for each orbit, with intentional breakups only occurring in lower orbits, where fragments dissolve more readily.

In the ensuing discussion, *Mr. Jasentuliyana*, Chief of the UN Outer Space Affairs Division, stressed that informal regulatory principles were to be preferred, where there was some degree of flexibility. He acknowledged that as space activities expand, new mechanisms for dealing with debris may be necessary.

Prof. Katherine M. Gorove
University of Mississippi
Law Center

Other Events

On October 23-24, 1990, a conference on Earth Observations and Global Change was organized in Washington, D. C. by NASA, NOAA and the Environmental Research Institute of Michigan.

TECHNOSPACE 90, the International Space Industries and Technologies Exhibition was held on November 6-10, 1990, in Brussels, Belgium. The conference was an opportunity for space professionals to learn more about the current dynamics shaping international and national space policies and also learn about emerging new technologies.

"Mobilizing Resources for Development" was the theme of the Africa TELECOM 90 sponsored by the International Telecommunication Union on December 3-9, 1990, at Harare, Zimbabwe.

Brief News

The **United States** is expected to launch a mission to Mars by 2019 . . . Pioneer 2 has become the fourth spacecraft to leave our solar system following on the heels of Pioneer 10, Voyager 1, and Voyager 2 . . . The Voyager 1 satellite transmitted pictures showing the solar system from a perspective beyond the farthest planets. . . The U.S. Air Force's Combined Release and Radiation Effects Satellite (CRRES) was successfully launched on an Atlas 1 launch vehicle. . . The hydrogen leak that grounded the space shuttle was caused by glass beads that damaged a fuel connector on a seal.

Both Houses of the Hawaii Legislature have approved a bill that bans the launching of nuclear-powered spacecraft from the proposed Hawaiian spaceport . . . Budget cuts all but eliminated the X-ray laser as a future weapon . . . An independent Advisory Committee on Future of the U.S. Space Program has been formed to review and evaluate all NASA programs and strategies for future space developments. . . The administration appears opposed to placing the remote sensing LANDSAT satellite program into the commercial sector.

According to a recent Congressional report, it may cost more than twelve billion dollars to build the proposed National Aerospace Plane. The plane's first sub-orbital flight may occur in 1997 and its first flight into orbit in 1999. With a speed of 17,500 m.p.h. the plane should reach any point on Earth in less than two hours . . . The U.S. Air Force is developing a new jam-resistant communications satellite, MILSTAR . . . The Spacelab experiment is not expected to be on any shuttle missions in the near future due to technical problems . . . The building of an Antarctica test facility, as a simulation of conditions on Mars to see if humans could withstand the rigor of living on Mars, is being considered by NASA and NSF . . . NASA's plan for its new Commercial Experiments Transporter (COMET) program involves the development of free-flying experimental satellites. . . The Magellan mission is expected to be completed by June 1991 . . . NASA's Microgravity Laboratory to be manned by an international crew is expected

to be launched aboard the Space Shuttle Columbia in March 1992 . . . A telerobotic system to automate assembly in space is to be developed by NASA . . . The Brilliant Pebbles experiments, which involve the launching of interceptors from missiles into suborbital trajectories, may begin in 1991.

Afrispace, Inc., a new satellite broadcasting firm, seeks FCC approval for Lightsat, a satellite and broadcasting system to offer direct radio broadcasting over the entire African continent . . . The National Oceanic and Atmospheric Administration (NOAA) is considering the use of smaller satellites, microsats, to perform much of its data-gathering functions . . . The International Space University may establish a central campus and auxiliary campuses by 1992.

U.S. and European space officials plan to promulgate rules to govern the growing commercial space launch industry . . . NASA and the **European Space Agency (ESA)** plan to build the Cassini spacecraft to be launched in 1996 to explore Saturn's system, including its giant satellite Titan . . . ESA plans to build its own orbiting space station by 2003 . . . ESA and the **Soviet Union** signed a ten year agreement to cooperate in exploration and use of space for peaceful purposes . . . The United States and the Soviet Union have tentatively agreed to have a Soviet cosmonaut on a future space shuttle mission and an American astronaut aboard the MIR space station . . . Soviet experiments indicate that long-duration space flights cause no serious medical problems and that the level of radiation around Mars is sufficiently safe for astronauts or cosmonauts . . . The Soviet Cosmos 2082 Satellite is to monitor and overtake enemy communications and radar signals . . . The Soviet Buran is to test a research vehicle for the MIR space station crew next year . . . The Soviet Zenit rocket carrying a reconnaissance satellite exploded on October 4 1990 shortly after lift-off from the Baikonur cosmodrome . . . Precarious economic conditions have prompted the Soviets to cut their space program's budget.

ESA and **Japan**'s National Space Development Agency (NASDA) have agreed to share remote sensing data as well as space plane design information. Japan is the third country to put a spacecraft in orbit around the Moon. Several large Japanese aerospace corporations, banks, and insurance companies have formed a new company, Rocket Systems, Inc., to assist Japan in entering into the commercial space launch market . . . The first Japanese shuttle astronaut on the Spacelab 2 mission is to be aboard on Atlantis late in 1991 . . . Japan plans to launch two astronomy satellites to furnish data on early developments in the universe . . . The first Japanese reusable spacecraft is planned for 1994 . . . Japan also expects to launch an advanced transmission technology satellite by 1993 and its own space station by 2010.

An Ariane-4 launch on November 20, 1990 placed two American satellites in geostationary orbit . . . SPOT Image barred public release of their satellite images of the Persian Gulf crisis . . . The major broadcast news organizations have been utilizing **INTELSAT** technology to keep track of events pertaining to the crisis . . . **EUTELSAT** launched its first

EUTELSAT 2 satellite leading up to the establishment of a satellite television system.

The **German** ROSAT satellite, designed to use x-rays to view the stars, was successfully launched from Cape Canaveral . . . The **Norwegian** Space Center may expand its Andoya Rocket Range in anticipation of an increasing demand for suborbital microgravity and small satellite launches . . . **Austria** plans to have its cosmonaut aboard the MIR space station by November 1991 . . . **Romania** joined EUTELSAT to improve its communications capabilities.

China has successfully launched its Long March 2E rocket from a launch site in the Sichuan province. It also launched the communication satellite "ASIA-I" of the Hong Kong Asian Satellite Company at the Chinese Xichang Satellite Launch Centre, using the Long March-3 (LM-3) launch vehicle. The satellite was made by the U.S. Hughes Company.

Increased demand for domestic satellite services by Asian countries is prompting **ASIASAT** to develop plans for building a second satellite by 1994 . . . **Australia** plans to develop its own mobile satellite service and make it operable by 1992 . . . **South Korea** expects to launch its own satellite by 1993 . . . An international group of scientists prepares to place microwave and laser transponders on the Moon to measure the distance between the Earth and the Moon.

B. FORTHCOMING EVENTS

The Aviation and Space Law Section of the Association of American Law Schools (**AALS**) is scheduled to have a program on "**The Space Station: Problems of Jurisdiction and Conflicts of Law**" at the Sheraton Washington Hotel on **January 5, 1991 in Washington, D.C.**

A **Conference on the Law, Policy and Commerce of International Air Transport and Space Activities,** organized by the Graduate Institute of European Studies, Tamkang University, Taipei, Taiwan and the International Institute of Air and Space Law, Leiden University, The Netherlands, is expected to be held **May 26-31, 1991 in Taipei,** Taiwan.

The 34th **Colloquium on the Law of Outer Space** will be held in **Montreal** in **October 1991.** Topics to be discussed include: (1) legal aspects of settlements on the Moon and Mars; (2) definitional issues in space law (only invited papers with open discussion to follow); (3) legal implications of nuclear power for satellites; (4) other legal subjects.

The 6th **World Telecommunication Exhibit and Forum** will be held **October 7-15, 1991 in Geneva,** Switzerland.

BOOK REVIEWS

Law and Space Telecommunications, by Francis Lyall (Dartmouth, 1989), pp. 428.

Francis Lyall of the Department of Public Law at the University of Aberdeen in Scotland has written a comprehensive and easily comprehensible tome on satellite communications and the law. U.S. domestic law is treated in terms of an analysis of the Communications Satellite Act of 1962. However, most of the book is devoted to international law and institutions. There are chapters on the ITU, INTELSAT, INMARSAT, INTERSPUTNIK and ARABSAT, and European organizations such as ESA and EUTELSAT. Further, the work of the U.N. Committee on the Peaceful Uses of Outer Space is concisely surveyed.

The analysis of the law and the institutions emphasizes international cooperation and consensus building on such issues as frequency allocations, allocations of slots on the geostationary orbit, and the development of voting arrangements, management structures and budgets in international organizations. Competition is analyzed in terms of the "leadership" role of the United States and the technological challenge from fiber optic cables. *Lyall* brings the story up through an assessment of WARC-ORB '85-'88.

One theme that *Lyall* demonstrates is that the development of technology and new institutions did not take place in a legal vacuum. Law influenced the way technologies have been introduced into the global marketplace. This is not a case of technological determinism. Another theme that *Lyall* develops is that law has not been subservient to narrow political interests. For instance, he writes that the agreements establishing INTELSAT "have been drafted to ensure that politics extraneous to the creation and maintenance of the satellite communications system is kept, as far as possible, from the organization's business." The ITU is also deemed to be a successful functional international organization, but *Prof. Lyall* regrets the recent politicization of some deliberations.

The conclusions to the book are a bit abrupt. "History . . . leads me to suspect that U.S. Law may become international space law - unless we foreigners are very careful and determined." This conclusion, castigating the U.S., is questionable because it is not supported by his analysis and assessment of the role of the ITU, in which politicization is said to be due to the less-developed countries, or to his description of the successful evolution of INTELSAT. I would think that the conclusions should be more integrative of his points on the relation between law and technology and law and politics, rather than as specific and pointed as they are.

The index to this book is rather brief. The work of *David Leive* is well developed in the text, but there is no index reference to him. Although there is extensive analysis of voting arrangements in various organizations, there is no reference to voting in the index.

This reader would have liked to see the text enlivened by a few graphics, *e.g.* the GSO slots, and tables, *e.g.* on frequency allocations.

Criticisms aside, this is a clear, well-organized and thorough description and analysis of the institutions and the laws which have enabled satellite telecommunications to be realized. It is an excellent source for professors, lawyers and policy-makers.

Prof. Jonathan F. Galloway
Lake Forest College

Novoe v kosmicheskom prave. Na puti k mezhdunarodnomu chastnomu kosmicheskomu pravu. (New Developments in Outer Space Law: On the Way to Private International Outer Space Law) (V.S. Vereshchetin ed., Institute of State and Law, Academy of Sciences of the USSR, Moscow, 1990) (In Russian), pp. 150.

This book consists of ten articles, written by Soviet, Bulgarian and Czechoslovak lawyers specializing in outer space law. It was intended, as *Prof. V. Vereshchetin* points out in its *Preface*, to attract attention to the examination and elaboration of such legal norms, regulating space activities with "foreign elements," which are traditionally considered to be part of national private (civil) law. These norms form a relatively new area of legal regulation, and such legal area can, in this context, be termed "private international space law".

The paper by *Prof. O. Kunts* (Czechoslovakia), *International Space Law and Private International Law*, deals with the problems of correlation between the two notions mentioned in the title. The author holds that international outer space law and "private international space law" (mostly national by its character), taken together as a whole, create a legal framework for space activities not only of the subjects of international law, but also of non-state juridical persons.

The article, *Commercial Cosmonautics - Some Peculiarities of Legal Regulation*, presents an analysis of the actual state of commercial space activities in the world, and the existing normative regulation of these activities in the USA, in the member countries of Intercosmos, and in the European Space Agency. Its author, the Soviet researcher *V. Postyshev*, emphasizes the necessity for a more flexible approach to the legal solution of the problem - how to harmonize the interests of the developed and less-developed countries as far as the access to the benefits of the use of the outer space is concerned.

The article by *L. Afanasyeva* (USSR), *Insurance of Space Activities: The Problems and the Prospects*, is the first survey in the Soviet juridical literature on the issues of space insurance. It describes the history of the problem and the difficulties, which space underwriters face nowadays in their business. Special questions like pre-launch and launch insurance, life insurance, liability insurance and some others are also examined.

The interrelationship between the copyright laws (and international agreements), on the one hand, and the legal instruments,

regulating direct TV broadcasting, on the other, is discussed in the paper by *V. Odintsova* (USSR), *Some Questions of Copyright and "Adjoining" Rights Protection in the Utilization of Artificial Earth Satellites for the TV Broadcasting*. The author underlines that it is desirable to conclude bilateral agreements between the copyright agencies of the countries involved in direct TV broadcasting.

The next article, written by *Ts. Kamenova* (Bulgaria), *Satellite Television and the Problems of International Private Law: A West European Example*, examines the issues raised in the previous paper, but special attention is drawn here to the practice of European states in the regulation of space TV broadcasting. The author shares the view that existing (or emerging) problems in this sphere can only be solved by the elaboration of new international agreements.

Some aspects of the transfer of technology are touched upon in the article by *G. Danilenko* (USSR), *Transfer of Space Technology: Legal Problems*. The contemporary outer space law does not contain specific norms regulating the transfer of technology, but the rapid development of space technology necessarily raises the question of adopting such norms. In the article, the author studies the applicability of approaches already assimilated in national legislation.

The article by *O. Vorobyova* (USSR), *Legal Protection and Utilization of Scientific-Technical Results in the Realization of International Cooperation in Outer Space Explorations*, is based on materials pertaining to the functioning of the Intercosmos Program.

The purely civilistic problems are dealt with in the paper by *L. Neustupna* (Czechoslovakia), *The Significance of the Law and the Treaty in the Development of Direct Links in the Intercosmos Program*. One of the issues discussed is the problem of choice between the determination of the conditions of cooperation in contracts and non-binding forms of cooperation.

The paper by the Soviet lawyers *E. Kamenetskaya* and *E. Zhukova*, *Space Conquest: National Regulation*, examines the acts of national legislation of the USA, Great Britain, and Sweden. The article is the first, published in Russian, which describes in detail the contents of the instruments regulating national space activities carried out by other countries. An opinion is expressed that the objective needs of legal regulation of such activities in the USSR make it necessary to work out Soviet space legislation.

Such a specific feature of Anglo-American law as privacy and its interaction with outer space law is examined in the article by *G. Silvestrov* (USSR), *The Institute of Privacy in the US Judicial Practice and the Observations from Outer Space*.

The described book reflects the present level of outer space law science in the Soviet Union. The only critical note that can be made is that

in most articles specific practical questions prevail over theoretical generalizations. But, of course, this factor cannot diminish the positive importance of publication.

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European Space Agency (ESA), Les Stations Spatiales Habitées - Aspects Juridiques (Manned Space Stations - Legal Issues) (1990), pp. 232.

The new European Space Agency (ESA) publication MANNED SPACE STATIONS: LEGAL ISSUES compiles speeches, papers and a transcript of the debates from an international colloquium held in Paris on November 7-8, 1989.[1] In addition, the work reprints the Inter-Governmental Agreement (IGA) on the Permanently Manned Civil Space Station, the Memorandum of Understanding (MOU) between ESA and NASA on the Permanently Manned Civil Space Station, and the Exchange of Letters on the National Security Issue between the U.S. and European Negotiating Teams, and offers a selected bibliography of works addressing the space station.

The first of the four substantive chapters addresses more general aspects of the Space Station, commencing with *Dr. J.J. Dordain* from ESA explaining the technical characteristics of space stations. Then *Prof.* S. *Gorove* directs attention to jurisdiction and control questions pertaining to the space station. He also discusses the various underlying policies for treating the Space Station as a cluster of different components requiring different registrations. The last author of the chapter, *Dr. Bourély,* focuses on responsibility for damages to space stations under different situations.

The next chapter on national and international aspects of the Space Station begins with an overview by *Prof. V.S. Vereshchetin* of the legal regime for foreign or joint experiements and regulation of space flights in the MIR (Soviet) Space Station. *Dr. R. Loosch* presents the history of the international space station negotiations and focuses specifically on the question of how and to what extent the peaceful and civil dedication of the Space Station allowing for national security or defense uses was eventually resolved by the negotiators. After an overview, *Dr. K. J. Madders* suggests that the space station agreements have "opened up a new category in the law of international associations that could act as a initial point of reference for those thinking about undertaking future large-scale cooperative projects." The last paper in this chapter by *Prof. S. Courteix* describes the various means for obtaining transportation to the Space Station and the legal issues surrounding the sharing of the resources of the manned base.

1. A summary of the Colloquium on Manned Space Stations written by Michel Bourély was published in 17 J. SPACE L. 180 (1989).

She also elaborates on the terms of Space Station utilization including the requirement of using it only for peaceful purposes.

Prof. Diederiks-Verschoor introduces the chapter addressing human work in space and legal status of astronauts by offering some thought as to the rules that would be necessary for the future for space stations. Then *Prof. A. Gorbiel* submits ideas concerning international legal aspects of national manned space stations while *Dr. J. Reifarth* discusses the astronaut's legal status. *Dr. P. Dubois* highlights problems pertaining to movement of goods, people and technologies across frontiers for the four space station partners, focusing particularly on the gaps presented by the IGAs.

The penultimate chapter focuses on production activities in space, commencing with *Sr. S.. Gantt* considering the IGA's clauses on intellectual property rights and their application to U.S. patent law prior to and after the Patents in Space Act. *Dr. J. P. Raynaud* and *Dr. V. Vache* concentrate briefly on the protection of innovations from a user's perspective. One of the most interesting works is by*Dr. D. . Stauder* who centers on the problems of protecting space innovations, addressing problems in attempting to derive a uniform international solution, as well as the challenges faced using a number of international patent sytems when they have to operate in a confined area such as the Space Station. *Mr. M.F. Murphy* concludes the chapter by offering possible solutions to protecting innovations in space.

The book concludes with papers by *Dean C.-A. Colliard* and *Dr. G. Lafferranderie* that thoroughly summarize the various issues highlighted throughout the Conference.

The organizers of this colloquium, *Dean Colliard, Prof. Courteix* and *Dr. Lafferrenderie,* have done an outstanding job of bringing together an international group of eminent technical and legal experts to provide a valuable insight into the complex legal and associated issues arising out of the operation of the proposed U.S./International Space Station.

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Space Law: Basic Legal Documents, Vol. I, edited by Karl-Heinz Böckstiegel and Marietta Benkö (Martinus Nijhoff, 1990) (Each document is separately numbered, without an indication of the volume's total pages).

This publication is a loose-leaf compilation of selected legal documents related to space law. Part A of the volume consists of the five basic space treaties and a section containing some documentation on the "West Ford" project and the Cosmos 954 incident. Part B consists of documents pertaining to: I. Direct broadcasting by satellite and telecommunication; II. Remote sensing; III. Environmental protection and the use of nuclear power sources; IV. Geostationary orbit; and, V. Peaceful uses and disarmament. Included are tables indicating the status of

multilateral agreements as of December 31, 1988 and, at the end of each section, a list of "Basic Literature."

This compilation will be an addition to the already existing documentary collections which include: UNITED STATES SPACE LAW - NATIONAL AND INTERNATIONAL REGULATIONS, Vols. I-III (S. Gorove ed. with yearly supplements, Oceana, 1982-1990) containing the national and international documents relevant to the United States; MANUAL ON SPACE LAW, Vols. I-IV (N. Jasentuliyana and R.S.K. Lee, Oceana, 1981), containing the travaux préparatoires relevant to space treaties and other international instruments, including U.N. General Assembly resolutions; SPACE LAW AND RELATED DOCUMENTS (U.S. Government Printing Office, 1990), containing international and U.S. space law documents; and texts and documents on the law of outer space, compiled and edited by Simone Courteix in Document d'Etudes nº 3.04 "LE DROIT DE L'ESPACE" (1990).

Much of the compiled materials may be found in the earlier collections, and many important space law instruments which are included in the prior documentations do not appear in this compilation. However, there are several novel items, such as three judgments of the Court of Justice of the European Communities regarding television broadcasts; and documents on arms control, including resolutions of the North Atlantic Asssembly and recommendations of the Western European Union on the Strategic Defense Initiative. Also, the reader may find useful a list of objects launched into outer space and registered with the United Nations between September 15, 1976 and February 28, 1987. On the negative side, it may be noted that some of the basic international treaties are not accompanied by the official U.N. Treaty Series citations and - although the editors state that the "Basic Literature" is not intended to be "exhaustive," - it is unfortunate that the bibliography appears to be extremely "scanty" at best.

The Case for Mars III: Strategies for Exploration -- General Interest and Overview (Vol. 74, Science and Technology Series), edited by Carol Stoker (American Aeronautical Society, 1989), pp. 727.

This volume is a compilation of papers and discussions from the third Case for Mars Conference, held at the University of Colorado, July 18-22, 1987. Among the topics covered by scientists, engineers, policymakers and other professionals were mission strategy, spacecraft design, human factors, Mars base design, and resource utilization.

As to the Mars mission itself, there are many opinions expressed, including arguments for and against it. *Easterbrook's* presentation, "The Case Against Mars" is a well written discussion of the problems associated with the Mars mission which he characterizes as (1) unrealistic, (2) too costly, and (3) serving career rather than national interests. *Staehle*, President of the World Space Foundation, bases his responses on public interest and priorities of the U.S. space program.

Aspects of international cooperation relating to the Mars mission are discussed by several scholars. *Michaud* states the United States should

turn first to its friends and allies if international cooperation is needed. He concludes that a joint manned mission with Western Europe, Japan, and/or Canada would be more advantageous than one with the Soviet Union. According to *Michaud*, these countries have interests and programs which are more in line with the United States' goals and projects; this, of course, is due in part to the fact that these countries' space programs have been strongly influenced by U.S. activities and policies. *Goldman* and *Forman* also discuss international cooperation and possible problems with the Mars mission.

Included in the volume are presentations devoted to various aspects of human participation in the Mars missions, such as effects of gravity, crew selection, habitability, stress, and the use of Antarctica stations as models. Although lawyers may find little value in much of the scientific and technical materials, the volume is a useful reference book for scholars wishing to study or research the Mars mission.

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CURRENT DOCUMENTS

I.

Draft for a Convention on Manned Space Flight

presented as the result of a
common research project among

the Institute of Air and Space Law,
Cologne University, Germany,
represented by *Prof. Karl-Heinz Böckstiegel,*

the Institute of State and Law,
Academy of Sciences of the USSR,
represented by *Prof. Vladlen Vereshchetin,*

the Research and Study of Space Law and Policy Center,
University of Mississippi Law School, USA,
represented by *Prof. Stephen Gorove*

November 1990

Manned space flight is already playing a major role in the field of space activities and this will no doubt continue even more in the future. While the present space conventions contain a number of applicable provisions, the legal framework for manned space flight remains unclear in many important aspects, as was noted in the course of negotiations on specific international projects involving manned space flight in recent years.

To improve the situation, in 1988 a common research project was initiated aiming at drafting a respective convention by the Institute of Air and Space Law of Cologne University, Germany, represented by *Prof. Karl-Heinz Böckstiegel,* the Institute of State and Law of the Academy of Sciences of the USSR, represented by *Prof. Vladlen Vereshchetin,* and the Research and Study of Space Law and Policy Center of the University of Mississippi Law School, USA, represented by *Prof. Stephen Gorove.*

In the course of this cooperative effort, it was early decided that instead of drafting a purely academic instrument an attempt should be made to draft a text which would not only deal with some of the major issues needing clarification, but should also take into account practical feasibility even if it meant concessions by the cooperating institutions on certain issues. In the course of our exchanges of views seven drafts were elaborated until the attached text was reached. As already indicated, the text contains several provisions which present a compromise among the different points of view advanced by those participating in this effort. However, this should be no surprise inasmuch as it is the normal aspect of any international drafting. By the same token, it can be expected that reactions after the presentation of this Draft Convention will agree with some of its provisions and disagree with others.

The primary objective of the participants cooperating in the preparation and presentation of this Draft is to initiate and promote international discussions in appropriate fora in the hope that eventually they will lead to negotiations between interested States either in the United Nations Committee on Peaceful Uses of Outer Space (COPUOS) or elsewhere. As a first step, the Draft Convention will be published in the Journals of the cooperating participants and then in other interested journals, unless otherwise agreed. At its session in Dresden in October 1990 the Board of Directors of the International Institute of Space Law (IISL) decided to communicate the Draft to the Legal Sub-Committee of COPUOS. The draft will also be communicated to respective government bodies in the three countries concerned for information and any appropriate action they might wish to take with respect to it.

Draft for a Convention on Manned Space Flight

presented as the result of a common research project among

- the Institute of Air and Space Law, Cologne University, Germany, represented by *Prof. Karl-Heinz Böckstiegel,*
- the Institute of State and Law, Academy of Sciences of the USSR, represented by *Prof. Vladlen Vereshchetin,*
- the Research and Study of Space Law and Policy Center, University of Mississippi Law School, USA, represented by *Prof. Stephen Gorove*

The States Parties to this Agreement,

Noting that manned space flight constitutes one of the great achievements in the exploration and use of outer space,

Believing that further progress in the exploration and use of outer space will greatly depend on the development of manned space flight,

Desiring to encourage broad international cooperation in these flights, particularly if persons from more than one State participate,

Recalling that the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies of 27 January 1967, provides that the exploration and use of outer space shall be carried out for the benefit and in the interests of all countries, and declares that astronauts are to be regarded as envoys of mankind,

Mindful of the Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space of 22 April 1968 and other international agreements which contribute to the safety of space flight,-

Have agreed on the following:

Art. I Definitions

For the purpose of this Agreement:

1. The term "manned space object" means a space object on which a person or persons effect a space flight.

2. The term "manned space flight" means a flight of a space object with a person or persons on board from Earth to outer space or in outer space and extends to the embarkation, launch, in orbit, deorbit, reentry, landing and disembarkation phases.

3. The term "international manned space flight" means a space flight in which persons of at least two or more States or of an international organization participate.

4. The Director of Manned Space Flight Operations is a person who is designated by the State exercising jurisdiction and control over the space object to be in charge of a particular manned space flight. This also applies in a case of international manned space flight unless the States whose persons participate in the flight agree otherwise;

5. The term "space flight elements" includes component parts of the space object, the launch vehicle and parts thereof as well as other objects on the flight, as specified by an agreement of those States participating in an international space flight.

6. The term "crew" means persons who effect professional activities during a space flight.

7. The term "intellectual property" is understood to have the meaning of Art. 2 of the Convention Establishing the World Intellectual Property Organization, done at Stockholm on 14 July 1967.

8. "The Outer Space Treaty" means the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies of 27 January 1967.

9. "The Rescue Agreement" means the Agreement on the Rescue of Astronauts, the Return of Astronauts, and the Return of Objects Launched into Outer Space of 22 April 1968.

10. "The Liability Convention" means the Convention on International Liability for Damage Caused by Space Objects of 29 May 1972.

11. "The Registration Convention" means the Convention on the Registration of Objects Launched into Outer Space of 14 January 1975.

Art. II Registration

1. In accordance with the Registration Convention a manned space object shall be registered by the launching State. Separate flight elements may be registered by different States. Such registration and furnishings of the necessary information to the Secretary-General of the United Nations, as required by Article IV of the same Convention, shall be effected in the shortest possible time after the launch of a manned space object. The information shall be regularly updated.

2. In international manned space flight, and in case there is more than one launching State, the States concerned shall jointly determine which one of them shall register the manned space object or a separate flight element. Multiple registration is excluded.

Art. III Jurisdiction and Control

1. Pursuant to Art. VIII of the Outer Space Treaty, the State on whose registry the manned space object or flight element is carried shall retain jurisdiction and control over such object or element and over any

persons thereof, while in outer space or on a celestial body, or on or in the high seas, or in any other place beyond the limits of the jurisdiction of any State.

2. In an international manned space flight, jurisdiction and control is subject to any agreement between the States Parties involved.

Art. IV Rights and Obligations of Persons On Manned Space Flight

1. The preparation of the manned space flight, determination of composition and functions of the crew and participation of other persons as well as their rights and obligations fall within the competence of the State exercising jurisdiction and control. The same applies to an international manned space flight, unless the States participating in the flight agree otherwise.

2. The commander of the manned space object shall (1) provide for the safety and well-being of all persons on board, and (2) provide for the protection of the space flight elements and any payload carried or serviced by the manned space object. The commander shall have sole authority throughout the flight to use any reasonable and necessary means to achieve this end.

3. The authority of the commander extends to all persons participating in the space flight, irrespective of their nationality. It also extends to all manned space flight elements and payloads.

4. Directions of the commander are subject to implicit execution by all persons participating in a space flight.

5. The commander may, when he/she deems such action to be necessary for the safety of the manned space flight elements and persons on board, subject any of the persons on board to such restraint as the circumstances require until such time as delivery of such individual or individuals to the proper authorities is possible.

6. Under normal flight conditions (other than emergencies or when otherwise designated) the commander is responsible to the Director of Manned Space Flight Operations.

7. Before each manned space flight, the State exercising jurisdiction and control shall determine the order in which members of the crew shall assume the responsibilities and authority of the commander under paras. 2-6 in the event that he/she is not able to carry out his/her duties.

8. All crew members remain accountable for their activities during their space flight to the Director of Manned Space Flight Operations.

9. A State Party to this Agreement exercising jurisdiction and control over the manned space object shall ensure that activities by the crew thereof shall be carried out in accordance with international law, including the Charter of the United Nations, in the interest of maintaining international peace and security and promoting international cooperation and understanding.

Art. V Ensurance of Safety

1. The States Parties to this Agreement shall conduct activities connected with the exploration and use of outer space and celestial bodies in a way which shall ensure, to the highest degree possible, the safety of the persons involved.

2. In order to avoid harmful space debris, pollution, contamination and harmful changes in the environment of the Earth and, in particular, to avoid risks therefrom to manned space flight, the States Parties shall study the feasibility of appropriate measures and shall make the respective information available to the Secretary-General of the United Nations for dissemination to all interested States.

3. If a State Party has reason to believe that the activities of another State or its nationals might interfere with the manned space flight of the State Party, it can request that international consultations be carried out. A State Party to which such a request is addressed is obliged to enter into such consultations in the shortest possible time.

Art. VI Mutual Assistance in Space

1. In accordance with Art. V of the Outer Space Treaty and the respective provisions of the Rescue Agreement, the crew participating in a manned space flight of a State Party to this Agreement shall render all possible assistance, including, if necessary, the provision of shelter on their manned space object, to persons who are experiencing conditions of distress in outer space or on celestial bodies.

2. To facilitate such assistance, the States Parties to this Agreement shall study and exchange information on possible steps to ensure the compatibility of manned space objects and technical means for carrying out rescue operations in outer space.

3. Any information received by a State Party to this Agreement concerning an emergency on a manned space object of another State shall be immediately transmitted to the launching State and the Secretary-General of the United Nations in accordance with Art. I of the Rescue Agreement so that any State may come to the rescue of the persons experiencing conditions of distress.

4. In the event of an emergency situation arising on a manned space object, the States Parties to this Agreement shall ensure by all possible means that communication to and from the manned space object in distress shall be available and that they shall not interfere with such communication.

5. Unless otherwise agreed by the States Parties concerned, the expenses incurred by a State Party or by another State in rendering assistance to a manned space object in distress shall be borne by the

launching State of that object, if the launching State has been informed in advance of the assistance and has not objected.

6. States shall regard any person in outer space as an astronaut within the meaning of Art. V of the Outer Space Treaty and as part of the personnel of a spacecraft within the meaning of Art. VIII of the Outer Space Treaty and the Rescue Agreement.

Art. VII Responsibility and Liability

1. The States Parties to the Agreement bear international responsibility for manned space flights, irrespective of whether they are carried out by governmental or non-governmental entities, in accordance with the norms of international law including Art. VI of the Outer Space Treaty.

2. The States Parties to this Agreement are liable for damage caused by a manned space object in accordance with the Liability Convention.

3. Actions by persons in the course of the manned space flight shall be subject to the responsibility, liability and other consequences provided for in the law of the State of registry unless otherwise agreed by States participating in an international space flight.

Art. VIII Intellectual Property

1. Subject to the provisions of this Article, for purposes of intellectual property law, an activity occurring in or on a manned space object or a separate space flight element shall be deemed to have occurred only in the territory of the State Party to the Agreement that has registered the space object or flight element respectively.

2. In respect of an invention made by a person who is not a national or resident of the State of registry, a State Party to the Agreement shall not apply its laws concerning secrecy of inventions so as to prevent the filing of a patent application (for example, by imposing a delay or requiring prior authorization) in any other State Party to the Agreement that provides for the protection of the secrecy of patent applications containing information that is classified or otherwise protected for national security purposes. This provision does not prejudice (a) the right of any State Party to the Agreement in which a patent application is first filed to control the secrecy of such patent application or restrict its further filing, or (b) the right of any other State Party to the Agreement in which an application is subsequently filed to restrict, pursuant to any international obligation, the dissemination of an application.

3. The temporary presence in the territory of a State Party to the Agreement of any articles, including the components of a space flight element, in transit between any place on Earth and the manned space flight station or any space flight element registered by another State Party to the Agreement, shall not in itself form the basis for any proceedings in the first State Party for patent infringement.

Art. IX Consultation and Settlement of Disputes

1. A State Party to this Agreement may request consultations with another State Party if it has reason to believe that the other State Party is not fulfilling the obligations incumbent upon it pursuant to this Agreement or that the other State Party interferes with the manned space flight of the requesting State. A State Party receiving the request shall enter into such consultations without delay.

2. If within three months, the consultations do not lead to mutually acceptable settlement and the States Parties concerned are unable to settle the issues by other peaceful means of their choice, at the request of one of the concerned States Parties, the dispute shall be decided by an Arbitral Tribunal. The Arbitral Tribunal shall be appointed in the same manner as provided for the Claim Commission in Arts. XV to XVII of the Liability Convention. The Arbitral Tribunal shall determine its own procedure and shall give its decision as promptly as possible. The decision shall be final and binding. The concerned States Parties undertake to carry out the Tribunal's decision promptly.

3. Unless otherwise agreed between the concerned States Parties, implementation of this Agreement and of any other agreement between the concerned States Parties concerning manned space flight will continue and will not be held in abeyance pending settlement or decision of issues under this Article.

Art. X Application to International Organizations

In this Agreement references to States Parties shall be deemed to apply to any international intergovernmental organization which conducts space activities, if the organization declares its acceptance of the rights and obligations provided for in this Agreement.

Art. XI Concluding Provisions

To be inserted later in accordance with international practice regarding:

- no effect on other international agreements
- signature and ratification by States Parties
- entry into force
- procedure for amendments
- procedure for withdrawals by States Parties
- authentic languages of Agreement.+

+ Several staff members of the Journal of Space Law, including John E. Carter, J. Brantley Durrett III, Dana G. Dew, Sean Wesley Ellis and Judy D. Lee participated in the initial phases of this project during the Summer of 1988 under the direction of Prof. Stephen Gorove.

II.

New National Space Policy Directive of September 5, 1990*

The President has approved a new National Space Policy Directive providing important guidance which will further encourage the growth of U.S. private sector space activities. This policy, developed by the Vice President and the National Space Council, is completely consistent with, and provided the policy framework for, the President's August 22, 1990, decision regarding participation by a U.S. firm in Australia's Cape York space launch project. The policy supplements the National Space Policy which the President approved on November 2, 1989.

The commercial space launch policy recognizes the many benefits which a commercial space launch industry provides to the United States. It balances launch industry needs with those of other industries and with important national security interests, and establishes the long term goal of a free and fair market in which U.S. industry can compete. The policy specifies a coordinated set of actions for the next ten years aimed at achieving this goal.

COMMERCIAL SPACE LAUNCH POLICY

Policy Findings

A commercial space launch industry can provide many benefits to the U.S. including indirect benefits to U.S. national security.

The long term goal of the United States is a free and fair market in which U.S. industry can compete. To achieve this, a set of coordinated actions is needed for dealing with international competition in launch goods and services in a manner that is consistent with our non-proliferation and technology transfer objectives. These actions must address both the short term (actions which will affect competitiveness over approximately the next ten years) and those which will have their principal effect in the longer term (*i.e.*, after approximately the year 2000).

- In the near term, this includes trade agreements and enforcement of those agreements to limit unfair competition. It also includes the continued use of U.S. manufactured launch vehicles for launching U.S. Government satellites.

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* Taken from the White House, Office of the Press Secretary, Press Release, Sept. 5, 1990.

- For the longer term, the United States should take actions to encourage technical improvements to reduce the cost and increase the reliability of U.S. space launch vehicles.

Implementing Actions

U.S. government satellites will be launched on U.S. manufactured launch vehicles unless specifically exempted by the President.

Consistent with guidelines to be developed by the National Space Council, U.S. Government Agencies will actively consider commercial space launch needs and factor them into their decisions on improvements in launch infrastructure and launch vehicles aimed at reducing cost, and increasing responsiveness and reliability of space launch vehicles.

The U.S. Government will enter into negotiations to achieve agreement with the European Space Agency (ESA), ESA member states, and others as appropriate, which defines principles of free and fair trade.

Non-market launch providers of space launch goods and services create a special case because of the absence of market-oriented pricing and cost structures. To deal with their entry into the market there needs to be a transition period during which special conditions may be required.

There also must be an effective means of enforcing international agreements related to space launch goods and services.

III.

Legislation on Inventions in Outer Space*

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SECTION 1. INVENTIONS IN OUTER SPACE.

(a) IN GENERAL. - Chapter 10 of title 35, United States Code, is amended by adding at the end the following:

"§105. Inventions in outer space

"(a) Any invention made, used or sold in outer space on a space object or component thereof under the jurisdiction or control of the United States shall be considered to be made, used or sold within the United States for the purposes of this title, except with respect to any space object or component thereof that is specifically identified and otherwise provided for by an international agreement to which the United States is a party, or with respect to any space object or component thereof that is carried on the registry of a foreign state in accordance with the Convention on Registration of Objects Launched into Outer Space.

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* The U.S. House of Representatives passed H.R. 2946, to amend chapter 10, title 35, United States Code, with respect to the use of inventions in outer space. Subsequently, a similar Senate-passed measure, S. 459, was passed in lieu - clearing the measure for the P>resident. The above text is version five of S. 459 which was passed November 7, 1990.

"(b) Any invention made, used or sold in outer space on a space object or component thereof that is carried on the registry of a foreign state in accordance with the Convention on Registration of Objects Launched into Outer Space, shall be considered to be made, used or sold within the United States for the purposes of this title if specifically so agreed in an international agreement between the United States and the state of registry."

(b) TABLE OF CONTENTS.- The table of sections of chapter 10 of title 35, United States Code, is amended by adding at the end the following:
"105. Inventions in outer space."

SEC. 2. SPECIAL RULES.

(a) EFFECTIVE DATE. - Subject to subsections (b), (c), and (d) of this section, the amendments made by the first section of this Act shall apply to all United States patents granted before, on, or after the date of enactment of this Act, and to all applications for United States patents pending on or filed on or after such date of enactment.

(b) FINAL DECISIONS. - The amendments made by the first section of this Act shall not affect any final decision made by a court or the Patent and Trademark Office before the date of enactment of this Act with respect to a patent or an application for a patent, if no appeal from such decision is pending and the time for filing an appeal has expired.

(c) PENDING CASES. - The amendments made by the first section of this Act shall not affect the right of any party in any case pending in a court on the date of enactment of this Act to have the party's rights determined on the basis of the substantive law in effect before such date of enactment.

(d) NON-APPLICABILITY. - The amendments made by the first section of this Act shall not apply to any process, machine, article of manufacture, or composition of matter, an embodiment of which was launched prior to the date of enactment of this Act.

IV.

Resolution on Space Law of the 64th Conference of the International Law Association, held in Queensland, Australia, 19-25 August 1990

Whereas the Seoul Conference of the Association in 1986 decided that the Space Law Committee should take up the issue of debris and pollution from activities in outer space;

Whereas the Warsaw Conference in 1988 decided that the Space Law Committee begin an exchange of views to elaborate principles and guidelines on the subject of environmental risks arising from space activities to be presented and considered by the Space Law Session of the 1990 Conference;

Pursuant to these instructions the Chairman and the Rapporteur of the Space Law Committee prepared and circulated a Questionnaire among

the members of the Space Law Committee concerning an evaluation of (1) the present state of the law, and (2) suggestions for the future;

And Whereas on the basis of the answers received to these questions, and the discussions held in other fora such as the International Institute of Space Law (1988-1989), the Instituto Iberoamericano de Derecho Aeronautico y del Espacio (1988), the Cologne Colloquium on the Environmental Aspects of Space Activities (1988) and the Ottawa Meeting of Experts on the Protection of the Atmosphere (1989), the Rapporteur of the Committee prepared a Report which was circulated to members before this Conference;

And Whereas a further discussion on the subject, based upon this Report, took place in Queensland in 1990 during a session of the 64th Conference;

Recommends that the Space Law Committee, on the basis of the work carried out so far, start work on the elaboration of an international instrument to be considered at the 1992 Conference.

Further recommends that, in doing so, the Committee should take into account the following principles and guidelines:

1. A general obligation to cooperate in the field of environmental risks arising from space activities, and to negotiate in good faith;

2. An obligation to ensure that space activities do not cause damage to persons, objects or the environment of other States, or to the environment in areas beyond national jurisdiction;

3. Particularly, an obligation to exchange information, to consult and to cooperate with other States and international organizations in order to reduce existing and prevent future space debris as much as possible;

4. An obligation to make every effort to settle eventual disputes in a prompt and amicable manner and, failing this, to resort to arbitration or adjudication to achieve a final and binding settlement.

V.

International Institute of Space Law of the International Astronautical Federation, Standing Committee on the Status of International Agreements Relating to Activities in Outer Space, Third Annual Report - October 1990

Background

At the meeting of the IISL Board of Directors held at Brighton, England in October 1987, the Board of Directors decided to create a standing committee of the Institute to prepare and submit at each annual Colloquium a report on the status of signatures to agreements relating to activities in space.

Institute members who can contribute substantively to the work of the Committee are invited to serve on the committee. Membership is open to any interested IISL member. The committee members help collect, review, and verify data concerning selected space agreements. Agreements of general global applicability or regional applicability are selected for reporting. Bilateral agreements are not being included in the report at this stage. In general, the agreements being included and their status are believed to be valid as of December 31, 1989.

For each agreement listed herein we intend to include citations to sources in various languages. Primary reference sources will be cited in major working languages of the United Nations and international organizations. It is not practical to attempt to list sources in every language because of volume and complexity. Work is progressing on the multilingual citation table.

Coded entries are used in the table as follows:

X	=	ratification, accession, succession; no reservations
Xr	=	ratification, accession, succession; reservations, clarifications or statements
Xu	=	signature only; agreement unratified
D	=	declaration of acceptance

When no entry is made in a column opposite a state's name, that state has not signed that agreement, or that state has withdrawn from the agreement.

AGREEMENTS INCLUDED

1. Treaties & Agreements of General Scope and Applicability

UN Charter -	Charter of the United Nations and Statute of the International Court of Justice; done at San Francisco June 26, 1945; entered into force October 24, 1945. (59 Stat. 1031; TS 993; 3 Bevans 1153)
1963 NTBT -	Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and Under Water; done at Moscow August 5, 1963; entered into force October 10, 1963. (14 UST 1313; TIAS 5433; 480 UNTS 43)
1967 OST -	Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies; done at Washington, London and Moscow January 27, 1967; entered into force October 10, 1967. (18 UST 2410; TIAS 6347; 610 UNTS 205)
1968 ARRA -	Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space; done at Washington, London and Moscow April 22, 1968; entered into force December 3, 1968. (19 UST 7570; TIAS 6599; 672 UNTS 119)
1972 Liab. Conv. -	Convention on International Liability for Damage Caused by Space Objects; done at Washington, London and Moscow March 29, 1972; entered into force September 1, 1972. (24 UST 2389; TIAS 7762; 961 UNTS 187)
1975 Regls. Conv. -	Convention on Registration of Objects Launched into Outer Space; done at New York January 14, 1975; entered into force September 15, 1976. (28 UST 695; TIAS 8480; 1023 UNTS 15)
1979 Moon Agrmt -	Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, done at New York December 18, 1979; entered into force July 11, 1984. (18 I.L.M. 1434)

2. Charters and Conventions of International Organizations

Intelsat -	Agreement Relating to the International Telecommunications Satellite Organization (INTELSAT) with annexes, and Operating Agreement Relating to the International Telecommunications Satellite Organization with annex; done at Washington August 20, 1971; entered into force February 12, 1973. (23 UST 3813, 4091; TIAS 7532)
Inmarsat -	Convention on the International Maritime Satellite Organization (INMARSAT) with annex, and the Operating Agreement on the International Maritime Satellite Organization with annex; done at London September 3, 1976; entered into force July 16, 1976. (31 UST 1, 135; TIAS 9605)
Intersputnik -	Agreement on the Establishment of the "Intersputnik" International System and Organization of Space Communications; done at Moscow November 15, 1971; entered into force July 12, 1972.
Intercosmos -	Agreement on Cooperation in the Exploration and Use of Outer Space for Peaceful Purposes; done at Moscow July 13, 1976; entered into force March 25, 1977.

3. Special Topic and Regional Agreements

Arabsat -	The Agreement of the Arab Corporation for Space Communications, done at Cairo, Wednesday 14 Rabi Al Akhar 1396 H., corresponding to April 14, 1976.
ESA -	Convention for the establishment of a European Space Agency with annexes; done at Paris on May 30, 1975; entered into force October 30, 1980.
Eutelsat -	Convention establishing the European telecommunications satellite organization, done at Paris, July 15, 1982; entered into force July 3, 1985.
Eumetsat -	Convention for the establishment of a European organization for the exploitation of meteorological satellites, done at Geneva, May 24, 1983; entered into force June 19, 1986.

State or Organization	1963 NTBT	1967 OST	1968 ARRA	1972 Liab. Convention	1976 Regis. Convention	1979 Moon Agreement	Intelsat	Inmarsat	Intersputnik	Arabsat	ESA	Eutelsat	Eumetsat	Intercosmos
Afghanistan	X	X					X		X					
Algeria	(Xu)			Xu			X	X		X				
Angola							X							
Antigua & Barbuda	X	X	X	X	X									
Argentina	X	X	X	X	Xu		X	X						
Australia	X	X	X	X	X	X	X	X						
Austria	X	X	X	Xr	X	X	X				X	X		
Bahamas, The	X	X	X				X							
Bahrain								X		X				
Bangladesh	X	X					X							
Barbados		X	X				X							
Belgium	X	X	X	X	X		X	X			X	X	X	
Benin	X	X		X			X							
Bhutan	X													
Bolivia	X	Xu	Xu				X							
Botswana	X	Xu	X	X										
Brazil (eq)	X	Xr	X	X			X	X						
Bulgaria	X	X	X	X	X			X	X					X
Burkina Faso	(Xu)	X					X							
Burundi	(Xu)	Xu		Xu	Xu									
Byelorussian SSR	X	X	X	X	X			X						
Cambodia				(Xu)										
Cameroon	(Xu)	Xu	X				X							
Canada	X	X	X	Xr	X		X	X			**			
Cape Verde	X													
Central African Rep.	X	Xu		Xu			X							
Chad	X						X							
Chile	Xr	X	X	X	X	X	X	X						
China, People's Rep. of		X	(X)	(X)	(X)		X	X						
Colombia (eq)	X	Xu	Xu	Xu			X	X						
Congo (eq)							X							
Costa Rica	X		Xu	Xu			X							
Cote d'Ivoire	X						X							
Cuba		X	X	X	X			(X)	X					X
Cyprus	X	X	X	X	X		X					X		
Czechoslovakia	X	X	X	X	X			(X)	X					X
Denmark	X	X	X	Xr	X		X	X			X	X	X	
Dominican Republic	X	X	Xu	X			X							

State or Organization	1963 NTBT	1967 OST	1968 ARRA	1972 Liab. Convention	1976 Regis. Convention	1979 Moon Agreement	Intelsat	Inmarsat	Intersputnik	Arabsat	ESA	Eutelsat	Eumetsat	Intercosmos
Ecuador (eq)	X	X	X	X			X							
Egypt	X	X	X	Xu			X	X		X				
El Salvador	X	X	X	Xu			X							
Equatorial Guinea	X	X												
Ethiopia	Xu	Xu					X							
Fiji	X	X	X	X			X							
Finland	X	X	X	X			X	X			**	X	X	
France		X	X	X	X	Xu	X	X			X	X	X	
Gabon (eq)	X		X	X			X	X						
Gambia, The	X	Xu	X	Xu										
German Dem. Rep.	X	X	X	X	X			⊗	X					X
Germany, Fed. Rep. of	X	X	X	X	X		X	X			X	X	X	
Ghana	X	Xu	Xu	Xu			X							
Greece	X	X	X	X			X	X				X	X	
Guatemala	X			Xu		Xu	X							
Guinea							X							
Guinea-Bissau	X	X	X											
Guyana		Xu	X											
Haiti	Xu	Xu	Xu	Xu			X							
Holy See		Xu					X					X		
Honduras	X	Xu		Xu			X							
Hungary	X	X	X	X	X				X					X
Iceland	X	X	X	Xu			X					X		
India	X	X	X	X	X	Xu	X	X						
Indonesia (eq)	X	Xu					X	X						
Iran	X	Xu	X	X	Xu		X	X						
Iraq	X	X	X	X			X	X		X				
Ireland	X	X	X	Xr			X				X	X	X	
Israel	X	X	X	X			X	X						
Italy	X	X	X	X			X	X			X	X	X	
Jamaica	Xu	X	Xu				X							
Japan	X	X	X	X	X		X	X						
Jordan	X	Xu	Xu	Xu			X			X				
Kenya (eq)	X	X		X			X							
Korea, Dem. People's Rep. of									X					
Korea, Republic of	X	X	X	X	X		X	X						
Kuwait	X	X	X	X			X	X		X				
Laos	X	X	X	X					X					
Lebanon	X	X	X	Xu			X							
Lesotho		Xu	Xu											
Liberia	X							X						
Libya	X	X					X			X				
Liechtenstein				X			X					X		
Luxembourg	X	Xu	Xu	X			X					X		

State or Organization	1963 NTBT	1967 OST	1968 ARRA	1972 Liab. Convention	1976 Regis. Convention	1979 Moon Agreement	Intelsat	Inmarsat	Intersputnik	Arabsat	ESA	Eutelsat	Eumetsat	Intercosmos
Madagascar	X	Xr	X				X							
Malawi	X						X							
Malaysia (eq)	X	Xu	Xu				X	X						
Maldives (eq)			X											
Mali	(Xu)	X		X			X							
Malta	X		Xu	X								X		
Mauritania	X						X			X				
Mauritius	X	X	X				X							
Mexico	X	X	X	X	X		X							
Monaco			Xu				X					X		
Mongolia	X	X	X	X	X				X					X
Morocco	X	X	X	X		Xu	X							
Mozambique							(X)	(X)						
Myanmar	X	X	Xu											
Nepal	X	X	X	Xu			(X)							
Netherlands	X	X	X	X	X	X	X	X			X	X	X	
New Zealand	X	X	X	Xr			X	X						
Nicaragua	X	Xu	Xu	Xu	Xu		X		X					
Niger	X	X	X	X	X		X							
Nigeria	X	X	X				X	X						
Norway	X	X	X	Xu			X	X			X	X	X	
Oman				Xu			X	X		X				
Pakistan	X	X	X	X	X	X	X	X						
Panama	X	Xu		X			X	X						
Papua New Guinea	X	X	X	X			X							
Paraguay	Xu						X							
Peru	X	X	X	Xu	X	Xu	X	X						
Philippines	X	Xu	Xu	Xu		X	X	X						
Poland	X	X	X	X	X			X	X					
Portugal	Xu		X				X	X				X	X	X
Qatar				X			X	X		X				
Romania	X	X	X	X		Xu			X					X
Rwanda	X	Xu	Xu	Xu			X							
San Marino	X	X	X									X		
Saudi Arabia		X		X			X	X		X				
Senegal	X		Xu	X			X							
Seychelles	X	X	X	X	X									
Sierra Leone	X	X	Xu	Xu										
Singapore	X	X	X	X	Xu		X	X						
Somalia (eq)	Xu	Xu	Xu				X			X				
South Africa	X	X	X	Xu			X							
Spain	X	X		X	X		X	X			X	X	X	
Sri Lanka	X	X		X			X	X						
Sudan	X						X			X				
Swaziland	X		X				(X)							

State or Organization	1963 NTBT	1967 OST	1968 ARRA	1972 Liab. Convention	1976 Regis. Convention	1979 Moon Agreement	Intelsat	Inmarsat	Intersputnik	Arabsat	ESA	Eutelsat	Eumetsat	Intercosmos
Sweden	X	X	X	Xr	X		X	X			X	X	X	
Switzerland	X	X	X	X	X		X	(X)			X	X	X	
Syrian Arab Republic	X	X	X	X			X			X				
Tanzania, United Rep. of	X			Xu			X							
Thailand	X	X	X				X							
Togo	X	X		X			X							
Tonga	X	X	X											
Trinidad & Tobago	X	Xu		X			X							
Tunisia	X	X	X	X			X	X		X				
Turkey	X	X	Xu				X	(X)				(X)	X	
Uganda (eq)	X	X					X							
Ukranian SSR	X	X	X	X	X			X						
USSR	X	X	X	X	X			X	X					X
United Arab Emirates							X	X		X				
United Kingdom	X	X	X	X	X		X	X			X	X	X	
United States	X	X	X	X	X		X	X						
Uruguay	X	X	X	X	X	X								
Venezuela	X	X	Xu	X			X							
Vietnam		X					X		X					X
Western Samoa	X													
Yemen (Aden)***	X	(X)	Xu						X	X				
Yemen (Sanaa)***	(X)		X				X			X				
Yugoslavia	X	Xu	X	X	X		X					X		
Zaire (eq)	X	Xu	Xu	Xu			X							
Zambia	X	X	X	X			X							
Zambia							(X)							
ORGANIZATIONS														
European Space Agency				D	D	D								
European Telecommunication Satellite Organization					D									

The following states are not members of the United Nations: the Democratic People's Republic of Korea, the Republic of Korea, Liechtenstein, Monaco, San Marino, Switzerland, and the Holy See.

**Canada has a cooperation agreement with ESA, but is not a member of ESA. Finland is an Associate member.

***On May 22, 1990 the Yemen Arab Republic and the Peoples' Arab Republic of Yemen merged to form a single state with the name Republic of Yemen.

ABBREVIATIONS

Dem. Rep. - Democratic Republic

(eq) - Equatorial, has national territory on the Earth's equator

Rep. - Republic

SSR - Soviet Socialist Republic

USSR - Union of Soviet Socialist Republics

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VOLUME 18, NUMBERS 1 & 2
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