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RESEARCH GUIDE

SPACE DEBRIS LEGAL RESEARCH GUIDE†

Irene Atney-Yurdin††

I. INTRODUCTION

Little more than three decades since the 1957 Soviet space launch of Sputnik,¹ Earth's first artificial satellite, debris left in orbit by past space missions has degraded Earth's orbital environment and potentially threatens future space programs.² The man-made debris in outer space now forms a cloud around the Earth consisting of nonfunctional satellites, spent rocket boosters, nuts, bolts, oxygen tanks and other litter, which increasingly clutters the space surrounding the earth.³ Alarming, debris is being added to by some 120 new space launches a year world-

† Information in this research guide is current to May, 1990. However, the space debris research aids contained herein direct the reader to current legal and non-legal materials.

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¹ N.Y. Times, October 26, 1987, §A, at 18, col. 1.

² Interagency Group (Space), REPORT ON ORBITAL DEBRIS 1 (1989). Another study assesses the risks posed by orbital debris as follows:

Collision and interference are the major risks space debris poses to human life and active payloads. A collision may result in loss of property or life, damage to persons or property, generation of further debris, misinterpretation, release of contamination, or the need to alter space operations or space object design. Interference with scientific, commercial and military space activities may be caused by the quantity of debris accumulating in outer space.

H. BAKER, SPACE DEBRIS: LEGAL AND POLICY IMPLICATIONS 9 (1989).

³ INTERAGENCY GROUP, *supra* note 2, at 1.

wide.⁴ This launch figure has remained virtually unchanged during the 1970s and 1980s.⁵ In addition, new fragments are created in orbit by explosions and collisions between existing fragments of space debris thereby increasing the number of debris fragments.⁶

By 1989, an estimated orbital debris population of 3,500,000 objects included mainly minuscule fragments between 0.1 and 1 centimeters (cm) in size, 17,500 debris fragments larger than a pea and smaller than a baseball, and an estimated 7,000 objects the size of a baseball or larger.⁷ Another study estimates that more than forty-eight active and/or inactive satellites carrying over a ton of highly radioactive materials are currently circling the Earth.⁸ By the year 2000, the unchecked proliferation of space debris will cause the Earth to be surrounded by a shell of self-propelling debris which poses an increasing threat of collisions and interference with space-based sensors, operating satellites, astronauts, manned spacecraft, and permanent Earth-orbiting space stations.⁹ The shell of debris may also hamper or prevent certain space missions.¹⁰

The high kinetic energy of objects orbiting at speeds several times faster than the speediest rifle bullet make the impact of even tiny debris fragments with functioning space equipment potentially catastrophic.¹¹ The damage caused by orbital debris

⁴ N. JOHNSON & D. MCKNIGHT, *ARTIFICIAL SPACE DEBRIS* 85 (1987).

⁵ *Id.*

⁶ INTERAGENCY GROUP, *supra* note 2, at 1.

⁷ *Id.* at 4. The debris count was derived from an extrapolation of tracked objects. *Id.* at 3.

⁸ N. JOHNSON & D. MCKNIGHT, *supra* note 4, at 90-91.

⁹ See R. MAURER, *JUNK IN SPACE*, (1989).

¹⁰ See INTERAGENCY GROUP, *supra* note 2, at 8; *Orbital Space Debris: Hearing Before the Sub-Committee on Space Science and Applications of the Committee on Science, Space, and Technology of the House of Representatives*, 100 Cong., 2d Sess. 112 (1988) [hereinafter *Space Debris Hearing*] (statement of Joseph B. Mahon, Deputy Associate Administrator for Flight Systems, Office of Space Flight, NASA) at 7.

Mr. Mahon's statement provides in pertinent part:

NASA's interest in minimizing orbital debris is fundamental. The success of our endeavors in space depends upon a space environment sufficiently free of debris to enable the safe and dependable operation of manned and unmanned spacecraft. An environment overly cluttered with debris would threaten our ability to utilize space for a wide variety of scientific, technological, and commercial purposes.

Id.

¹¹ INTERAGENCY GROUP, *supra* note 2, at 4.

depends on the velocity and mass of the debris fragments. For debris fragments measuring under 0.01cm, surface pitting and erosion are the primary effects of impact.¹² Over time, the cumulative effect of individual fragments colliding with functioning satellites can pose a significant threat.¹³ For debris measuring roughly larger than 0.1 cm, structural damage to satellites becomes an important consideration. For example, a 0.3 cm sphere of aluminum traveling at 10 kilometers per second has about the same kinetic energy as a bowling ball traveling at 100 kilometers per hour (60 mph).¹⁴ One can expect significant structural damage to orbiting satellites when such impacts occur.¹⁵ In fact, a fragment the size of a salt grain was credited with gouging a centimeter-wide pit in the windshield of the space shuttle Challenger in 1983.¹⁶ The chipped outer layer of the triple-paned windshield cost \$50,000 to replace.¹⁷ Needless to say, a similar encounter with an astronaut during extravehicular activity could cause human injury or death and abruptly devastate a space mission.¹⁸

The purpose of this research guide is to present the laws, government agencies and research materials relating to the problems posed by space debris. It is not intended to serve as a comprehensive listing of all relevant federal and international documents relating to space debris. It is intended to provide a convenient starting point for the experienced legal practitioner and the novice alike.

Section II provides suggestions for the researcher. The research material presented in this guide is primarily divided into two parts, which are found in sections III and IV. Section III presents primary legal sources including the federal statutory law and international legal instruments that address the issues raised by space debris. Each source of federal or international

¹² *Id.*

¹³ *Id.*

¹⁴ *Id.*

¹⁵ *Id.*

¹⁶ This impact represents the first confirmed damage to an operational spacecraft caused by space debris. It was later determined that the object was a particle of paint. H. BAKER, *supra* note 2, at 10 (1989). See also *Space Debris Hearing*, *supra* note 10, at 9.

¹⁷ *Space Debris Hearing*, *supra* note 10, at 107.

¹⁸ See H. BAKER, *supra* note 2, at 10.

law is introduced with particularized research suggestions. The second part, section IV, presents an array of secondary and reference sources, including legal and nonlegal space debris journal articles, scientific studies, bibliographies and other selected documents.

II. SUGGESTIONS FOR THE RESEARCHER

No comprehensive policies or commercial regulations concerning space debris currently exist in the United States or other spacefaring nations. If conducting preliminary research in this area of the law, an attorney should begin by consulting two recent documents of cardinal interest which focus specifically on issues raised by orbital debris: *Report on Orbital Debris* (Inter-agency Group (Space) for the United States National Security Council 1989), and *Space Debris: A Report of the ESA Space Debris Working Group*, (European Space Agency 1988).¹⁹ These reports define the problem, review and assess legal approaches, propose mitigation and prevention measures, identify needed research and consider implementation procedures.

Because concern over orbital or space debris has only recently arisen, it is not yet regulated. As a consequence, a researcher would do well in keeping an eye on the *Congressional Index*, published by the Commercial Clearing House, which reports on the status and history of legislation and other Congressional matters. This two-volume index lists, summarizes and indexes public bills and resolutions and provides information about Congressional members, committees and subcommittees, nominations, treaties and reorganization plans. Volume 1 contains matters that pertain to both Houses and the Senate. Volume 2 pertains to matters concerning the House of Representatives only. The *Congressional Index* provides exhaustive subject and author indexes. Research in this source can be conducted by committee or under headings such as "outer space."

Committees of particular interest in Congress which may specifically deal with space debris include: the House Science, Space and Technology Committee; the House Space Science and Applications Subcommittee; the Senate Commerce, Science and

¹⁹ European Space Agency, 8-10 rue Mario-Nikis, 75738 Paris Cedex 15, France.

Transportation Committee; and the Senate Science, Technology and Space Subcommittee.

A researcher seeking up-to-date information on the catalogs, abstracts and index publications issued by Congress each month would do well to check the *Congressional Information Service* (CIS). The two-part CIS/Index is a valuable reference which is published monthly, along with quarterly and annual cumulative indexes. The "Abstracts Book" contains abstracts of the month's individual publications and includes Committee Hearings, House and Senate Reports, House and Senate Publications and Senate Treaty Documents. The CIS "Index Book" contains indexes by subject and name, bill number, report number, title of publication, and includes the name of committee and subcommittee chair. The subject index identifies numerous "space" topics by committee and document and lists committee hearings and some United Nations reports.

III. FEDERAL STATUTES AND INTERNATIONAL LEGAL INSTRUMENTS

No explicit legal standards regarding space debris appear to govern United States private and military space activities. However, scattered policy statements and regulating mechanisms pertaining to space debris issues in United States government and commercial space ventures can be found.

A. *Federal Policy Statements Concerning Space Debris*

1. *United States National Space Policy*

The first national policy statement made by the United States on space debris is contained in the revised National Space Policy, signed by President Ronald Reagan on January 5, 1988.²⁰ The policy, designed to set the course of space efforts for the future, directs that: "all space sectors will seek to minimize the creation of space debris. Design and operations of space tests, experiments and systems will strive to minimize or reduce accumulation of space debris consistent with mission require-

²⁰ Office of the Press Secretary, The White House, Fact Sheet: *Presidential Directive on National Space Policy*, 1 (February 11, 1988); H. BAKER, *supra* note 2 at 118.

ments and cost effectiveness.”²¹

2. *The National Environmental Policy Act of 1969*

The National Environmental Policy Act of 1969 (NEPA)²² requires an environmental assessment of major federal actions significantly affecting the environment.²³ Executive Order 12114 was issued by President Jimmy Carter to implement the extra territorial application of NEPA.²⁴ The Executive Order applies NEPA to the global commons. The Order defines global commons as the “geographical areas that are outside the jurisdiction of any nation, and include the oceans outside territorial limits and Antarctica. Global commons do not include contiguous zones and fisheries zones of foreign nations.”²⁵ Several United States government agencies have determined, as a legal matter, that activities involving outer space do not fall under the purview of the Act.²⁶ Nevertheless, as space exploration increases, federal agencies, such as NASA, may conduct environmental assessments of space missions, because there is a strong argument that “global commons” includes outer space.²⁷

²¹ Office of the Press Secretary, *supra* note 20, at 4.

²² 42 U.S.C. §§ 4321 (1988).

²³ 42 U.S.C. § 4332. subsection 2 provides in part:

The Congress authorizes and directs that, to the fullest extent possible . . . all agencies of the Federal Government shall . . . include in every recommendation or report on proposals for legislation and other major Federal actions significantly affecting the human environment, a detailed statement by the responsible official on . . . the environmental impact of the proposed action.

§ 4332(2).

²⁴ Exec. Order No. 12114, 32 C.F.R. 197 (1991), *reprinted in* 42 U.S.C. § 4332 app. at 978-979 (1988).

²⁵ Exec. Order No. 12114, 32 C.F.R. 197.3(d) (1991), *reprinted in* 42 U.S.C. § 4332 app. at 978-979 (1988). *Compare with* Baker, U. COLO. L. REV. 69 (1989) (This author defines global commons as including “those territories outside the jurisdiction of any state, such as the high seas and the atmosphere above them, Antarctica, and outer space.”) While Baker indicates it is by no means clear that the global commons, as interpreted under NEPA, includes outer space, he does state that “the inclusion of outer space as a global commons may be inferred, since outer space is beyond the territorial reach of any State.” H. BAKER, *supra* note 2, at 112.

²⁶ INTERAGENCY GROUP, *supra* note 2, at 43.

²⁷ *Id.*; H. BAKER, *supra* note 2, at 111-12; *see generally* 14 C.F.R. § 415 (The Office of Commercial Space Transportation, Department of Transportation (DOT) may require commercial launch applicants to prepare an environmental assessment or an EIS concerning the environmental effects of a proposed launch activity); 14 C.F.R. § 1216.306 (which obligates NASA to prepare an environmental assessment under certain circum-

3. *The National Aeronautics and Space Administration*

National Aeronautics and Space Administration²⁸ (NASA) regulations, applicable to all civil space activities, implement environmental protection as delineated by NEPA.²⁹ NASA activities which may have a significant impact on the quality of the environment are subject to NEPA's environmental assessment (EA) process or environmental impact statement (EIS) process.³⁰ If "the environment" is construed as including useful orbits, then these statutes and regulations may act as a regulatory mechanism for federal activities that create space debris.

NASA's environmental regulations do not appear to apply to activities in the "global commons" of outer space in which all nations have a common but nonpossessory interest.³¹ From a commercial viewpoint, the absence of such regulations appears to be advantageous to the United States. This is so because the lack of regulation in this area avoids the problem of precedent setting regulations which may constrain NASA's programs and in turn put American civil commercial space ventures in a less competitive position internationally.³²

stances to determine whether its actions require the preparation of an EIS); 32 C.F.R. § 197, Encl. 2 D. 3 and 32 C.F.R. § 214.6 C. (which obligates the DOD to prepare an environmental assessment under certain circumstances to determine if its activities require the preparation of an EIS).

²⁸ For more information contact the National Aeronautics and Space Administration, Federal Office Building, 400 Maryland Avenue, S.W., Washington, D.C. 20546, (202) 453-1000.

²⁹ 14 C.F.R. § 1216.301(b) (1990). "This subpart sets forth NASA procedures implementing the provisions of section 102(2) of the National Environmental Policy Act (NEPA). The NASA procedures of this subpart supplement the regulations of the Council on Environmental Quality (43 FR 55978) which establishes uniform procedures for implementing those provisions of NEPA." § *Id.* at 1216.300.

³⁰ 14 C.F.R. § 1216.305 (1991) states in part: "A NASA action shall require the preparation of an Environmental Assessment (§§ 1501.3 and 1508.9 of the CEQ Regulations) provided the action is not one normally requiring an Environmental Impact Statement . . . or it is not categorically excluded from the requirement for an Environmental Assessment and an Environmental Impact Statement . . ." *Id.* at 1216.305(a). "NASA actions expected to have a significant effect on the quality of the human environment shall require an Environmental Impact Statement." 1216.305(c).

³¹ H. BAKER, *supra* note 2, at 112. "Whether the NASA provisions for environmental protection extend to activities affecting the outer space environment turns on the definition of global commons." *Id.* Presently NASA does not provide for the legal protection of the space environment, nor for the regulation of space refuse. *Id.* NASA has however implemented initiatives to reduce the risk of collision with space debris. *Id.* at 113.

³² See, Baker, *supra* note 25, at 70.

The space debris issue has been addressed extensively within NASA on a policy level. The *1981 Space Debris Assessment Program Plan* was a proposal to quantify the debris problem, conduct hazard assessments, develop a space object management strategy and formulate policy to deal with the problem.³³ It was envisioned that the ten-year program would develop policies regarding space debris which would first be adopted by other United States agencies and thereafter by other spacefaring nations. The policy envisioned, ultimately, a subsequent development of corresponding international agreements regarding space debris issues.³⁴

In 1982, NASA instituted a debris reduction policy which, to date, has proved successful in lowering the generation of new debris in orbit.³⁵ The policy requires that unspent propellants and gases be vented from upper rocket stages to prevent the inadvertent explosion and fragmentation of these rockets in orbit.³⁶ The policy has been adopted by the European Space Agency and the space agencies of other nations.³⁷

4. *The Department of Defense*

In February 1987, the Department of Defense³⁸ (DOD) expressly addressed orbital debris in its space policy.³⁹ DOD policy regards space debris as a factor which must be considered in the

³³ *Id.* at 71; See NASA Conference Publication 2360, *Orbital Debris* 8-9, 1985 (hereinafter NASA Proposal). The plan referred to in the publication was a proposal. It was formulated in 1981 and discussed at a 1982 Orbital Debris Conference, the minutes of which were published in the 1985 Conference Publication. The conference discussion focused on the need for detailed measurements of the space environment. Since then several program plans for space debris assessment have been devised and implemented within NASA. Telephone conversation with Donald Kessler, Senior Scientist for Orbital Debris Studies, NASA, Johnson Space Center (May 31, 1991). For further information contact the Johnson Space Center, 2101 NASA Road 1, Houston, Texas 77058.

³⁴ NASA Proposal *supra* note 33, at 16-17.

³⁵ See *Space Debris Hearing*, *supra* note 10, at 18.

³⁶ *Id.*

³⁷ INTERAGENCY GROUP, *supra* note 2, at 17. See *supra* note 19 and accompanying text.

³⁸ For more information contact the Department of Defense, The Pentagon, Washington, DC 20301, (202) 545-6700.

³⁹ *Space Debris Hearing*, *supra* note 10, at 15 (statement of Philip Kunsberg, Assistant Deputy Undersecretary of Defense for Policy).

planning of military space operations.⁴⁰ The agency policy states: "DOD will seek to minimize the impact of space debris on its military operations. Design and operations of DOD space tests, experiments and systems will strive to minimize or reduce accumulation of space debris consistent with mission requirements."⁴¹ Under DOD policy, nonfunctional satellites are boosted to graveyard orbits to prevent the accumulation of space debris in useful Earth orbits.⁴²

5. *Department of Commerce: National Oceanic and Atmospheric Administration*

The policy of the National Oceanic and Atmospheric Administration⁴³ (NOAA), similar to that of DOD, encourages the boosting of nonoperational satellites into graveyard orbits beyond useful orbits to prevent congestion of the limited orbital slots available for communications satellites.⁴⁴ This policy not only preserves limited orbits for constant use but further prevents inadvertent collisions in cluttered orbits.⁴⁵

6. *The Air Force*

The Air Force⁴⁶ seeks to avoid orbital positioning problems under Space Systems Division Regulation § 55-1.⁴⁷ The regulation directs program managers and directors to adjust satellite development and deployment plans by considering the congestion of outer space in locating or transferring satellites in Earth

⁴⁰ *Id.* at 15-16; INTERAGENCY GROUP, *supra* note 2, at 17-18.

⁴¹ *Space Debris Hearing*, *supra* note 10, at 16; INTERAGENCY GROUP, *supra* note 2, at 18.

⁴² H. BAKER, *supra* note 2, at 117.

⁴³ For more information contact National Oceanic and Atmospheric Administration; National Environmental Satellite, Data and Information Service; Public Affairs, Suitland Federal Center, FB#4, Room 0124, Washington, DC 20233, (301) 763-4690.

⁴⁴ See INTERAGENCY GROUP, *supra* note 2, at 18.

⁴⁵ *Id.*

⁴⁶ For more information contact Air Force Systems Command, Space Systems Division Los Angeles, AFS Box 92960, CA 90009-2960, (213) 363-1110.

⁴⁷ Department of the Air Force, Space Systems Division Regulation § 55-1 (1985). "Program offices and operators must address positioning concerns in their planning. . . . Maintaining acceptable distance between satellites is necessary to reduce the chance of . . . debris damage from other space systems and damage from collision with another satellite." *Id.* § 55-1(1).

Orbit.⁴⁸

B. *Federal Law: Statutes, Regulations and Executive Orders*

1. *Statutes*

a. *The Commercial Space Launch Act*

Private commercial launches are regulated by the Department of Transportation (DOT) under The Commercial Space Launch Act (CSLA).⁴⁹ Under the CSLA, DOT "may, with respect to launches and the operation of launch sites, prescribe such additional requirements as are necessary to protect the public health and safety, safety of property, and national security interests and foreign policy interests of the United States. . . ."⁵⁰ The DOT Secretary has not yet issued regulations creating standards for the minimization of space debris by the commercial launch industry. Under 14 C.F.R. §§ 400-415, commercial space venturers are required to comply with the CSLA.⁵¹ These DOT regulations apply to DOT launch license applicants and address issues of safety concerning a launch including in-orbit safety, reentry hazards and, by implication, the risks posed by orbital debris.⁵²

⁴⁸ "At lower orbits, potential conflicts become more complex with fixed and maneuvering satellites. The level of congestion must be considered when planning final orbit location or transfer to another orbit". *Id.* "Although the likelihood of one operational satellite with another satellite or with a piece of debris is small at present, it will grow with the proliferation of space objects, increased system size, and extended on-orbit lifetimes. Future planning must minimize the possibility of collision." *Id.* § 55-1(2)(c).

⁴⁹ 49 U.S.C. §§ 2601 (1988). For more information contact the Department of Transportation, Office of Commercial Space Transportation, Nassif Building, 400 Seventh Street, SW Washington, DC 20590, (202) 366-4570.

⁵⁰ 49 U.S.C. § 2607(b) (1988).

⁵¹ 14 C.F.R. §§ 400-415 (1991). "The basis for the regulations in this chapter is the Commercial Space Launch Act of 1984, and applicable treaties and international agreements to which the United States is a party." *Id.* § 400.1. "These regulations set forth the procedures and requirements applicable to the authorization and supervision of all space launch activities conducted from United States territory or by United States citizens. *Id.* § 400.2.

⁵² INTERAGENCY GROUP, *supra*, note 2, at 43.

b. *The Land Remote Sensing Commercialization Act of 1984*

The Land Remote Sensing Commercialization Act of 1984⁵³ requires that a licensee shall "upon termination of operations under the license, make disposition of any satellites in space in a manner satisfactory to the President. . . ."⁵⁴ Under this provision, the Department of Commerce (DOC) could choose at some point in the future to require that a nonoperational satellite be removed from orbit to prevent orbital clutter.⁵⁵ Likewise, DOC could also impose design and orbital specifications for satellite disposal.⁵⁶

c. *The Federal Tort Claims Act*

Theoretically, the common law of torts could apply if damages caused by orbital debris were traced to the party responsible for the release or creation of debris. Suits against the United States for its tortious acts can be instituted under the Federal Tort Claims Act.⁵⁷ Federal courts might seek to establish jurisdiction under the Act in cases of negligence by the United States, where damage is caused by debris either in space or outside of the United States.⁵⁸ There are no reported cases that involve space debris issues, but common law may develop in the future, with respect to damage by space debris. This in turn could lead to uniform standards regarding space debris.

2. *Federal Regulations*

As yet, few federal regulations exist regarding orbital or space debris. However, as the topic takes on greater importance in the future, the *Code of Federal Regulations Index and Finding Aids* should be checked as to the agencies listed above. Updates for the Index are available in (1) *Code of Federal Regulations Sections Affected* which publishes changes in the Code of Regulations (C.F.R.) volume on a monthly basis and (2) *The Cu-*

⁵³ 15 U.S.C. §§ 4201 (1988).

⁵⁴ *Id.* § 4242(b)(3).

⁵⁵ *See generally* 15 U.S.C. § 4242(b)(3).

⁵⁶ *Id.*

⁵⁷ Tort Claims Procedure, 28 U.S.C. §§ 2671 (1988).

⁵⁸ *See generally id.*

mulative List of Parts Affected which is contained in the daily publication of the *Federal Register*, as well as in its weekly index. *Shepard's Code of Federal Regulations Citations* contains up-to-date information on regulations and citations which may be unavailable elsewhere.

3. *Executive Order 12114*

Executive Order 12114⁵⁹ concerns certain federal actions which potentially affect the environment of the "global commons outside the jurisdiction of any nation (e.g., the oceans or Antarctica)."⁶⁰ The Order furthers the purpose of the National Environmental Policy Act, although it states that it is based on independent authority.⁶¹ This Order encompasses the policy and procedures to be undertaken by federal agencies with respect to "major federal actions" having "significant effects on the environment outside the geographical borders of the United States and its territories and possessions."⁶² Several United States agencies consider outer space exempt from the Order's requirements, but, as a matter of policy, some agencies perform environmental impact assessments regarding the potential generation of debris in orbit.⁶³

C. *International Law*

International treaties are a primary source of space law relating to space debris. Treaties formulated under the auspices of, or within the framework of an international organization are found within its documents. The *United Nations Treaty Series* (U.N.T.S.) contains all treaties registered with the United Nations by member nations and some non-member nations. Cumulative indexes are available. Unfortunately, U.N.T.S. is routinely up to ten years behind in publishing treaties. The bi-monthly *International Legal Materials* (ILM), published by the American Society of International Law, includes current multilateral and bilateral treaties which may not yet be available in general

⁵⁹ Exec. Order No. 12114, 44 Fed. Reg. 1957 (1979).

⁶⁰ *Id.* § 2-3(a).

⁶¹ *Id.* § 1-1.

⁶² *Id.* § 1-1.

⁶³ INTERAGENCY GROUP, *supra* note 2, at 43; Baker, *supra* note 25, at 69.

treaty collections.⁶⁴

United States Treaties and Other International Agreements is the official source of United States treaties.⁶⁵ *Treaties in Force*⁶⁶ lists treaties and other international agreements of the United States in force on January 1 of each year. The publication is arranged into two parts with an appendix. International agreements and bilateral treaties are listed by country or international entity within subject headings in Part 1. Multilateral treaties and other international agreements to which the United States is a party lists parties to the agreement, and are arranged by subject in Part 2.⁶⁷

Texts of treaties to which Canada is a party are published in the Canada Treaty Series/*Recueil des traités du Canada*.⁶⁸ British treaties are numbered as a Treaty Series, are published as Command Papers, and appear in bound volumes of Parliamentary Papers.⁶⁹ In France, multilateral treaties are published

⁶⁴ ILM also contains summaries and text of judicial and quasi-judicial proceedings, foreign legislation and regulations, summaries and text of other international documents, such as conferences.

⁶⁵ Treaties and Other International Acts Series (T.I.A.S.). T.I.A.S. is published under the direction of the Secretary of State, United States Government Printing Office. It is compiled, edited, indexed and published by authority of law. 1 U.S.C. § 113. ("[T]he Treaties and Other International Acts Series issued under the authority of the Secretary of State shall be competent evidence . . . of the treaties, international agreements other than treaties . . . in all courts of law and equity . . . of the United States, and of the several States, without further proof or authentication thereof.") Bound volumes are current through 1982. Thereafter annual cumulative indexes to slip treaties and agreements are available through 1989.

⁶⁶ TREATIES IN FORCE is published annually by the United States Department of State.

⁶⁷ The appendix contains a consolidated tabulation of documents affecting international copyright relations of the United States which are not relevant to space debris research. Research on outer space debris or orbital debris is best conducted in these volumes under the headings "astronaut," "nuclear accidents," "nuclear test ban," "outer space," "satellite communications," and "space."

⁶⁸ 19__ Can. T.S. No. __. Issue dates 1928-1964, 1967-date. Available in the United States at University of California at Berkeley, California.

⁶⁹ 1__ Gr. Brit.T.S. No. __ (Cmd. __); Treaty Series began in 1892-date. Indexes are issued irregularly covering three or more years. Treaty Series are also issued in the parliamentary series as Papers by command, P. __; (Catalogue of Parliamentary Papers issued 1801-1900, 1901-1910, 1911-1920, 1922). In addition, by treaty, England has joined the European Economic Community (EEC) and EEC treaties now take precedence over English law when there is a conflict. D. MACELLVEN, *LEGAL RESEARCH HANDBOOK*, 271 (2nd ed. 1986).

in the *Journal Officiel*.⁷⁰ The official source of treaties for the Federal Republic of Germany is the *Verträge der Bundesrepublik Deutschland*.⁷¹

The MANUAL ON SPACE LAW, (N. Jasentuliyana and Roy S.K. Lee 1979), provides, in Volume II, the text of space law treaties, treaty status information, and a selected bibliography of treaties and articles.

1. *Space Law Treaties*

Among the treaties that address issues of space law, five are potentially relevant on space debris issues: the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and other Celestial bodies⁷² (The Outer Space Treaty); the Convention on the International Liability for Damage Caused by Space Objects⁷³ (The Liability Convention); the Convention on Registration of Objects Launched into Outer Space⁷⁴ (The Registration Convention); the Agreement on the Rescue of Astronauts, the Return of Astronauts, and the Return of Objects Launched into Outer Space⁷⁵ (The Rescue Agreement); and the Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and Under Water⁷⁶ (The Limited Test Ban Treaty).

⁷⁰ Publication 1881-1941, and 1945-date. Available in the United States at the University of Mississippi, Mississippi.

⁷¹ 1955-date. Available at various locations within the United States.

⁷² Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, October 10, 1967, 18 U.S.T. 2410, T.I.A.S. No. 6347, 610 U.N.T.S. 205 [hereinafter, The Outer Space Treaty].

⁷³ Convention on International Liability for Damage Caused by Space Objects, October 9, 1973, 24 U.S.T. 2389, T.I.A.S. No. 7762, 961 U.N.T.S. 187 [hereinafter, The Liability Convention].

⁷⁴ The Convention on Registration of Objects Launched into Outer Space, September 15, 1976, 28 U.S.T. 695, T.I.A.S. No. 8480, 1023 U.N.T.S. 15 [hereinafter, The Registration Convention].

⁷⁵ The Agreement on the Rescue of Astronauts, the Return of Astronauts, and the Return of Objects Launched into Outer Space, December 3, 1968, 19 U.S.T. 7570, T.I.A.S. No. 6599, 672 U.N.T.S. 119 [hereinafter, The Rescue Agreement].

⁷⁶ The Treaty Banning Nuclear Weapons Tests in the Atmosphere, in Outer Space and Under Water, October 10, 1963, 14 U.S.T. 1313, T.I.A.S. No. 5433, 480 U.N.T.S. 43 [hereinafter, The Limited Test Ban Treaty].

a. *The Outer Space Treaty*

The Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies,⁷⁷ entered into force on October 10, 1967.⁷⁸ The Outer Space Treaty provides that nations bear international responsibility for their national activities in outer space, including the moon or other celestial bodies whether such activities are carried on by governmental agencies or by non-governmental entities.⁷⁹

A party that launches or procures the launch of a space object, or from whose territory or facility an object is launched is liable for damage caused by the object or its component parts on Earth, in air space or outer space.⁸⁰ Jurisdiction and control is retained over the object by the party who registers it.⁸¹ A party to the treaty may request a consultation if an activity or experiment planned by another state would potentially cause harmful interference with activities in outer space.⁸²

⁷⁷ The Outer Space Treaty, *supra* note 72.

⁷⁸ The Outer Space Treaty, *supra* note 72, 18 U.S.T. 2410, T.I.A.S. No. 6347, at 1, 610 U.N.T.S. 205, 206 n.1.

⁷⁹ Article VI of the treaty provides in pertinent part:

States Parties to the Treaty shall bear international responsibility for national activities in outer space, including the moon and other celestial bodies, whether such activities are carried on by governmental agencies or by non-governmental entities, and for assuring that national activities are carried out in conformity with the provisions set forth in the present Treaty. The activities of non-governmental entities in outer space, including the moon and other celestial bodies, shall require authorization and continuing supervision by the appropriate State Party to the Treaty.

Id. at art. VI.

⁸⁰ Article 7 provides in pertinent part:

Each State Party to the Treaty that launches or procures the launching of an object into outer space, including the moon and other celestial bodies, and each State Party from whose territory or facility an object is launched, is internationally liable for damage to another State Party to the Treaty or to its natural or juridical persons by such object or its component parts on the Earth, in air space or in outer space, including the moon and other celestial bodies.

Id. at art. VII.

⁸¹ "A state Party to the Treaty on whose registry an object launched into outer space is carried shall retain jurisdiction and control over such object, and over any personnel thereof, while in outer space or on a celestial body." *Id.* at art. VIII.

⁸² Article IX provides, in pertinent part:

A State Party to the Treaty which has reason to believe that an activity or experiment planned by another State Party in outer space, including the moon and

b. *The Liability Convention*

The Convention on International Liability for Damage Caused by Space Objects⁸³ entered into force on October 9, 1973.⁸⁴ The Liability Convention, the most relevant space law treaty regarding space debris, provides a legal mechanism for establishing absolute liability for damage caused by space operations and any resulting space debris.⁸⁵ Under the Convention, a means is established for the recovery of losses by damaged claimant states, private owners and insurers.⁸⁶

c. *The Registration Convention*

The Convention on Registration of Objects Launched into Outer Space⁸⁷ entered into force on September 15, 1976.⁸⁸ The Registration Convention requires the registration of any space object launched into orbit or beyond with the United Nations.⁸⁹ The registration system is designed to help a state damaged by a space object identify the launching state or launching party.⁹⁰

other celestial bodies, would cause potentially harmful interference with activities in the peaceful exploration and use of outer space, including the moon and other celestial bodies, may request consultation concerning the activity or experiment.

Id. at art. IX.

⁸³ The Liability Convention, *supra* note 73.

⁸⁴ *Id.* at 24 U.S.T. 2389, T.I.A.S. No. 7762, at 1, 961 U.N.T.S. 187, 188 n.1.

⁸⁵ "A launching State shall be absolutely liable to pay compensation for damage caused by its space object on the surface of the earth or to aircraft in flight." *Id.* at art. II.

⁸⁶ The term "damage," as used in the treaty, means "loss of life, personal injury or other impairment of health; or loss of or damage to property of states or of persons, natural or juridical, or property of international intergovernmental organizations. . . ." *Id.* at art. I.

⁸⁷ The Registration Convention, *supra* note 74.

⁸⁸ *Id.* at 28 U.S.T. 694, 695, T.I.A.S. No. 8480, at 1, 1023 U.N.T.S. 15, 16 n.1.

⁸⁹ Article II, section 1 provides in pertinent part that "[w]hen a space object is launched into earth orbit or beyond, the launching State shall register the space object by means of an entry in an appropriate registry which it shall maintain." *Id.* at art. II § 1.

⁹⁰ The preamble to the Registration Convention provides, in part:

Recalling further that the Convention on International Liability for Damage Caused by Space Objects of 29 March 1972 (footnote omitted) establishes international rules and procedures concerning the liability of launching States for damage caused by their space objects, . . . Desiring also to provide for States Parties additional means and procedures to assist in the identification of space objects[.]

Id. at 28 U.S.T. 695, 697, T.I.A.S. No. 8480, at 3, 1023 U.N.T.S. 15, 16.

d. *The Astronaut Rescue Agreement*

The Agreement on the Rescue of Astronauts, the Return of Astronauts, and the Return of Objects Launched into Outer Space,⁹¹ which entered into force on December 3, 1968,⁹² obligates a party discovering a space object or component part, which has returned to Earth in its territory, to notify both the launching state and the United Nations.⁹³ In instances where the discovering party believes the object is of a hazardous or deleterious nature, the party may so notify the launching authority who must then take immediate steps, under the direction and control of the discovering party, to eliminate any possible danger or harm.⁹⁴

e. *The Limited Test Ban Treaty*

The Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and Under Water,⁹⁵ which entered into force on October 10, 1963,⁹⁶ obligates parties to prohibit and prevent any nuclear explosions, at any place under its jurisdiction or control in the atmosphere, beyond its limits, under water or in outer space.⁹⁷ The intent of the treaty is to prevent the

⁹¹ The Rescue Agreement, *supra* note 75.

⁹² *Id.* at 19 U.S.T. 7570, 7570, T.I.A.S. No. 6599, at 1, 672 U.N.T.S. 119, 120 n.1.

⁹³ *Id.* at art. 5 § 1.

⁹⁴ Section 4 of Article 5 provides in part:

[A] Contracting Party which has reason to believe that a space object or its component parts discovered in territory under its jurisdiction, or recovered by it elsewhere, is of a hazardous or deleterious nature may so notify the launching authority, which shall immediately take effective steps, under the direction and control of the said Contracting Party, to eliminate possible danger of harm.

Id. at art. 5 § 4.

⁹⁵ The Limited Test Ban Treaty, *supra* note 76, at art. I § 1(a).

⁹⁶ *Id.* at 14 U.S.T. 1313, 1313, T.I.A.S. No. 5433, at 1, 480 U.S.T.S. 43, 45 n.1.

⁹⁷ Article I provides:

1. Each party to this Treaty undertakes to prohibit, to prevent, and not to carry out any nuclear weapon test explosion, or any other nuclear explosion, at any place under its jurisdiction or control:

(a) in the atmosphere; beyond its limits, including territorial waters or high seas; or

(b) in any other environment if such explosion causes radioactive debris to be present outside the territorial limits of the State under whose jurisdiction or control such exposure is conducted. . . .

Id. at art. I § 1(a).

global distribution of radioactive waste.⁹⁸

D. *The United Nations*

The complexity of outer space issues and space technology has led to the formation of the United Nations Committee on the Peaceful Uses of Outer Space and its legal, and scientific and technical sub-committees and various task forces and working groups.⁹⁹

Thousands of legal and nonlegal documents have been published by the United Nations on the peaceful uses of outer space since 1958.¹⁰⁰ The documents include verbatim debates, reports of committees and subcommittees, working papers, draft conventions and resolutions, national space programs and policies, and national positions on legal issues.¹⁰¹ Apart from the Committee on the Peaceful Uses of Outer Space, other specialized agencies of the United Nations which generate potentially useful publications with respect to the topic of space debris include the International Atomic Energy Agency and the International Telecommunications Union.

The following are publications which list documents relating to space law treaties and space or orbital debris.

Li, Kuo Lee. *World Wide Space Law Bibliography*. Toronto: The Carswell Company Ltd., 1978; *World Wide Space Law Bibliography*. Montreal: De Daro Publishing, Vol. 2, 1987; *World Wide Space Law Bibliography, Update 1987*, 1988; *World Wide Space Law Bibliography, Update 1988*, 1989.

This is a comprehensive and invaluable bibliography with an extensive table of contents, and author and subject indexes listing virtually all relevant United Nations docu-

⁹⁸ The preamble to The Limited Test Ban Treaty provides that the parties to the treaty "[s]eek[] to achieve the discontinuance of all test explosives of nuclear weapons for all time, determined to continue negotiations to this end, and desir[e] to put an end to the contamination of man's environment by radioactive substances[]." See *Id.* at 14 U.S.T. 1313, 1316, T.I.A.S. No. 5433, at 4, 480 U.N.T.S. 43, 45.

⁹⁹ THE UNITED NATIONS AND OUTER SPACE, at 34, U.N. Sales No. E.77.1.9 (1977).

¹⁰⁰ SPACE ACTIVITIES OF THE UNITED NATIONS AND INTERNATIONAL ORGANIZATIONS 233-271, U.N. Doc. A/AC.105/358, U.N. Sales No. E.86.I.2 (1986).

¹⁰¹ *Id.*

ments. The bibliography also provides an array of various space law topics. Subject listings appear for space debris, space damage, and environmental control in outer space. The bibliography is the only publication available which includes a descriptive analysis and indexes the subject contents of documents published by the United Nations as well as other organizations and individuals. It provides easy access to the documents by topics.

UNDOC: Current Index. Dag Hammarskjold Library, vol. 12, no. 4. United Nations Publications, New York, 1990.

This index contains publications issued by the United Nations throughout the world. The index uses a standard arrangement of placing the various types of documents under one of eleven different types of headings. The same document may appear under more than one heading.

United Nation's Juridical Yearbook 1983. United Nations Publications, New York, 1990.

The Juridical Yearbook is published annually. The legal bibliography of the United Nations and related intergovernmental organizations includes documents concerning space law published during the year in question. Thus, this source is also of some value in researching specific space debris topics.

IV. SECONDARY LEGAL SOURCES AND NONLEGAL REFERENCE MATERIALS

Basic research can be conducted under specific or general subject headings. Nonetheless, since few printed catalogs list space debris or orbital debris within its own category, outer space or space law headings must be searched for material. Electronic databases, however, are likely to include "space debris" or "space junk" in separate headings.

A. *General Research Tools*

1. *Subject Headings in Library Catalogs*

Library of Congress subject headings include: Junk in space, Space debris, Debris, Space, Orbital debris, Space junk, and Space environment. Information or discussions about space debris appear in various other areas and may be found under "outer space" headings and sections dealing with the environmental degradation of space.

Card catalog subject headings, which may include space debris issues, are found under headings such as aerospace law, artificial satellites, astronautics, outer space, space flight, space law, and space stations.

2. *Index Headings in Printed Indexes*

Books in Print, 1988-89. 7 Vols. New York: R.R. Bowker, Co., 1988.

The subject heading "space law" includes numerous references which appear under other "space" headings. Of special value are the listings of annual colloquia on the law of outer space which often contain legal discussions of space debris issues. This index is published annually.

Current Law Index. 9 Vols. Foster City, CA: Information Access Company, 1988.

Subject headings under "space" topics are numerous and may include: space debris, space environment, or space law. The contents include a title index, thus making it a useful tool for researching space debris areas. This index is published annually.

Index to Legal Periodicals, 29 Vols. New York: H.W. Wilson Co., 1990.

The Index is published monthly except September, with a bound cumulative volume each year. Space debris subjects may be researched under the heading of "space law" or "air law." This source may be of limited use, particularly when electronic databases, which cover a wider range of publica-

tions, are available to the researcher.

Law Books & Serials in Print 1988. 3 Vols. New York: R.R. Bowker Co., 1988.

The subject heading "space law" contains colloquia proceedings, space annals, and government hearings which may be omitted from other sources. This index is updated annually.

Reynolds, Thomas H., ed. *Index to Foreign Legal Periodicals*. Berkeley: University of California Press, 1989.

It is suggested that the researcher use "space law" in the subject index heading to identify current articles in foreign publications. This index may be of limited value except to multilingual researchers as publication materials are not translated into English. This index is published quarterly in soft-cover. Cumulative hardbound volumes are published annually.

Triffin, Nicholas, ed. and comp. *Law Books in Print*. 5th ed. Dobbs Ferry: Glanville Publishers, 1987; *Law Books Published, 1990 Supplement to Law Books in Print*. 5th ed. Vol. 22. Dobbs Ferry: Glanville Publishers, 1990.

This valuable reference lists books in English published throughout the world that are still in print as of 1990. The subject heading "space law" refers also to "international law" and "satellite broadcasting," both of which may include books dealing with space debris issues.

3. *Electronic Databases*

DIALOG Information Services, Inc., 3460 Hillview Ave., Palo Alto, CA 94304.

DIALOG contains information from 320 databases. Included in its aerospace database are two vital data bases which cover the field worldwide, International Aerospace

Abstracts¹⁰² (IAA) and Scientific and Technical Aerospace Reports¹⁰³ (STAR). Searches can be conducted by using the terms space junk, space debris, or orbital debris. This is an excellent source.

Directory of Online Databases, Vol. 7, Nos. 1 and 2. New York: Cuadra/Elsevier (1986).

While not an electronic database, this directory contains current information with respect to the countless available online database services. Included with entries are descriptions of the databases and distinctly named files within the database families.

Infotrac, Information Access Co., 362 Lakeside Drive, Foster City, CA 94404.

Infotrac contains sixteen different databases, one of which is *Legaltrac*. The *Legaltrac* database accesses more than 800 publications including all major law reviews, bar association journals, legal newspapers and specialty publications as well as featured articles from over 2000 additional publications. Research can be done under numerous "space" topics including "space debris," or "space environment."

LEXIS, Mead Data Central Inc., 9393 Springboro Pike, Dayton, OH, 45401-9964.

The researcher may retrieve legal journal articles in LEXIS under the LAWREV service. The NEXIS library contains newspapers, magazines, news wire services and newsletters. The researcher is recommended to use terms such as space environment, space or orbital debris, or space junk. These services are very useful in identifying the general outlines of the subject matter.

WESTLAW, West Publishing Co., 50 W. Kellogg Blvd., St. Paul, MN, 55164-9752.

¹⁰² Discussed *infra* p. 189

¹⁰³ Discussed *infra* p. 190.

Under its database identifier, TP, WESTLAW will access over 200 law reviews and bar journals in the Texts and Periodicals database. Searches may be conducted under space environment, space or orbital debris or space junk. This service does not appear to be as useful on this topic as LEXIS.

4. *Legal Bibliographies*

- Li, Kuo Lee. *World Wide Space Law Bibliography*. Toronto: The Carswell Company Ltd., 1978; *World Wide Space Law Bibliography*. Montreal: De Daro Publishing, Vol. 2, 1987; *World Wide Space Law Bibliography, Update 1987, 1988*; *World Wide Space Law Bibliography, Update 1988, 1989*.

This work is a singular comprehensive guide which details subject classifications, works on astronautics, space communications and space law topics. Subject and author indexes are included in this invaluable work. The term "Space debris" is listed as a subject heading.

- Magraw, Daniel B. and Ketler, Theresa. "Law Relating to Outer Space: A Bibliography — Part I." *International Lawyer* 19 (Fall 1985): 1391-1427; Magraw, Daniel B. and Ketler, Theresa. "Law Relating to Outer Space: A Bibliography — Part II." *International Lawyer* 20 (Winter 1986): 399-421.

This two-part bibliography is a comprehensive work which contains numerous headings of use to a researcher. The heading "Environmental Regulations" contains numerous useful articles regarding space debris which have been presented to colloquia on the law of outer space.

- Rawnsley, L. Scott, *Selective Bibliography of Outer Space Law*. Dobbs Ferry: Oceana Publications, Inc., 1987.

This bibliography organizes topics, but does not contain author or subject indexes. Space debris papers are covered under "protection of the Earth's environment." This source is not as useful or comprehensive as other bibliographies in the space debris area.

- Wise, Sally H. and Andrus, Kay L. "Bibliography: Current

Literature on Aerospace Law." *Journal of Air Law and Commerce*. 51(1985): 273-301; Wise, Sally H. and Andrus, Kay L. "Bibliography: Current Literature on Aerospace Law." *Journal of Air Law and Commerce*. 52(1986): 305-321.

This two-part bibliography does not contain a table of contents or index. One must search through listings for subjects of interest. The bibliography contains aviation as well as space law topics.

5. *Abstracts Services*

International Aerospace Abstracts (IAA).¹⁰⁴

IAA is an abstract service which, along with STAR, covers the entire world's literature on aerospace topics, including space debris material. This database is available electronically from DIALOG,¹⁰⁵ and from the European Space Agency.¹⁰⁶ The service scans journals, books, proceedings, transactions and translations for aerospace material. To locate sources within the abstract one should look under the headings "space debris," or "space junk."

Scientific and Technical Aerospace Reports (STAR).¹⁰⁷

STAR is an abstract service which covers the entire aerospace industry and, along with IAA, virtually abstracts all aerospace literature worldwide. This database is available electronically from DIALOG,¹⁰⁸ and the European Space Agency.¹⁰⁹ The researcher can find material under the terms space debris, orbital debris, or space junk.

¹⁰⁴ For more information contact American Institute of Aeronautics and Astronautics, 555 West 57th Street, New York, NY 10019.

¹⁰⁵ See *supra* p. 170.

¹⁰⁶ See *supra* note 19.

¹⁰⁷ National Aeronautics and Space Administration, 600 Independence Avenue, SW Washington, DC 20546.

¹⁰⁸ See *supra* p. 187.

¹⁰⁹ See *supra* note 19.

6. *Document Retrieval Services*

Document retrieval services are useful for obtaining documents identified in aerospace databases. The following are of special interest in the area of space debris.

Aerospace Research Application Center.¹¹⁰ Indiana/Purdue University of Indianapolis, 611 North Capitol Avenue, Indianapolis, IN 46204. (317) 264-4644.

American Institute of Aeronautics and Astronautics Technical Information Service.¹¹¹ 555 West 57th Street, New York, NY 10019. (212) 247-6500.

B. *Treaties, Handbooks and Published Conference Proceedings*

Overviews of space debris issues are available in secondary sources such as handbooks, treatises, newsletters, technical and scientific journals and looseleaves.

1. *Handbooks and Treatises*

Baker, Howard A. *Space Debris: Legal and Policy Implications*. Dordrecht, the Netherlands: Martinus Nijhoff, 1989.

U.S. Congress. House. Committee on Science, Space, and Technology. Subcommittee on Space Science and Applications. *Orbital Space Debris*. 100 Cong. 2d Sess., 1988. Committee Print 112 (Supt. Docs. No. Y 4.Sci 2:100/112).

COSPAR, Plenary Meeting (25th: Graz, Austria) *Space Debris: Asteroids and Satellite Orbits*, 1st ed. Oxford: Pergamon Press, 1985.

European Space Agency, *Space Debris: A Report of the ESA Space Debris Working Group*. ESA SP 1109. The Netherlands: ESA Publications Division, 1988.

Interagency Group (Space), *Report on Orbital Debris*. Prepared for the National Security Council, Washington, D.C.:

¹¹⁰ Listed in *Document Retrieval: Sources & Services*, edited by Katherine T. Alvord, 3rd ed. San Francisco: The Information Store, Inc., 1985.

¹¹¹ *Id.*

GPO, Feb. 1989.

Jasentuliyana, N. and Chipman, R., eds. *International Space Programmes and Policies: Proceedings of the Second United Nations Conference on the Exploration and Peaceful Uses of Outer Space (Unispace)*. New York: Elsevier Science Pub. Co., 1984.

Jasentuliyana, N. and Lee, R.S., eds. *Manual of Space Law*. Dobbs Ferry: Oceana Publications, Inc., 1979.

Johnson, N.L. and McKnight D.S., *Artificial Space Debris*.

Malabar: Orbit Book Co., 1987.

Kessler, D. and Su, K. National Aeronautics Space Administration, Scientific and Technical Information Branch. 1985. *Orbital Debris*. NASA Conference Publication no. 2360.

United Nations. *Space Activities of the United Nations and International Organizations*, U.N. Pubs. A/AC.105/358, sales no. E.86.I.2. 1986.

U.N. Committee on the Peaceful Uses of Outer Space, *Environmental Effects of Space Activities*, 14 U.N. Doc. A/AC. 105/420. 1988.

U.S. Department of Transportation. *Hazard Analysis of Commercial Space Transportation*. Prepared by the Office of Commercial Space Transportation. Washington, D.C.: GPO, 1988.

2. *Loose-leaf Publications*

Gorove, Stephen, ed. *United States Space Law: National and International Regulations*. Dobbs Ferry: Oceana Publications, Inc., 1986-date.

As yet, this publication contains no information directly dealing with space debris. However, because of periodic supplements, this single publication in the subject area of space will probably include regulations on space debris as they are issued.

3. *Encyclopedias*

Osmanczyk, Edmund Jan., *The Encyclopedia of the United Nations and International Agreements*, Philadelphia, Taylor & Francis, Inc., 1986.

This encyclopedia contains international agreements, conventions and treaties and includes explanations of political, economic, military, geographical and sociological terms. The source is a useful research tool for space law treaties and general information about organizations and committees dealing with space law issues worldwide.

4. *Newsletters*

Many newsletters are available in the areas of aeronautics and astronautics which may include information on space debris issues. Subscription costs may run as high as \$750.00 a year and may be of limited value as the publications may only report sporadically about space debris. The newsletters listed below also include less costly publications which may occasionally include some information concerning orbital debris. An extensive listing of publications issued on a continuing basis by national non-profit membership organizations of the United States is available in the *Encyclopedia of Associations: Association Periodicals*, Vol. 2. Detroit: Gale Research Co., 1987, which covers science, medicine and technology.

AAS Newsletter. American Astronautical Society, Inc., 6060 Duke Street, Alexandria, VA 22304, (703) 751-7323.

This newsletter contains news of upcoming meetings, society affairs, section meetings and items of interest to the astronautical community.

Aerospace Daily. Ziff-Davis Publishing Co., Inc., 1156 Fifteenth Street, NW, Washington, DC 20005, (202) 822-4600.

This news service reports on the entire aerospace industry and covers programs, funding, technology and people in every aerospace and defense center in the world.

Air and Space Lawyer. American Bar Association, Forum Committee on Air and Space Law, 750 North Lake Shore Drive, Chicago, IL 60611, (312) 988-5000.

This journal is published quarterly and available to ABA forum committee members.

AIAA Journal. American Institute of Aeronautics and Astronautics (AIAA), 370 L'Enfant Promenade, SW, Washington, DC 20024, (202) 646-7400.

This technical journal covers new developments in aeronautical and astronautical areas and the aerospace environment.

IIE News: Aerospace. Institute of Industrial Engineers, 25 Technology Park/Atlanta, Norcross, GA 30092, (404) 449-0460.
International Institute of Space Law Newsletter. International Institute of Space Law, Leestraat 43, NL-3743, EH Baarn, Netherlands. Information about the International Institute of Space Law appears *infra*. at p. 196.

Report of the United Nations Expert on Space Applications to the Scientific and Technical Sub-Committee. United Nations Committee on the Peaceful Uses of Outer Space (COPUOS), United Nations, New York, NY 10017, (212) 963-6051.

Satellite News. Phillips Publishing, Inc., 7811 Montrose Road, Potomac, MD 20854, (301) 340-2100.

This source covers the commercial satellite industry as to its management, marketing, regulation and profit aspects.

Satellite Week. Warren Publishing, Inc., 2115 Ward Court, NW, Washington, DC 20037, (202) 872-9200.

This newsletter reports on regulatory, technological and industry developments in space technology and communications.

C. *International Organizations*

Numerous governmental and nongovernmental organizations are actively involved in space exploration and research and hold colloquia, activities and annual meetings dealing with scientific and legal issues relating to outer space.¹¹² The United Nations and the European Space Agency are two of the most significant international organizations.¹¹³ These organizations produce a variety of publications relating to the areas of space or orbital debris. Listings of these organizations are available in the following sources.

Irvin, Linda, ed. *The Encyclopedia of Associations: International Organizations*, 25th ed. Part 2, Indexes, 1991.

The encyclopedia lists scientific, engineering and technical international nonprofit organizations and national organizations based outside the United States. Extensive listings appear under headings such as aerospace, astronautics, space communications, space law and various other space categories.

Yearbook of International Organizations, Subject Guide. Vol. 3. Munchen; New York; London; Paris: Saur, 1984.

This volume contains a comprehensive list of organizations under "aerospace" and "satellites" categories. The volume includes organizations involved in academia, government, and the civil sector throughout the world.

D. *Professional Associations*

Groups interested in space or orbital debris issues are listed in a number of publications including the following: *Encyclope-*

¹¹² The JOURNAL OF SPACE LAW (see *infra* p. 196) contains a section entitled "Events of Interest" which includes information on the various symposia, conferences, and colloquia held by international organizations. This section also includes information on various forthcoming events related to space law. ANNALS OF SPACE LAW (see *infra* p.) includes a section in each volume entitled "Comments on International Organizations." The comments discuss legal developments within the international organizations in the past year. This section is extremely useful to a researcher keeping current on space debris issues.

¹¹³ See *supra* pp. 184 and 170, respectively.

dia of Legal Information Sources (1987), the *Encyclopedia of Associations* (1988), and *Law and Legal Information Directory*. The associations as well as research centers and institutes can be contacted for information about meetings, research and researchers in space debris topics. A few representative groups are listed below.

Association of United States Members of the International Institute of Space Law (c/o Office of the President, University of Mississippi Law Center, University, MS 38677).

This national organization seeks to promote the participation and contribution of United States members in solving legal problems arising from the use and exploration of outer space.

Forum Committee on Air and Space Law (American Bar Association, 750 North Lake Shore Drive, Chicago, IL 10522).

Association of American Law Schools (Section on Aviation and Space Law, Association of American Law Schools, One Dupont Circle, NW, Washington, DC 20036).

E. *Research Centers and Libraries*

Air and Space Research Center (Air & Space Law Research Center, 15 Jalan Banyumas, Jakarta, Indonesia).

Ibero-American Institute of Aeronautics and Space Law and Commercial Aviation (Avenida de Los Reyes Catolicos 4, Madrid 3, Spain).

The group consists of university professors, aeronautical company executives, officials in civil aviation and aeronautical companies who study the rights and laws pertaining to aeronautics and commercial aviation.

Institute and Centre of Air and Space Law (McGill University, 3690 Peel Street, Quebec H3A 1W9, Canada).

Institute of Air and Space Law (University of Cologne, Albertus-Magnus-Platz, 5000 Cologne 41, Federal Republic of Germany).

International Institute of Space Law (Leestraat 43, NL-3743, EH Baarn, The Netherlands).

This group, a subsidiary body of the International Astronautical Federation, conducts annual space law colloquia on various space law topics each year. Sessions often include space or orbital debris discussions. These colloquia are summarized in the *Journal of Space Law* and are an invaluable source of information regarding this topic.

McGill University (Institute of Air and Space Law, 3690 Peel Street, Montreal, Quebec, H3V 1C2, Canada, Director: Dr. Nicolas Mateesco Matte).

The University serves as a center of documentation for air and space law publications.

University of Mississippi (School of Law Library, University, MS 38677).

The library contains a special collection of 500 space law volumes.

F. *Space Law Journals*

The journals listed below deal specifically with space law topics on a continuing basis. Major trends are often delineated in these publications and policy and treaties are analyzed, often article by article. These journals regularly report on meetings of interest to the community and review books.

Annals of Air and Space Law (Institute and Centre of Air and Space Law, McGill University, 3690 Peel Street, Montreal, Quebec, H3A 1W9, Canada).

The index in this law review consists of a subject and author index, lists of cases, lists of statutes and a book review section. The index regularly publishes the continuing reports of colloquia, meetings, and activities of international organizations.

Journal of Air Law and Commerce (School of Law, Southern Methodist University, Dallas, TX 75275).

Journal of Space Law (University of Mississippi Law Center, MS 38677).

This journal contains reports of United Nations sub-committee and committee sessions, meetings and colloquia held by international organizations dealing with space law. These reports discuss space debris issues covered at international forums. They are an excellent resource for keeping abreast of research and development presented at international organizations. Both the *Annals of Air and Space Law* and the *Journal of Space law* report extensively on topics of interest to space lawyers and are a prime research tool.