

LEGAL ASPECTS OF THE UNITED STATES/INTERNATIONAL SPACE STATION

I. INTRODUCTION

The United States committed itself in the last decade to major participation in one of the largest and most complex international cooperative ventures in history. This venture is known as the U.S./International Space Station and will be named Space Station Freedom upon its completion. In his State of the Union address on January 25, 1984, President Reagan gave official approval to develop a space station and called for "our friends to help us meet these challenges and share in their benefits. NASA will invite other countries to participate so we can strengthen peace, build prosperity, and expand freedom for all who share our goals."¹ Other countries agreed to participate in the space station,² thus creating, on a worldwide scale, an experimental habitat for international cooperation and problem-solving existing outside the earth's boundaries. Such a unique framework for testing principles of international law and cooperation has not existed in previous earthbound international ventures.³

The uniqueness of the space station lies in the fact that it is a completely international space venture, which presents previously unencountered legal and cooperative complexities.⁴ By the second half of this decade, the space station will be con-

1. Address Before a Joint Session of the Congress on the State of the Union, PUB. PAPERS 87, 90 (Jan. 25, 1984); Eilene Galloway, *The Space Station: United States Proposal and Implementation*, 14 J. SPACE L. 14-15 (1990). President Reagan's speech initiated what the State Department has described as the "world's largest international cooperative venture—and the most complex." George Paul Sloup, *Conflict Resolution for Space Station Crew Members—the Space Station Intergovernmental Agreement and Beyond*, in 32 COLLOQUIUM ON THE LAW OF OUTER SPACE 404 (1989).

2. Sloup, *supra* note 1, at 406.

3. See Hamilton DeSaussure, *Tort Jurisdiction Over the New International Space Station*, in 32 COLLOQUIUM ON THE LAW OF OUTER SPACE 304 (1989).

4. See Galloway, *supra* note 1, at 15.

structed and operational in its low orbit above the earth.⁵ The space station will be an independent facility manned by crews from many different countries.⁶ Therefore, before the facility is operational, the participants must either develop and agree upon a system of laws to govern the space station and its crews, or face chaos when the first inevitable dispute arises.⁷ The parties involved have reached a number of bilateral and multilateral agreements to resolve some of the complexities which will exist aboard the space station.⁸ However, in order to promote operational efficiency and avoid disputes, more detailed international agreements are necessary to specify jurisdiction aboard the space station, decide how disputes are to be resolved, and determine which participating country's law will govern the various legal issues which exist in the daily life of any society.⁹

5. DeSaussure, *supra* note 3, at 304.

6. See Sloup, *supra* note 1, at 404. Similar to a ship on the high seas, the space station and its crew will be completely independent from Earthbound counterparts in mission control when in orbit. *Id.*

7. Sloup, *supra* note 1, at 404.

8. Arrangement Concerning Application of the Space Station Intergovernmental Agreement, *done at* Washington, D.C. Sept. 29, 1988, *reprinted in* STEPHEN GOROVE, 3 UNITED STATES SPACE LAW NATIONAL AND INTERNATIONAL REGULATION § II.A.22 [hereinafter Intergovernmental Agreement or IGA] (the IGA, to which the U.S., Japan, Canada, and the ESA are signatories, is a multilateral agreement for the development of the space station). In addition, bilateral memoranda of understanding were signed by the U.S. and each of the other counterparts. Memorandum of Understanding between the United States National Aeronautics and Space Administration and the European Space Agency on Cooperation in the Detailed Design, Development, Operation, and Utilization of the Permanently Manned Civil Space Station, *done at* Washington, D.C. September 29, 1988 [hereinafter MOU] (the two other MOUs are identical to the ESA's except "Japan" or "Canada" is substituted for "ESA").

9. These issues include torts, contracts, patents, criminal law. While choice of law questions are difficult within different jurisdictions of a single country, multinational choice of law questions can create international controversies which can be avoided if agreement is achieved beforehand. Suggestions for choice of law agreements include: advanced designation of a particular jurisdiction's laws based on a degree of control and responsibility for the day-to-day operations; and contractual stipulations with all space station personnel as to the law to be applied. DeSaussure, *supra* note 3, at 307-08.

space activity is the communications satellite industry, followed by remote sensing programs, space experiment labs, and space manufacturing.¹⁷ While it is now the smallest sector of space activities, manufacturing commentators predict manufacturing will become the biggest sector by the year 2000.¹⁸ Some also predict that such manufacturing activities will become full-scale orbiting industrial plants in the future.¹⁹ The zero-gravity, near-vacuum, and temperature extremes available in space will allow production of items whose quality and quantity cannot feasibly be produced on Earth.²⁰ The Center for Space Policy in Cambridge, Massachusetts predicts that space activities will generate between \$16.8 billion and \$51.3 billion by the year 2000.²¹ As more countries realize the value of space activity, the necessity for cooperation and for setting legal guidelines will become apparent. The legal regime designed for the space station will provide the only framework for increasing numbers of future international space ventures.

B. Space Station Participants

The United States, Canada, Japan, and the European Space Agency (ESA) will construct and will operate the space station.²² The Intergovernmental Agreement (IGA), signed by all the Partners in 1988, establishes a long-term international

stations have already proven their usefulness as experimental labs through the United States Skylab and Soviet Mir programs, which produced valuable scientific data for use on earth. *Id.*

17. *Id.* at 112-13. The communication satellite industry earns revenues of \$3 billion annually. *Id.*

18. *Id.* at 113. Space manufacturing is exists only on a small scale. *Id.*

19. One company, Space Industries Incorporated, has contracted with NASA to conceptually develop a purely industrial orbiting facility for manufacturing. If such a facility is produced, then the space station could be wholly devoted to experiments. Interview with Jeff Lasater, Project Engineer, Space Industries, Inc., Houston, Texas (March 16, 1991).

20. GOLDMAN, *supra* note 16, at 10. Manufacturing possibilities include growing pure crystals for semiconductors, combining metals that are unmixable on Earth, and making pharmaceuticals. Most notably, the near-zero gravity provides an environment for the production of invaluable pharmaceuticals which cannot be produced on Earth that may cure a variety of diseases. *See* Gorbziel, *supra* note 15, at 511.

21. GOLDMAN, *supra* note 16, at 113.

22. Intergovernmental Agreement, *supra* note 8, art. 4.

A. *Physical Makeup of the Space Station*

Space Station Freedom represents the first jointly sponsored, permanently manned space facility.¹⁰ All previous space stations, such as Mir and Skylab, have been entirely produced and operated by individual nations.¹¹ The space station will be over 500 feet long, weigh over half a million pounds, and is designed to orbit for thirty years.¹² The space station will consist of different modules attached to an overall infrastructure provided by the United States.¹³ Completion of the project will require twenty-nine shuttle flights.¹⁴ The Background Paper on Space Stations and the Law defines a space station as "an object or a collection of objects which is in an intentional long-duration orbit and is, at least in part, habitable."¹⁵

The space station will be principally used as a laboratory and manufacturing facility.¹⁶ Currently the largest area of

10. NASA NEGOTIATING TEAM, SPACE STATION PHASE C/D/E AGREEMENTS, No. OSS-9845 (1988) (on file with the *Houston Journal of International Law*) [hereinafter C/D/E Agreements].

11. See DeSaussure, *supra* note 3, at 304 (Skylab was launched by the United States on May 14, 1973, and was the first manned U.S. space station. In 1986, the Soviet Union launched MIR, the second manned space station currently in orbit.)

12. DeSaussure, *supra* note 3, at 304.

13. See C/D/E Agreements, *supra* note 10, at OSS-9345B.

14. NASA to Appoint Separate Managers for Space Station Construction, *Utilization*, AVIATION WK. & SPACE TECH., Feb. 26, 1990, at 24. Eighteen flights will be required for assembly, and eleven for logistics and to resupply the facility after it is permanently manned. *Id.* Crews will remain on board for six months. Initially, only crews from the participating countries will man the space station. However, missions will eventually include crew members from many different countries. *Id.*

15. I.H. Ph. Diederiks-Verschoor, *Space Stations & Their Legal Implications*, in 31 COLLOQUIUM ON THE LAW OF OUTER SPACE 262 (1988) [hereinafter *Legal Implications*]. Such a definition of space station specifically excludes the space shuttle from this classification because it can not sustain a long duration orbit. The following are characteristics of orbiting inhabited space stations: "(1) periodic replacement of personnel is possible; (2) a sufficiently wide range of tasks can be performed; and (3) the station can actively function for long periods in space." Andrzej Gorbiel, *Orbiting Inhabited Space Stations: Selected International Legal Aspects*, 7 HASTINGS INT'L & COMP. L. REV. 509, 509 (1984) (Previous facilities classified as space stations include Salyut-Soyuz, Skylab, Spacelab, and the currently operating Soviet Mir station.).

16. See NATHAN C. GOLDMAN, AMERICAN SPACE LAW 112 (1988). Space

cooperative framework based on a "genuine partnership."²³ The space station Partners will all share operating costs, provide crews, participate in management of the station, and provide flight hardware and ground support elements.²⁴ Likewise, article 27, paragraph 1, titled "Withdrawal," states that "[a]ny partner may withdraw from this Agreement at any time by giving . . . at least one year's prior written notice."²⁵ Each Partner's contribution is different, yet significant.

(1) United States

The United States is producing the core of the space station and its overall infrastructure.²⁶ The United States is responsible for overseeing construction of the facility.²⁷ Further, the United States will transport the construction materials into orbit.²⁸ Finally, the United States will provide power, com-

23. C/D/E Agreements, *supra* note 10, at OSS-9344B. Such international agreements usually use the term "States Parties." The term "genuine partnership" was first used at the 1985 Bonn World Economic Summit when Europe, Japan, and Canada decided to join the space station venture. While the meaning of "genuine partnership" is not entirely clear, it is more than mere cooperation and "implies a conduct which is based on mutual trust, fairness, basically equal rights and a maximum of common interests." Tanja L. Zwann & Walter W.C. DeVries, *Liability Aspects of the International Space Station Agreement of 29 September 1988*, in 32 COLLOQUIUM ON THE LAW OF OUTER SPACE 445, 446 (1989).

24. See C/D/E Agreements, *supra* note 10, at OSS-9845.

25. See Intergovernmental Agreement, *supra* note 8, art. 27. Withdrawal is a key element in any partnership because it is a basic principle that partners have the right to end involvement in the partnership at anytime. *Id.*

26. C/D/E Agreements, *supra* note 10, at OSS-9344B, OSS-9345B. The core and hardware elements provided by the United States are referred to as the "Core U.S. Space Station." The United States elements, in conjunction with Partner provided elements, are referred to as the "international Space Station complex," or "space station." *Id.* at OSS-9344B. While the United States will provide core space station and habitation modules, the ESA will provide a "manned, free flyer and polar platform," Japan will provide an experimental module, and Canada will provide a remote manipulator arm. DeSaussure, *supra* note 3, at 304.

27. C/D/E Agreements, *supra* note 10, at OSS-9444A.

28. *Id.* at OSS-9356A. Also, the United States has guaranteed the Partners "open, continuing and nondiscriminatory access to their Space Station facilities via the Shuttle." Ken Pederson, *Space Station: Risks and Vision*, 14 J. SPACE L. 1, 8 (1986). Until the other Partners develop their own space transport vehicles, the space shuttle has sole responsibility to provide transportation for all

munications and environmental systems, one habitation module, one laboratory module, and one unmanned satellite platform.²⁹

(2) Canada

Canada will provide a remote manipulator arm similar to the one built for the space shuttle.³⁰ The space station project is the largest international development project ever undertaken by Canada.³¹ Canadian astronauts (Space Team Canada) will be part of the space station crew on a regular basis.³² Finally, because Canada's contribution is an essential part of the space station, article 27 of the Intergovernmental Agreement provides that should Canada withdraw, it must provide all necessary materials and data to the United States to ensure effective use and operation of the Canadian elements.³³

(3) Japan

Japan will provide one experiment module, a multi-purpose laboratory for materials processing and life science work.³⁴ Similarly, NASA is also looking to the Japanese space program for lessons on efficiency, because Japan's successful program operates at one-tenth of NASA's budget and utilizes a much smaller government work force.³⁵ Japan is also providing a

international crews to the space station. *Id.* Other space transportation vehicles, such as the ESA's Ariane, and Japan's H-2, will have ready access to the space station as long as the vehicles are safe and non-disruptive to onboard operations. The design of the space station's docking facilities will be made adaptable to vehicles other than the shuttle to prevent a NASA monopoly on transportation to and from the space station. *Id.*

29. Sloup, *supra* note 1, at 405.

30. GOVERNMENT OF CANADA, CANADA'S PLACE IN SPACE, 0988 (1988).

31. *Id.* Canada's financial outlay will amount to \$1.2 billion over seventeen years. *Id.*

32. *Id.* One Canadian astronaut will be a crewmember for a six month period every two years. *Id.*

33. Intergovernmental Agreement, *supra* note 8, art. 27.

34. Japan's Participation in the International Space Station Program, Japanese Government Contribution Fact Sheet (on file with *The Houston Journal of International Law*) (describing the JEM Baseline Configuration and primary characteristics). Japan will spend over \$2.5 billion on their space station facility, and Japanese managers are voicing unwavering support for the NASA program. Donald E. Fink, *The Pacific Space Powers*, AVIATION WK. & SPACE TECH., Aug. 13, 1990, at 9.

35. Craig Covault, *Japanese Accelerate Space Program for 21st Century*, AVI-

backup launch site for the shuttle when used for space station resupply flights.³⁶ In return, two Japanese astronauts will fly on the shuttle every two years beginning in 1991.³⁷

(4) European Space Agency

The European Space Agency (ESA) is the most unique participant in the space station. The ESA is an intergovernmental organization with thirteen member states, of which ten will participate in the space station venture.³⁸ Special legal problems arise because part of the space station will belong to the ESA. Only the ESA as a whole has the power to vote and negotiate in its Partner status. Individual European countries may not directly negotiate with other space station Partners in their individual capacities. However, each participating country within the ESA is individually subject to liability, jurisdictional, and funding agreements made by the ESA. Even though not a "state," the ESA is still subject to all United Nations space treaties as if it were a state.³⁹ The ESA Council has declared that participation in the space station program is a basic, long-term goal of the European space plan.⁴⁰

ATION WK. & SPACE TECH., Aug. 13, 1990, at 38 [hereinafter *Japanese Accelerate*].

36. Craig Covault, *Japan's New H-2 Launch Site Rivals Largest U.S. European Facilities*, AVIATION WK. AND SPACE TECH., Aug. 13, 1990, at 41 [hereinafter *H-2 Launch Site*]. This launch site will be in Japan at its launching center on Tanegashima island. *Id.*

37. *Id.* at 40.

38. Zwaan & DeVries, *supra* note 23, at 445. The ESA's space station program is called the Columbus Programme. ESA member countries are Ireland, the United Kingdom, Spain, France, Belgium, the Netherlands, Italy, West Germany, Denmark, Sweden, and Norway. GOLDMAN, *supra* note 16, at 46.

39. See Gorbil, *supra* note 15, at 516. United Nations space treaties drafted before formation of the ESA did not contemplate membership by international organizations and only used the term "States" in setting forth principles. Later agreements and treaties specifically include international organizations and private entities under applicable space law principles. *Id.*

40. Stephen Gorove, *Events of Interest - the U.S./International Space Station - Aspects of Technology and Law*, 15 J. SPACE L. 56, 59 (1987). The ESA will contribute a manned lab module, an unmanned lab module, and a satellite platform. Sloup, *supra* note 1, at 405.

II. COOPERATIVE SPACE PRECEDENTS

Space exploration has long provided an atmosphere for international cooperation. In fact, collaborative space ventures are the rule rather than the exception.⁴¹ NASA has entered into over one thousand formal agreements with other countries since the agency was founded in 1958.⁴² Also, the Soviet Union provided the United States with information from their Mars missions to aid the United States Viking mission in exchange for information to aid the Soviets' exploration of Venus.⁴³ Finally, the world's reliance on satellites has provided another basis for extensive international cooperation in space.⁴⁴

While space venture cooperation precedents are numerous, such cooperation has been increasingly difficult to achieve since around 1980 because more countries are realizing the monetary value of space.⁴⁵ However, those countries involved in space activity agree that international cooperation is essential to the efficient and productive use of space in the future. Masato Yamano, President of the Japanese space agency, stated that it will "no longer be a case where just one country promotes its own space development. The exploration of space will become a joint effort of humankind."⁴⁶

III. SOURCES OF SPACE LAW

The Intergovernmental Agreement (IGA) of September 29, 1988 laid the foundation for the legal regime that will exist on

41. JoAnn C. Clayton, *International Cooperative Missions to Mars-Some Legal Considerations*, in 31 COLLOQUIUM ON THE LAW OF OUTER SPACE 243, 243 (1988).

42. *Id.* at 243-44. These cooperative precedents include: 1) Apollo-Soyuz - docking between the United States and Soviet Union in 1975; 2) Spacelab - experimental lab built by the ESA and flown on the shuttle; 3) Intelsat - international telecommunications satellite organization; 4) Inmarsat - international maritime satellite organization. *Id.* at 244.

43. *See id.* at 244.

44. Orbiting satellites disregard national boundaries. Furthermore, the operation of all satellites requires cooperation in the use of internationally regulated radio frequencies. Galloway, *supra* note 1, at 331-32.

45. *See* GOLDMAN, *supra* note 16, at 87.

46. Covault, *supra* note 35, at 38.

the space station.⁴⁷ However, as with the IGA, all previous space treaties will apply to the space station.⁴⁸ Also, the Partners have agreed that the basic principles of international law will apply to the space station.⁴⁹

A. *Common Heritage of Mankind*

Space law has developed under the "common heritage of mankind" principle introduced by Ambassador Pardo of Malta in the United Nations in 1967.⁵⁰ Under this doctrine, outer space cannot be owned or claimed by any sovereignty.⁵¹ In this respect, the only similar models against which to compare space law are treaties involving the high seas and Antarctica. International treaties on both the high seas and Antarctica have used the "common heritage of mankind" principle long before the theory was adopted for space law.⁵² Both the high seas and Antarctica are available for use by all nations equally and may not be appropriated by any one sovereignty.⁵³

The use of this principle in space law is also understandable when looking to parallels drawn between the environments of space, Antarctica and the seas. For example, outer space resembles Antarctica in the "inhospitable nature of the environment, isolation, difficulties of survival, lack of permanent population, only recently accessible, and unsuitable to the type of habitation in temperate regions of the earth."⁵⁴ While all

47. Intergovernmental Agreement, *supra* note 8, art. 1.

48. *Id.* art. 2.

49. G.C.M. RELJNEN & W. DEGRAFF, *THE POLLUTION OF OUTER SPACE, IN PARTICULAR OF THE GEOSTATIONARY ORBIT* 51 (1989).

50. Christie Condara, Comment, *Outer Space: Like the Sea and the Air, Whose Frontier?*, 6 HOUS. J. INT'L. L. 175, 177 (1984). When introduced, this principle referred to the seabed. *Id.*

51. Under the common heritage of mankind principle, nations may only utilize space for the benefit of all mankind. Outer Space Treaty, *opened for signature* Oct. 10, 1967, art. 1, 18. U.S.T. 2410, 610 U.N.T.S. 205 [hereinafter *Outer Space Treaty*].

52. United Nations Convention on the Law of the Sea, *opened for signature* Dec. 10, 1982, U.N. Doc. A/Conf.62/122, *reprinted in* 21 I.L.M. 1261 (1982).

53. Richard DalBello, *The Application of U.S. Domestic Law to Space Station Activities* 12 (Nov. 26, 1985) (unpublished manuscript, on file with *The Houston Journal of International Law*).

54. Clayton, *supra* note 41, at 245.

space law is founded on the "common heritage of mankind" principle, the background for development of space station law also lies in other international law principles, various space treaties, and bilateral and multilateral space station agreements.

B. *International Law Principles*

Another source of space law is general international law.⁵⁵ The law of outer space is a branch of substantive international law, as are aviation and maritime law.⁵⁶ International law has always governed space, even though these principals have gone largely untested.⁵⁷ Space law principles, such as the "common heritage of mankind," were adopted in the 1960s when space activity was virtually exclusive to the United States and the Soviet Union. Therefore, while nations espoused concepts of international law and cooperation in space, such ideas of international harmony were purely speculative. The early space treaties were negotiated for the future and not in reaction to existing legal demands. Therefore, it was easier to make space law harmonize with international law.⁵⁸ The Partners in the IGA have agreed to conduct themselves in space "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."⁵⁹

C. *Space Treaties*

The United Nations Committee on the Peaceful Uses of Outer Space has enacted major treaties attempting to create a legal regime for outer space. The space station, as other space objects, will be governed by the general principles laid down in the following international space conventions.⁶⁰

55. See Galloway, *supra* note 1, at 333.

56. See GOLDMAN, *supra* note 16, at 71.

57. MANFRED LACHS, LAW OF OUTER SPACE 135 (1972).

58. Clayton, *supra* note 41, at 243.

59. Outer space Treaty, *supra* note 51, art. 3. See generally GOLDMAN, *supra* note 16, at 71.

60. I.H. Ph. Diederiks-Verschoor, *The Legal Aspects of Inhabited Space Stations*, 7 HASTINGS INT'L & COMP. L. REV. 479 (1984) [hereinafter *Inhabited*].

(1) Outer Space Treaty

The first of the United Nations treaties was the Outer Space Treaty of 1967 (OST).⁶¹ This treaty adopted the "common heritage of mankind" philosophy for outer space.⁶² The OST states that the nation "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."⁶³ This basic principle of the OST sets forth the essential concept that, similar to ships on the high seas, the launching state maintains jurisdiction and ownership over its space objects even after they are put into space. It is essential to space development that under the OST, countries are guaranteed that ownership of those objects in which they invest and develop continues when such objects are put into space. It is highly unlikely that countries would invest in a space object which, once launched, could legally be appropriated by another country because the ownership disappeared once put into space.

(2) Liability Convention

The second major space treaty was the Liability Convention of 1972.⁶⁴ This agreement provides for strict liability for damage caused by launching vehicles on land, sea, or air.⁶⁵ However, a mere negligence standard is applied for damages caused in space.⁶⁶ In addition, both the launching nation and the nation procuring the launch are liable to innocent third par-

Space Stations].

61. Outer Space Treaty, *supra* note 51.

62. *Id.* art. 1.

63. *Id.* art. 8. See generally LACHS, *supra* note 57, at 69.

64. Convention on International Liability for Damage Caused by Space Objects, September 1, 1972, 24 U.S.T. 2389, 961 U.N.T.S. 187 [hereinafter Liability Convention].

65. This is because launching is an inherently dangerous activity. *Id.* art. II (providing for absolute, not strict, liability for damages occurring on land or in the air).

66. *Id.* art. III. Goldman believes that the treaty reflects a pro-victim philosophy. He reasons that when the treaty was drafted, most nations did not benefit from space, and asks "why, therefore, should these nations bear the risks of space related damages?" GOLDMAN, *supra* note 16, at 79-80.

ties.⁶⁷ Countries involved in space activities considered it important that the Liability Convention not adopt a strict liability standard for damage caused in space. Because of the inherently dangerous nature of space activity and the unknowns involved during the early stages of space exploration, anything other than a negligence standard would have stifled space activities. Potentially unlimited strict liability costs would have compounded the already exorbitant costs of space activities.

(3) Registration Convention

The final space treaty applicable to the space station is the Registration Convention of 1975.⁶⁸ The Registration Convention formalized the process for countries or private entities to register their space objects in order to maintain jurisdiction and ownership of such objects.⁶⁹ To gain the benefits of the United Nations space treaties, any space object must be registered under this Treaty. The Secretary General of the United Nations maintains the register.⁷⁰

Each Party is required to register any object launched into space.⁷¹ When two or more States jointly launch an object, only one State registers the object.⁷² However, the States can agree among themselves as to which State will maintain jurisdiction and control over the object.⁷³ Each State determines how it will compile and maintain its register.⁷⁴ When space objects cause damage and are unidentifiable through the registry, the Parties will cooperate to identify the object using all space monitoring and tracking technology available.⁷⁵ These provisions attempt to ensure that when space objects cause damage, the proper party will be held liable.

67. Liability Convention, *supra* note 64, art. IV.

68. Convention on Registration of Objects Launched into Space, January 14, 1975, 28 U.S.T. 695, 1023 U.N.T.S. 15 [hereinafter Registration Convention].

69. The register is open for public inspection. *Id.* art. III(2). See also GOLDMAN, *supra* note 16, at 83.

70. Registration Convention, *supra* note 68, art. III(1).

71. *Id.* art. II(1).

72. *Id.* art. II(2).

73. *Id.*

74. *Id.* art. II(3).

75. *Id.* art. VI.

D. Space Station Agreement

The 1988 Intergovernmental Agreement (IGA) focuses on the political commitments of the Partners and the legal regime within which the program will operate.⁷⁶ The IGA was signed by the governments of the United States, Canada, Japan, and all the countries participating in the ESA's Columbus Program.⁷⁷ Supplementing the IGA are three virtually identical bilateral Memoranda of Understanding (MOUs) signed by NASA and each of the Partners.⁷⁸ The MOUs focus on the programmatic and technical aspects of the space station, and establish management mechanisms to implement the program with less focus on legal issues than is contained in the IGA.⁷⁹

The IGA defines the international cooperative framework as a "genuine partnership."⁸⁰ With the signing of the IGA it was felt that "international cooperation in outer space has reached new heights."⁸¹ The signing of the IGA represented the culmination of agreements for the largest (in terms of numbers of participants, financial outlays, and complexity) international cooperative space venture in history.⁸² The Partners will hold

76. Intergovernmental Agreement, *supra* note 8, pmb1.

77. Stephen Gorove, *The U.S./International Space Station Agreement of September 29, 1988: Some Legal Highlights*, 16 J. SPACE L. 182 (1988) [hereinafter *Legal Highlights*].

78. MOU, *supra* note 8. The MOUs provide much greater detail on what each Partner is to provide the space station than is given in the IGA. The MOUs also set target time milestones for completion of each component, provide detailed specifications of management responsibilities among the Partners, and contain specifications on crews provided by each Partner to be trained by NASA. *Id.*

79. C/D/E Agreements, *supra* note 10, at OSS-10,684.

80. Intergovernmental Agreement, *supra* note 8, art. 1.

81. DeSaussure, *supra* note 3, at 304. All previous manned and unmanned stations have been undertaken independently by either the U.S. or the Soviet Union. The Space Station Freedom, will be jointly sponsored and permanently manned by the United States, Canada, Japan and members of the ESA for a period of 30 years. *Id.*

82. See Sloup, *supra* note 1, at 404. The station will be designed and constructed under four international agreements: the Space Station Intergovernmental Agreement and three Memoranda of Understanding between NASA and the ESA, and the Ministry of State for Science and Technology of Canada. The memoranda outline cooperative responsibilities in the detailed design, development, operation and utilization of the Permanently Manned Civil Space Station.

a Space Station Cooperative Review every three years to promote and review cooperation in the space station program.⁸³ The goal of the IGA is to have decision-making by consensus at all levels.⁸⁴ Where consensus cannot be achieved, NASA is authorized under the IGA to make those decisions necessary for safety and efficiency aboard the space station.

The agreements among the Partners contemplate future use of the space station by nonpartners. Any proposed use of a component of the space station by a nonpartner or private party requires prior notice to all other Partners.⁸⁵ Likewise, a partner may not transfer ownership to any nonpartner without first obtaining the concurrence of all the other Partners.⁸⁶ Finally, under the IGA "[a]ny partner may withdraw . . . at any time by giving . . . at least one year's prior written notice."⁸⁷

The space station project presents the opportunity for unprecedented cooperation in terms of scientific and technological challenge, funding requirements, and long-term commitments.⁸⁸ The IGA is seen as a model for future international cooperative space ventures. The IGA presents many legal issues, some of which are not addressed as adequately as others. Legal issues involved in the space station include: jurisdiction and control, liability and registration, criminal jurisdiction, dispute resolution, and taxes.⁸⁹

The IGA and memoranda are the product of three years of negotiation between NASA, the U.S. Department of State, Japan, Canada and the ESA member states. *Id.*

83. C/D/E Agreements, *supra* note 10, at OSS-9344B.

84. Intergovernmental Agreement, *supra* note 8, art. 7(5); DeSaussure, *supra* note 3, at 305 n.16.

85. Intergovernmental Agreement, *supra* note 8, art. 9(8)(a). *See generally* F. Kenneth Schwetje, *The Legal Regime of the U.S. Space Station*, in 31 COLLOQUIUM ON THE LAW OF OUTER SPACE 179, 180 (1988).

86. *See* Schwetje, *supra* note 85, at 180.

87. Wulf von Kries, *Some Reflections of the Fate of the Space Station Agreement*, in 32 COLLOQUIUM ON THE LAW OF OUTER SPACE 436, 436 (1989). As previously noted, there are certain stipulations that only Canada must comply with before withdrawing because its contribution is vital to the space station.

88. *Id.* at 436.

89. Schwetje, *supra* note 85, at 179-81.

IV. THE LAW OF THE SPACE STATION

The planned space station will have unique technical and operational characteristics which distinguish it from previous international space ventures.⁹⁰ Therefore, both the application of existing space law and the creation of new laws and agreements must take these unique international cooperative features into consideration.⁹¹ Adjustments in current legal guidelines are necessary to accommodate such an unusual combination of factors: scientific research and its commercial applications; governmental and nongovernmental operational activities; national and international concerns with problems of cooperation and competition; centralization and decentralization in handling problems of jurisdiction and control; criteria for selecting and managing personnel and missions; conditions for equitable access by other nations; existing commitments to international law and agreement on definitions for the future; adjustment to other relevant international organizations (including the United Nations); and relating national law to international cooperation, especially in situations involving taxation, contracts, procurement, liability for damages, and settlement of disputes.⁹²

Space law has been broken into two components. One involves principles of international treaties, essentially Earth-oriented law in the areas of launch liability and contracts.⁹³ The other component deals with more futuristic legal concepts to be applied to the social order of long-duration manned missions, such as will exist aboard the space station.⁹⁴ This second component has been referred to as "astrolaw," the law

90. See Galloway, *supra* note 1, at 36. It is the first space venture to be constructed by so many different countries, the first to be composed of different modules owned and operated by different nations, and it will be the largest and longest running international space venture. *Id.*

91. *Id.*

92. *Id.*

93. Robinson, *Astronauts and a Unique Jurisprudence: A Treaty for Spacekind*, 7 HASTINGS INT'L & COMP. L. REV. 483 (1984). The world is into its fourth decade of space exploration. Thus, the areas of launch liability and contract principles have been adequately covered in current space treaties and agreements, such as the Liability Convention and the Outer Space Treaty. *Id.*

94. *Id.* at 483.

of living and working in outer space.⁹⁵ The legal regime of the space station is primarily concerned with astrolaw. This area of space law will expand as space law becomes predominantly private law to "deal with the day-to-day problems of people living and working in space."⁹⁶

While some legal issues have been resolved through treaties, conventions, and bilateral agreements, not every contingency that could arise on the space station can be anticipated through these arrangements. Therefore, as proposed by John O'Brien, General Counsel of NASA, while agreement can be reached on some of the wide range of legal issues that will arise onboard the space station, "other long-term issues will probably be left to develop as the 'common law' of the space station."⁹⁷ O'Brien feels that such natural development is preferable to the development and use of an extensive legal code created before the space station is operational. A common law system is desirable due to the general lack of familiarity with the effects of a space station environment, in the context of a permanent manned presence, and the unknown extent of the interaction to exist between representatives of diverse societies.⁹⁸ Such a common law for space will develop as it did on Earth to resolve disputes arising from daily life in space society.

A. *Jurisdiction and Conflict of Laws*

(1) Jurisdiction

The space station will be composed of modules built and owned by different countries, providing a unique situation for jurisdiction and conflicts of law provisions. However, under the OST, each country will maintain jurisdiction and control over its objects while in space.⁹⁹ Therefore, several systems of law will coexist within the few cubic feet of the space station.¹⁰⁰

95. GOLDMAN, *supra* note 16, at 131.

96. *Id.* at 116. Goldman includes in the definition of private law: antitrust, corporations, tax, insurance, securities, commercial transactions, contracts, torts, and real and personal property. *Id.* at 115-16.

97. Gorove, *supra* note 40, at 58.

98. *Id.*

99. Outer Space Treaty, *supra* note 51, art. 8.

100. Dr. Pierre M. Martin, *The Legal Regime of Inventions in Outer Space*,

The IGA did not regulate civil jurisdiction; therefore, article VIII of the Outer Space Treaty applies.¹⁰¹ Under article VIII, the State retains jurisdiction and control over objects and any personnel thereof while in outer space or on a celestial body.¹⁰² The laws of each part of the space station will be based on which Partner owns the particular module in which an event occurs. The Registration Convention requires States to provide the Secretary General of the United Nations with all of the information in their registry of space objects.¹⁰³ This agreement standardized the registration process by clarifying who and what must be registered.¹⁰⁴ Each Partner must register its contribution to the space station in order to maintain jurisdiction and ownership under the OST. Such registration is vital to determine which Partner's law applies to an issue arising in a particular module because, "within an area—outer space—which cannot be subject to appropriation, sovereignty shall, inside the space station, be the main element because it provides certainty about the law that shall apply."¹⁰⁵

(2) Conflicts of Law

Numerous conflicts of law issues exist in an international venture such as the space station. Basic to the complexities involved is that some participating countries have common law systems while others have civil law systems.¹⁰⁶ Currently, un-

in 32 COLLOQUIUM ON THE LAW OF OUTER SPACE 366, 367 (1989). As the agreements now stand, each partner will maintain jurisdiction over the module it constructs and adds to the space station complex. Schwetje, *supra* note 85, at 180. Such modules are being built by the United States, Japan, and the ESA. *Id.* at 179.

101. Zwaan and DeVries, *supra* note 23, at 446.

102. GOLDMAN, *supra* note 16, at 72.

103. Registration Convention, *supra* note 68, art. II.

104. *Id.*

105. Martin, *supra* note 100, at 367. Sovereignty and conflicts of law issues may jeopardize the whole project if agreement is not reached beforehand. Three suggestions to alleviate these problems, which have been rejected are: the choice of one jurisdiction's law, jurisdiction of an international organization which would operate and register the space station, and the use of concurrent jurisdiction. *Id.*

106. *Id.* at 367. For example, the United States, Canada, and England are common law jurisdictions, while France, Germany, Italy, Netherlands, Spain, and Japan are civil law jurisdictions.

der article VIII of the OST, different laws will apply depending on the part of the space station in which an event occurs.¹⁰⁷ However, alternative proposals have been made which are intended to prevent this morass of conflicts of law issues. Some examples include: using the law of the launch site (Florida law), rotating use of the laws of the Partners, and setting up law by contract as in maritime law.¹⁰⁸ While none of these proposals has yet been accepted, the Partners are considering choosing a simpler system of jurisdiction and control in order to obtain uniformity of law aboard the space station.¹⁰⁹

B. Liability

The space station is classified as a space object;¹¹⁰ therefore, liability for space station activities is based on the United Nations Liability Convention of 1971.¹¹¹ Under the Liability Convention, strict liability applies to damages caused on land, on the sea, or in the air, while damages caused in space are subject only to a negligence standard.¹¹² Likewise, not only is the country which launches a space object which causes damages liable to innocent third parties, but the nation that procured the launch from the launching country is also liable.¹¹³ For example, in shuttle launches used to build the space station, both the United States (the launching country) and the particular country that owns the payload aboard the space shuttle will be liable for any damages caused by the launch.¹¹⁴

107. Outer Space Treaty, *supra* note 51.

108. See DeSaussure, *supra* note 3, at 308. Of these proposals, the rotation of laws is the only one with very much support. This is because using either the law of the largest Partner or of the launching country would mean exclusive use of United States laws, to which the other Partners will not agree. *Id.*

109. See *id.* at 308. The Partners as well as the individuals onboard would know beforehand what law governed their conduct and what forum would decide any controversy. *Id.*

110. Liability Convention, *supra* note 64, pmb1.

111. *Id.* art. I(d).

112. *Id.* art. III. See generally GOLDMAN, *supra* note 16, at 79-80. Goldman explains that through the early 1970s the world perceived space as a battleground for the superpowers. For this reason, most nations derived no benefits from space. Therefore, these nations should not bear liability. *Id.*

113. Outer Space Treaty, *supra* note 51, arts. 6, 8. See also DeSaussure, *supra* note 3, at 308 (noting the requirements for selection of laws and enforcement of decisions).

114. The liabilities will not apply to other Partners, however, because of the

A new doctrine in international law makes nations responsible for the acts of individual and corporate entities in space.¹¹⁵ Under article VI of the OST, a nongovernmental agency performing space activities must be licensed by its government because that government is legally responsible for space activities.¹¹⁶ Commercial Space Launch Act.¹¹⁷ This act requires licensing of all space vehicles with the Department of Transportation.¹¹⁸ In addition, in 1984 the United States created the Office of Commercial Space Transportation to supervise privately-owned launch vehicle corporations.¹¹⁹ Licensing of government space activities in the United States is supervised by NASA and the Department of Transportation. The Office of Commercial Space Transportation supervises licensing of private space activities.¹²⁰

Many experts agree that limited liability is as necessary for space activities as it is for maritime law¹²¹ and the laws of international air commerce.¹²² Such limited liability is believed to promote international commerce and encourage investment in space activities.¹²³

In response to liability questions, article 16 of the IGA provides for broad cross-waivers of liability among the Part-

cross-waivers of liability in the IGA.

115. GOLDMAN, *supra* note 16, at 72.

116. MORRIS D. FORKOSCH, OUTER SPACE AND LEGAL LIABILITY 47 (1982).

117. Commercial Space Launch Act, 49 U.S.C. app. §§ 2601-2623 (1991).

118. *Id.*; Office of Commercial Space Transportation, 14 C.F.R. 400 (1991); see generally Gyula Gal, *Some Reflections to the System of the Sources of Space Law*, in 32 COLLOQUIUM ON THE LAW OF OUTER SPACE 326, 327 (1989) (explaining that space activities require authorization and continuing supervision by the participating nation).

119. Executive Order No. 12,465, 14 C.F.R. § 400 (1991), *reprinted in* 46 U.S.C. app. § 2602(3) (1991).

120. GOLDMAN, *supra* note 16, at 72. In the last decade private space activity has greatly increased especially in the area of private satellite launches. Since such companies are not supervised by NASA, separate licensing is required. 14 C.F.R. § 400 (1991).

121. DeSaussure, *supra* note 3, at 309. See generally 3 BENEDICT ON ADMIRALTY § 2 (1989). The ship owner must not have had privity or knowledge of negligent act(s) to obtain limitation of liability. See also DeSaussure, *supra* note 3, at 309. Under maritime law, liability is limited to the value of the ship. *Id.*

122. DeSaussure, *supra* note 3, at 309.

123. See *id.* Such limited liability also provides a basis to calculate risk for insurance purposes. *Id.*

ners.¹²⁴ These cross-waivers "remove from the liability equation any damage suffered by one [Partner] as a result of the activities of another [Partner]."¹²⁵ Thus, the Partners "become self-insurers for their own property damaged during protected space operations."¹²⁶ Among the Partner countries and the ESA member states, a total of thirteen countries have waived all liability arising from space station activities through the cross-waivers contained in the IGA.¹²⁷ Additionally, a Partner's cross-waivers extend to all of its contractors, subcontractors, users, and any customers of that Partner.¹²⁸ The cross-waivers do not apply to claims for intentional torts, intellectual property claims, or claims by a natural person for injury or death.¹²⁹ The liability waivers are intended to promote space station development; therefore, such cross-waivers "shall be broadly construed to achieve this objective."¹³⁰

C. Management Responsibilities

The Partners have made several agreements on the division of management responsibilities aboard the space station.¹³¹ The division of management among the Partners is basically laid out in the IGA¹³² with the MOUs providing more detailed

124. Intergovernmental Agreement, *supra* note 8, art. 16.

125. Schwetje, *supra* note 85, at 180.

126. Intergovernmental Agreement, *supra* note 8, art. 16; *see generally* Schwetje, *supra* note 85, at 223. "The term 'Protected Space Operations' means all launch vehicles activities, Space Station activities, and payload activities on Earth, in outer space, or in transit between Earth and outer space, or in transit between Earth and outer space in implementation of this Agreement, the MOUs and implementing arrangements." Intergovernmental Agreement, *supra* note 8, art. 16(2)(f).

127. Intergovernmental Agreement, *supra* note 8, art. 16.

128. Schwetje, *supra* note 85, at 181.

129. *Legal Highlights*, *supra* note 77, at 183.

130. Intergovernmental Agreement, *supra* note 8, art. 16(1). The space station cross-waiver is designed to remove from the liability equation any damage suffered by one partner as a result of the activities of another partner. *See generally* Schwetje, *supra* note 85, at 180 (explaining that cross-waivers are designed to waive liability of any Partner nation whose activities cause an injury to another partner).

131. *See, e.g.*, Intergovernmental Agreement, *supra* note 8, art. 7; MOUs, *supra* note 8, art. 8.

132. Intergovernmental Agreement, *supra* note 8, art. 7.

management specifications.¹³³ NASA has overall responsibility for coordinating the entire program, but each Partner is responsible for its own contribution to the program.¹³⁴ In addition, the Partners agreed to establish future management bodies for consensus decision making aboard the space station.¹³⁵

D. *Dispute Resolution*

The space station will be a "laboratory for experimentation in multinational community living and working."¹³⁶ Such an environment is bound to breed a variety of on board disputes. Unfortunately, the IGA ignores necessary provisions regarding how on board disputes will be handled.¹³⁷ Dispute resolution was addressed in article 23 of the IGA, entitled "Consultations."¹³⁸ However, this provision only provides that "the Partners shall exert their best efforts to settle such matters through consultation between or among their Cooperating Agencies."¹³⁹ This article is clearly lacks a procedure to resolve onboard disputes.¹⁴⁰ The IGA provides that "if an issue not resolved through consultations still needs to be resolved, the concerned Partners may submit that issue to an agreed form of dispute resolution such as conciliation, mediation, or arbitration."¹⁴¹ Therefore, dispute resolution is subject to future development.

Effort must be made to develop a legal framework that will encourage the establishment of an acceptable social order aboard the space station.¹⁴² Some suggest that an administra-

133. MOU, *supra* note 8, arts. 7, 8.

134. DeSaussure, *supra* note 3, at 305.

135. Intergovernmental Agreement, *supra* note 8, art. 7(5).

136. DeSaussure, *supra* note 3, at 304.

137. *Id.*

138. Intergovernmental Agreement, *supra* note 8, art. 23.

139. Sloup, *supra* note 1, at 405.

140. *Id.*

141. Intergovernmental Agreement, *supra* note 8, art. 23. While a dispute between crew members aboard the space station could, if not resolved properly, eventually lead to a situation in which the Partners would wish to invoke article 23, that situation, involving government-level consultation, should be avoided. Rather, crew members should be provided the necessary orientation, training and legal framework to resolve such intra-crew disputes themselves. Sloup, *supra* note 1, at 405.

142. See Robinson, *supra* note 93, at 494.

tive rather than a judicial forum is better suited for resolution of space station disputes.¹⁴³ Whichever forum is chosen, it must be composed of the various countries participating in the venture, all of which have significantly different legal frameworks. An administrative forum is better suited to space station necessities because such a nonjudicial forum will avoid the "morass of conflicting laws that plague transborder civil disputes on earth."¹⁴⁴ Some suggestions for an international body to act as an outer space court to resolve disputes are similar in structure and cooperative operation to other international organizations such as the ESA, the International Court of Justice (World Court), and the United Nations Human Rights Committee.¹⁴⁵ Such a legal framework for the space station is necessary "to break the historical cycles of imperialism, colonialism, and war" that exist on Earth.¹⁴⁶

(1) Criminal Law

The IGA does not adequately provide for criminal law issues.¹⁴⁷ Because the space station is an international venture, problems relating to criminal law are created due to the lack of uniformity among nations in their criminal laws.¹⁴⁸ Criminal laws vary in what constitutes criminal activity, in extradition treaties or a complete lack thereof, in authority to apprehend and incarcerate, and in different countries' subjugation of individuals to foreign criminal laws and courts.¹⁴⁹

Agreements among the Partners provide that the United States has criminal jurisdiction over anybody on board the

143. DeSaussure, *supra* note 3, at 306. The Liability Convention has created a useful precedent. The convention requires the Parties to first seek diplomatic settlement. If no settlement is reached within one year from the date of the claim, a commission is appointed to hear the claim and make the award. *Id.*

144. *Id.* at 307.

145. FORKOSCH, *supra* note 116, at 4. Forkosch suggests that neither the World Court nor any analogous body is well suited for formulating policy and deciding cases which involve liability in outer space. *Id.* at 5.

146. Robinson, *supra* note 93, at 494.

147. See Intergovernmental Agreement, *supra* note 8, art. 22.

148. John O'Brien, *The U.S./International Space Station*, 15 J. SPACE L. 35, 37 (1987) (illustrating the wide range of potential problems from serious criminal activities to simple misdemeanors).

149. *Id.*

space station whose misconduct endangers the facility or other crew members.¹⁵⁰ Likewise, en route to the space station aboard the space shuttle, the shuttle commander has authority to enforce order and discipline during flight among all onboard personnel, regardless of nationality.¹⁵¹ However, future arrangements will decide other priority issues aboard the space station where countries' criminal jurisdictions are in conflict and United States laws do not apply because the activity does not endanger the facility or crew.¹⁵²

Until 1981, United States courts were only able to impose a one year sentence and a \$5,000 fine for any crime occurring onboard United States spacecraft.¹⁵³ These penalties were based on the maximum penalty for refusing to obey a shuttle commander under NASA's authority to regulate conduct on board its vessels.¹⁵⁴ In 1982, Congress modified the criminal code to include jurisdiction over spacecraft.¹⁵⁵ Under this provision, an applicable spacecraft is "any vehicle used or designed for flight or navigation in space on the registry of the United States while that vehicle is in flight."¹⁵⁶ Finally, the United States criminal code applies to all activity aboard the shuttle regardless of a person's nationality "from the moment when all external doors are closed on earth until the moment when each door is opened on earth."¹⁵⁷ While criminal laws are very spe-

150. Intergovernmental Agreement, *supra* note 8, art. 22. Article 22 permits each Partner to exercise criminal jurisdiction over its own flight elements and over its own nationals aboard, wherever they may be. *See generally* DeSaussure, *supra* note 3, at 305.

151. GOLDMAN, *supra* note 16, at 135.

152. DeSaussure, *supra* note 3, at 305.

153. Space Transportation System, 14 C.F.R. § 1214.704 (1991) [hereinafter Space System]; *see also* GOLDMAN, *supra* note 16, at 135. Therefore, prior to 1981, murder (or any other felony) aboard the shuttle was only punishable at the maximum one year sentence and \$5,000 fine. *Id.* at 128.

154. Space System, *supra* note 153, § 1214.704; *see also* GOLDMAN, *supra* note 16, at 128 (explaining that, before 1981, the maximum sentence for a murder committed on the space shuttle was one year).

155. Crimes and Criminal Procedure, 18 U.S.C. § 7(6) (Supp. 1991); GOLDMAN, *supra* note 16, at 120.

156. Hamilton DeSaussure and Peter P.C. Haanappel, *Determination of Applicable Law to Living and Working in Outer Space*, 25 INT'L INST. SPACE L. 223 (1982).

157. 18 U.S.C. § 7(6) (Supp. 1991).

cific regarding shuttle activity, such specificity has yet to be achieved for criminal law aboard the space station.

(2) Tort Conflicts

The IGA also fails to sufficiently cover tort conflicts because it only calls for application of the rules set out in the Liability Convention.¹⁵⁸ The Liability Convention details a method for space tort resolution. The government of the victim must formally present the victim's claim through diplomatic channels to the launching state or states liable for the injury.¹⁵⁹ If the dispute is not settled diplomatically, then within one year the government of the victim may call for a claims commission.¹⁶⁰ The claims commission shall decide the merits of the claim and the amount, if any, to be awarded to the victim.¹⁶¹ While this process seems potentially effective, the award will only be enforced if the represented countries agree to be bound by the judgment.¹⁶² Therefore, it seems highly unlikely that in hotly contested tort disputes the liable country will agree to be bound by the commission's judgment and to compensate the victim.

It will be necessary to develop standards for tort liability to apply in space. Some experts claim that the reasonable person standard used for tort claims in the United States should be different for space tort liability because people are biologically affected by the environment of space.¹⁶³ First, the decrease in red cell mass during spaceflight leads to a decrease of

158. Intergovernmental Agreement, *supra* note 8, art. 17. "[T]he Partner States, as well as the ESA, shall remain liable in accordance with the Liability Convention." *Id.*

159. Liability Convention, *supra* note 64, art. IX; *see generally* GOLDMAN, *supra* note 16, at 81 (stating that this procedure avoids the inevitable delays a claimant faces when filing in the courts and administrative agencies of the defendant nation).

160. Liability Convention, *supra* note 64, art. XIV; *see generally* GOLDMAN, *supra* note 16, at 81-82 (finding that the Claims Commission is comprised of one member from each side and the Chairman, appointed by both sides, is required to reach a decision promptly and no later than one year from its establishment).

161. Liability Convention, *supra* note 64, art. XVIII; *see generally* GOLDMAN, *supra* note 16, at 82.

162. Liability Convention, *supra* note 64, art. XI.

163. Robinson, *supra* note 93, at 485.

oxygen and an excess of carbon dioxide.¹⁶⁴ "The impact of diminished hemoglobin on vital endocrinological and neurological functions can be seen in the various aberrant biological facets of what constitutes the reasonable man functioning in space amidst a deprivation of oxygen and an overload of carbon dioxide."¹⁶⁵

Further, experiments have confirmed that living in space affects the plasma and vascular systems of astronauts.¹⁶⁶ "These effects, along with consequent variations in the functioning of the central nervous system, the sympathetic/parasympathetic nervous system and the endocrine system make for an individual who, very likely, should not be judged in his or her space habitat by the reasonable man criteria established for Earth inhabitants."¹⁶⁷ Also, weightlessness causes fluid movement to the head which creates some dizziness and pronounced slowness in physical and intellectual reactions.¹⁶⁸ Further, weightlessness affects the normal flow of the endocrine system making body chemical composition and temperature unstable.¹⁶⁹ Weightlessness also affects the vascular and autonomic systems.¹⁷⁰ Abnormal physiological functions resulting from problems in these systems can be stabilized by drugs and exercise on short-term missions. However, the success of stabilization for long-term missions is still largely unknown.¹⁷¹ Finally, another biomedical problem that has an impact on the formulation of legal regimes for the unique requirements of space habitation involves the different refractive indices of the habitat atmosphere. Nonnormative gas mixtures that bend light cause objects to be visually perceived differently than if seen in the Earth's atmosphere. This phenomenon would, of course, significantly influence the vast body of Anglo-American evidentiary law that relies on visually-derived evidence relating to tortious or criminal acts.¹⁷² The entire effect of these biomedical

164. *Id.* at 486.

165. *Id.*

166. *Id.*

167. *Id.*

168. *Id.*

169. *Id.*

170. *Id.* at 487.

171. *Id.*

172. *See generally*, Robert Buckhout, *Eyewitness Testimony*, 231 SCI. AM. 23,

changes cannot be determined until long-term missions actually occur.

Some recognition must be given to these biomedical differences that will exist for "Spacekind" (also called *Homo alterios*).¹⁷³ "The imposition in space of cultural institutions that have evolved in response to the Earth's environment could well suppress the very necessary and natural evolution of legal regimes peculiar to *Homo alterios*."¹⁷⁴ Therefore, the exact reasonable person standard for spacekind should not be determined until the space station is operational.

(3) Inventions and Patents

The IGA provides for resolution of intellectual property disputes.¹⁷⁵ Different laws on patent rights exist among the Partners: For example, the United States gives patents to the first to invent, while most of the world gives the patent to the first to register.¹⁷⁶ Paragraph two of article 21 of the IGA adopts the territorial approach, applying the law of the state of registry of the module.¹⁷⁷ The only exception is that on an ESA registered module "any European Partner State may deem an activity to have occurred within its territory."¹⁷⁸ Further, activities by one Partner on any other Partner's registered elements of the space station do not effect the jurisdiction over

23-31 (Dec. 1974). In his article, Buckhout challenges problems of perception as they relate to eyewitness testimony. Buckhout claims "[h]uman perception is sloppy and uneven, albeit remarkably effective in serving our need to create structure out of experience. In an investigation or in court, however, a witness is often asked to play the role of a kind of tape recorder on whose tape the events of the crime have left an impression." *Id.* Buckhout also finds it "discouraging to note that the essential findings on the unreliability of eyewitness testimony were made by Hugo Münsterberg nearly 80 years ago, and yet the practice of basing a case on eyewitness testimony . . . continues to this day." *Id.* at 176.

173. Robinson, *supra* note 93, at 484.

174. *Id.*

175. See Intergovernmental Agreement, *supra* note 8, art. 21.

176. GOLDMAN, *supra* note 16, at 117.

177. See Intergovernmental Agreement, *supra* note 8, art. 21(2); see also Schwetje, *supra* note 85, at 181.

178. Intergovernmental Agreement, *supra* note 8, art. 21(2); Schwetje, *supra* note 85, at 181. It is left to the ESA participating countries to decide conflicts of laws issues among themselves in the area of patent rights.

inventions in that element.¹⁷⁹ However, patent infringement does not occur due to the temporary presence of an article in transit in the territory of another Partner.¹⁸⁰ The October 1988 Patents in Space Act¹⁸¹ extends United States patent law to inventions made in space on United States space objects.¹⁸² Through registration under the Registration Convention, each Partner to the IGA has jurisdiction and control over its elements and any invention made in the space station will be deemed to have occurred in the territory of the state of that module's registry.¹⁸³

(4) Crew Code of Conduct

An important goal of all the space station agreements is to avoid onboard disputes altogether. Towards this end, the Partners have agreed to develop and implement a Crew Code of Conduct. Article 11 of the IGA, entitled "Crew," provides that "the Code of Conduct for the space station crew will be developed by all the Partners, in accordance with the MOUs."¹⁸⁴ The purposes of the Code are set forth in the MOUs as follows:

establish a clear chain of command; set forth standards for work and activities in space, and, as appropriate, on the ground; establish responsibilities with respect to elements and equipment; set forth disciplinary regulation; establish physical and information security guidelines; and provide the Space Station Commander appropriate authority and responsibility, on behalf of all the Partners, to enforce safety procedures and physical and information security procedures in or on the Space Station.¹⁸⁵

179. Intergovernmental Agreement, *supra* note 8, art. 21(2).

180. *Id.*

181. H.R. 2946, 101st Cong., 1st Sess., 136 CONG. REC. 12,973 (1990).

182. *Id.*; see generally Martin, *supra* note 100, at 366 (explaining that this extension of United States patent law illustrates the United States commitment to rapid commercial exploitation of space).

183. Intergovernmental Agreement, *supra* note 8, art. 21(2); Martin, *supra* note 100, at 366.

184. See Intergovernmental Agreement, *supra* note 8, art. 11(2).

185. See MOU, *supra* note 8, art. 11.5; Sloup, *supra* note 1, at 406.

The Crew Code of Conduct has not been developed beyond these guidelines. The Code is vital to the efficient operation of the space station because of the high probability of conflict among crew members on long-term missions in such confined spaces, similar to documented conflict problems among crews of submarines, surface ships, and research stations in polar and other isolated and hazardous regions of the Earth.¹⁸⁶ All Partners have agreed to abide by the Crew Code of Conduct whenever that Partner exercises its right to have crew members aboard the space station.¹⁸⁷

V. TAX IMPLICATIONS

Commercial activities do not escape tax implications even though conducted in space. Whenever a new source of income-producing activity is discovered, a new form of taxation is sure to follow.¹⁸⁸ However, some taxation benefits may be granted to stimulate investment in a particular area. This was done to encourage space activity, the Internal Revenue Code now gives duty-free status to goods produced in space.¹⁸⁹ Likewise, Congressman Robert Walker introduced the Omnibus Commercialization of Space Act of 1990, which would provide various tax incentives for products created in space.¹⁹⁰

VI. CONCLUSION

As space activities increase, the resulting collision of international interests will require more extensive definitions of rights and obligations in space.¹⁹¹ The United States, Soviet Union, ESA, Japan, China and India are already launch-capable.¹⁹² What President John F. Kennedy called "this new ocean" of space is now made up of a multitude of activities from

186. Sloup, *supra* note 1, at 404.

187. *Id.* at 406.

188. O'Brien, *supra* note 148, at 40. Whether significant commercial interests decide to experiment with the space station for economic gain may depend upon the tax structure within which they will be required to operate. *Id.*

189. GOLDMAN, *supra* note 16, at 116.

190. Commercial Space Act, AVIATION WEEK & SPACE TECH., July 23, 1990, at 13.

191. GOLDMAN, *supra* note 16, at 129.

192. Brazil will soon be launch capable as well. *Id.* at 7.

most of the world's technologically advanced countries.¹⁹³ Many of these countries are participating in the space station and it is likely that numerous nonparticipating nations will also be permitted to use the space station facility. This great conglomeration of international interests in space and on board the space station requires an expansion of existing space law.

Existing space law consists primarily of United Nations treaties, applicable international law principles, and bilateral and multilateral agreements. These legal bases have proven adequate for existing space activities. However, the increase in space ventures and, more importantly, international space projects such as the space station, call for many new legal issues to be addressed. Legal issues affecting the space station include registration, proprietary rights, technology transfer, patent law, liability issues, dispute settlement, jurisdiction and control.¹⁹⁴ The space station Partners are working towards settling these legal questions as much as possible before the space station is operational.

The space station agreements were hailed as a model for other international cooperative space ventures.¹⁹⁵ The legal framework established for the space station is already viewed as a precedent for an international cooperative mission to Mars. President Bush has already approved talks for late 1991 with the Soviets to explore Soviet participation in an international Mars mission.¹⁹⁶ The space station has already proven successful in international cooperation, unprecedented in terms of "challenge, funding requirements and long term commitment."¹⁹⁷ However, the program's continued success is highly dependent upon the further development and implementation of an efficient and equitable legal framework for the space station. Space lawyer Arthur Dula argues that the legal framework for space should reach a balance called "minimal responsible regulation . . . between chaos and expropriation."¹⁹⁸ Whatever legal regime operates on board the space

193. Condara, *supra* note 50, at 187.

194. Gorove, *supra* note 40, at 57.

195. von Kries, *supra* note 87, at 436.

196. Craig Covault, *White House Approves Soviet Talks on Moon/Mars Exploration Initiative*, AVIATION WK. & SPACE TECH., Apr. 9, 1990, at 24.

197. von Kries, *supra* note 87, at 436.

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station, it will surely represent the sole precedent upon which all future international cooperative space ventures will be structured.

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