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

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THE UNITED STATES PROPOSED PATENT IN SPACE LEGISLATION - AN INTERNATIONAL PERSPECTIVE

G. Lafferranderie*

The United States Congress has had on its agenda since 1985[1] a bill with the aim of adding a new Section 105 to the Patent Act[2] to provide that an invention "made, used or sold on a space object or component thereof under the jurisdiction or control of the United States shall be deemed to have been made for use within the United States." It is not the intent of the author to comment on the need to introduce such a provision in the U.S. legislation but to concentrate on its impact on the conduct of space activities in the international field. Space activities will have more and more of an international character; according to article II of the Outer Space Treaty of 1967,[3] outer space is "extraterritorial" and no State can declare their domestic legislation applicable to this "non-territory." It is obvious that space activities not only require a number of patented

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* Legal Advisor, European Space Agency. The views expressed are those of the author and do not necessarily reflect the views of the European Space Agency.

1. A legislation on patent law in space was passed by the U.S. House of Representatives during the 99th and 100th Congresses, but the Senate did not act on this subject. In January 1989, Rep. Robert A. Roe introduced in the 101st Congress another "patents in space" bill (H.R. 352) identical to the House version of H.R. 1510 passed in 1988 at the initiative of Representative Kastenmeier. Senator Albert Gore, Jr. introduced thereafter a similar bill (S. 459). On July 20, 1989, Rep. Robert Kastenmeier introduced a new version (H.R. 2946) and S. 459 was amended to make it identical.

   The House Judiciary Committee's Subcommittee on Courts, Intellectual Property, and the Administration of Justice held its hearing on 4 October 1989. The patents in space legislation will probably be enacted in early 1990.

   See Patents in Space: Hearings Before the Subcomm. on Courts, Civil Liberties and the Administration of Justice of the House Comm. on the Judiciary, 99th Cong., 2d Sess. (1988); H.R. 2946: *Hearings Before the Subcomm. on Courts, Intellectual Property and the Administration of Justice of the House Comm. on the Judiciary*, 101st Cong., 2d Sess. (1989)(in particular *Hearings* dated October 4, 1989) when witnesses were: Messrs. Kempf (NASA), Kresczko (U.S. State Department), Denny (Patent Office), and Prof. Reynolds (University of Tennessee). *See* 38 PAT., TRADEMARK & COPYRIGHT J. (BNA), No. 95-1, at 625 (October 12, 1989).
2. 35 U.S.C. sec. 101 *et seq.* (1982).
3. Treaty on Principles Governing the Activities in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, Jan. 27, 1967, 18 U.S.T. 2410, T.I.A.S. No. 6347, 610 U.N.T.S. 205 (*entered into force for the United States* Oct. 10, 1967).

techniques for their conduct but will also create technical innovations. As the principle of territoriality is a governing principle in patent law, patent protection can only be claimed in the territory of the State which granted the patent. The question of whether national laws extend protection to space objects is not governed by an international convention. The sole international agreement dealing with this issue today is the International Space Station Agreement (IGA),[4] signed in Washington on 29 September 1988, between four Partners representing twelve signatory States: the United States, Canada, Japan, and Europe (for Europe, the nine Member States of the European Space Agency participating in the Columbus development programme: Germany, Belgium, Denmark, Spain, France, Italy, Netherlands, Norway, and the United Kingdom).[5] The International Space Station could provide, for example, a laboratory in space, a research and manufacturing capability in space "where the unique space environment enhances commercial opportunities,"[6] and an infrastructure to encourage commercial investment in space. Therefore, the question will arise on the compatibility of the proposed bill not only with the IGA but also with other U.S. treaty obligations.

I. *The Proposed Bill and U.S. Treaty Obligations: "Jurisdiction and Control" or "Jurisdiction or Control"?*

The patent in space question occupied much of the negotiations of the IGA in particularly in relation to the Bill introduced by Congressional

4. Agreement Among the Government of the United States of America, Governments of Member States of the European Space Agency, the Government of Japan, and the Government of Canada on Cooperation in the Detailed Design, Development, Operation, and Utilization of the Permanently Manned Civil Space Station, Sept. 29, 1988 (*not in force as of* Mar. 1, 1990)[hereinafter "IGA"]. *See* Lafferranderie, *Les accords relatifs à la Station spatiale internationale: analyse et commentaire*, 93 REVUE GéNéRALE dE DROIT INTERNATIONAL PUBLIC 317 (1989); Manned Space Stations: Legal Issues, Paris 7-8 Nov. 1989 (proceedings will be published by the European Space Agency in early 1990); K. Gorove, *The U.S./International Space Station Agreement of September 29, 1988: Some Legal Highlights*, 16 J. SPACE L. 182 (1988); Reifarth, *Rechtliche Aspekte des Übereinkommens über die Internationale Raumstation*, 38 ZEITSCHRIFT FÜR LUFT- UND WELTRAUMRECHT 35 (1989).
5. Sweden joined later on the Columbus Programme and will also sign the IGA.
6. See the Memorandum of Understanding (MOU) concluded between NASA and ESA on 29 September 1988; similar provisions appear in the Canadian and Japanese MOUs. For texts of the MOUs, see 3 UNITED STATES SPACE LAW - NATIONAL AND INTERNATIONAL REGULATION sec. II.A.22(a), (b), and (c) (S. Gorove ed. 1982-1990).

Representative Kastenmeier in Congress.[7] In particular, the Europeans were concerned by the use of the words "jurisdiction or control" since this wording deviated from article VIII of the Outer Space Treaty[8] and from a basic principle also reflected in the text of the IGA. These concerns regarding the language used were partially reduced by assurances that the Space Station vehicles are the subject of an international agreement to which the United States is a party.

This wording "or" could appear to be in contradiction with the IGA provisions itself. Why this alternative "or?" What does "or control" mean? The proposed language was seen not only as potentially conflicting with the text of the IGA, impacting on its implementation but also as opening a potential issue beyond the Space Station cooperation.

1) The IGA Case

Two articles from the IGA have to be quoted: article 21 on intellectual property rights[9] and article 5 on "jurisdiction and control." Article 21, paragraph (2) states in part that

> [s]ubject to the provisions of this article, for purposes of intellectual property law, an activity occurring in or on a Space Station flight element shall be deemed to have occurred only in the territory of the Partner State of that element's registry, except that for ESA-registered elements any European Partner State may deem the activity to have occurred within its territory.[10]

The solution finally retained by the negotiators, after exploration of other, less classical, possibilities, is based on two fundamental principles: the territorality, the "flight element" being considered to be on Earth - the registration, as defined in article VIII of the Outer Space Treaty, thus implying jurisdiction and control of the State of registry of the flight element; the "State of registry" being ESA, an international organization, for the European contribution to the International Space Station.

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7. H.R. 1510, 100th Cong., 2d Sess. (1988); for text, see Current Documents section of this issue of the JOURNAL OF SPACE LAW.
8. Outer Space Treaty, *supra* note 3. The first sentence of article VIII reads:
   "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."
9. *See* Oosterlinck, *The Intergovernmental Space Station Agreement and Intellectual Property Rights,* 17 J. SPACE L. 23 (1989).
10. IGA, *supra* note 4, art. 21(2).

Article 2, paragraph 1 of the IGA reaffirms the legally binding value of "space law" in the development, operation and utilization of the International Space Station: "The Space Station shall be developed, operated and utilized in accordance with international law, including the Outer Space Treaty, the Rescue Agreement, the Liability Convention, and the Registration Convention."[11] Therefore, "space law" is the primary law for the conduct of the International Space Station cooperation, in particular here the Outer Space Treaty of 1967 and the Registration Convention.[12]

The "Space Station" is the complex composed of attached elements (assembled in outer space), the manned-base, and of separate elements (the Columbus free-flying laboratory and the two polar platforms, one U.S. and one European), contributed by the four Partners. The attached elements will constitute the manned-base, the Space Station Freedom. The Space Station manned-base is, therefore, a "cluster" of space objects; each flight element contributed by the Partners and identified in the Annex to the IGA receives the qualification of "space object."

According to article 5, paragraph 2 of the IGA

> Pursuant to Article VIII of the Outer Space Treaty and Article II of the Registration Convention, each Partner shall retain jurisdiction and control over the elements it registers in accordance with paragraph 1 above and over personnel in or on the space station who are its nationals. The exercise of such jurisdiction and control shall be subject to any relevant provisions of this Agreement, the MOUs, and implementing arrangements, including relevant procedural mechanisms established therein.[13]

Article 7 of the IGA describes the different levels of management; in particular, NASA will be responsible for overall programme coordination and direction of the Space Station (the complex), except as otherwise provided. The U.S. acting through NASA shall be responsible for overall planning for and direction of day-to-day operation of the manned-base. That means NASA will exercise certain technical "control" over the contribution to the Space Station of the other Partners, in particular for servicing and transportation aspects, including all elements (very large wording) coming within the Operational Command and Control Zone (CCZ) of the manned-base.

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11. *Id.* art. 2, para. 1.
12. Outer Space Treaty, *supra* note 3; Convention on the Registration of Objects Launched into Outer Space, *opened for signature* Jan. 14, 1975, 28 U.S.T. 695, T.I.A.S. No. 8480, 1023 U.N.T.S. 15 *(entered into force for the United States* Oct. 10, 1967)[hereinafter "Registration Convention"].
13. IGA, *supra* note 4, at art. 5, para. 2.

The exercise of the "jurisdiction and control" by ESA on its space objects (and on the nationals) have to be defined by the participating States in the Columbus programme. This has been partly done via the IGA and the Memorandum of Understanding between NASA and ESA and has to be enlarged in the Columbus programme Declaration and its accompanying annexes and arrangements.

Consequently, the new Section 105 of the Patent Act will apply to the flight elements of the Space Station complex, identified in the Annex of the IGA, subject to their registration by U.S. and not to the fligh elements registered by the other three Partners (Japan, Canada, and Europe).

Passing a bill on intellectual property rights was presented as the prerequisite for the United States government being able to notify its approval of the IGA, a condition for the entry into force of the latter. Due to the fact that certain provisions of article 21 of the IGA affect the Inventions Secrecy Act, the U.S. delegation delivered before the IGA a signed "letter of comfort" prepared by the U.S. Patent Office explaining paragraph 104 of the U.S. Patent Code.[14] In such a situation, the Partners would have to be assured that the implementing legislation would appear in line with the international agreements and treaties to which the United States is a party.

Moreover, this bill had much wider implications than those affecting the International Space Station cooperation and will affect any type of activity performed in outer space by the U.S. alone, in cooperation, or even by others. Its language would have an impact on the use of any U.S. space facility by non-U.S. experimenter, or user, for its own purposes (use of NASA's tracking and data relay satellite system, the shuttle, or even the use of a non U.S. facility when it could be considered as under U.S. "technical control").

B) A Wider Implication

Europe, considering the wide impact of the Kastenmeier Bill beyond the Space Station and also the fact that the IGA will simply be an executive agreement under U.S. constitutional law, continued to express concern on the language used ("or") and to request formal and authoritative assurances that no degree of technical control on a non-U.S.-registered space station element, or a non-U.S.-registered space object, will provide the basis for an enforceable assertion of U.S. jurisdiction. In a letter to the U.S. State Department dated 6 March 1989, the ESA Director General addressed these concerns. He noted that an assertion based on the sole technical control (implied by the use of "or control") would be inconsistent with the letter and spirit of article 21 of the IGA. He also remarked that as to other space objects (like Hermes, for instance) which might come within the manned-base command and control zone, one has to avoid creating the impression

14. 35 U.S.C. sec. 104 (1982).

that any U.S. temporary technical "control" would be invoked in U.S. courts as grounding a claim for patent infringement. ESA and its Member States urged that the U.S. new legislation adhered to the logic of the Outer Space Treaty, to extend national jurisdiction only where a space object has been duly registered rather than using a test of jurisdiction or control. Canada supported these views by a letter underlining that the right of a State to regulate the rights of persons is based on the concept of State jurisdiction and not from the concept of mere control.

Clarifications were obtained and progress was made in discussions between ESA representatives and U.S. agencies. The two approaches were analyzed: the jurisdiction or control on one side and the registration only on the other side. Taking into account these discussions, the U.S. administration worked on an updated version of the bill still based on the "jurisdiction or control" approach. Representative Kastenmeier, when introducing H.R. 2946, stated that changes in the bill have been suggested by the Administration, taking into consideration treaty obligations and the views of the European Space Agency. He stressed that the new bill differs from legislation introduced in the last two Congresses in one principal respect: "the language has been revised to meet U.S. international treaty obligations." The Director General was pleased to confirm that the new bill met the European concerns.

II. Analysis of H.R. 2946

The H.R. 2946[15] follows the original approach, the "jurisdiction or control," instead of the registration only approach, but adds an express exception in its second sentence, in the case of foreign registered space objects. The proposed legislation would explicitly provide that inventions made, used, or sold in outer space on a foreign registered space object, or any component thereof, shall not be subject to U.S. patent laws, even if the object or component is at the time within the jurisdiction or control of the U.S., unless it is "specifically so agreed" in an international agreement between the U.S. and the State of registry. Nevertheless, this wording leaves the door open to interpretation of certain questions of great interest for U.S. partners in space which should be clarified at least in the legislative history.

A) The Registration as Determinative

The registration is determinative of whose law applies in outer space. As already stated, the main European concern was the use of the expression of "jurisdiction or control" which could give rise to

15. For a text of H.R. 2946, see Current Documents section of this issue of the JOURNAL.

unnecessary procedural problems. The legislative report that accompanies the previously passed House bill, H.R. 1510, was ambiguous by referring to registration as being "prima facie" determinative of jurisdiction. By offering an alternative "or," a court would be perfectly correct in considering only "control," in its technical sense, to the exclusion of "jurisdiction" even in the case of a registered space object. Each criterion, "jurisdiction" on the one hand and "control" on the other hand, was accorded equal status and neither the language nor the legislative history suggested an order of priority. Such a language, not being in line with article VIII of the Outer Space Treaty, could have considerable impact when a non-U.S. space object is using a U.S. facility or when it could be considered for one reason or another, even temporarily, under U.S. "technical control."

The insert "or control" was intentional and designed to provide certainty where there was no registration of a space object, for example, in the case of suborbital flights which are not covered by the Registration Convention.[16] Even this argument is debatable; in the event of suborbital flights conducted from U.S. territory, using U.S. facilities, it is up to the U.S. government to consider the "objects" in question as space objects and to register them. But, in the case of "objects" not launched by the U.S., it is doubtful to conclude that these objects, even non-registered by foreign states, will automatically fall under U.S. jurisdiction, U.S. patent law being rendered applicable. One could also say that a State can be party to the Outer Space Treaty and not to the Registration Convention; nevertheless, it will retain the rights recognized to it by article VIII of the Outer Space Treaty. The Registration Convention illustrates this article VIII and permits, in case of several launching States, the latter to elaborate special arrangements.[17]

Europe suggested it was made explicit the fact that registration alone would be dispositive of the issue as to whether U.S. patent law would apply and that only where there was no registration (either U.S. or foreign) of a space object, would the criterion of "control," in a technical sense, be considered as possibly relevant. Registration means that the space object is carried on the registry of the U.S., a foreign State, or an international organization pursuant to the Outer Space Treaty.

When the U.S. will be one of the launching States of a space object, it will have to agree with the other launching States as to which State will be the registering State; they could also agree on specific provisions regarding the exercise of jurisdiction and control. The agreement on whose launching State will register the space object will be determinative as to which law will apply, unless specifically agreed.

When the U.S. is not a launching State of a space object, the registering State could entrust the U.S. with some "control" tasks over the

16. Registration Convention, *supra* note 12.
17. *Id.* at art. II(2).

space object. Unless specifically agreed, this fact does not lead to the application of U.S. law over the space objects. U.S. law will apply on U.S. registered space objects when the U.S. is the sole launching State; beyond that, the application of U.S. law is subject to an international agreement to which the U.S. will be a party.

States should, therefore, become more attentive to the registration of space objects, in particular, in the case of cooperative programmes. States should be encouraged to develop a clear registration policy and register their space objects to reduce the possibility of a U.S. court applying U.S. patent law to the space object if it finds some evidence, even remote, of U.S. technical control over the object.

B) The "International Agreement" and the "Foreign State" Issues

The presence of an international agreement will play an important role, since, by an international agreement, exceptions could be made to limit or to expand the application of the U.S. patent in space law. What is meant by "international agreement?" According to the Restatement (Third) of Foreign Relations Law of the United States,[18] it is "an agreement between two or more States or international organizations that is intended to be legally binding and is governed by international law."[19] The Case-Zabloski Act[20] was amended in 1978 to provide that the Secretary of State shall determine for and within the Executive Branch whether an arrangement consitutes an "international agreement within the meaning of the Case Act." The Department of State has promulgated regulations identifying five criteria for deciding what constitutes an international agreement for the purpose of compliance with the Case Act.[21]

An agreement like the Intergovernmental Space Station Agreement obviously falls within the category of "international agreement" referred to in the Bill. What about the Memorandums of Understanding which constitute today the principal expression of international cooperation in the space field? A Memorandum of Understanding concluded between NASA and ESA for the conduct of a cooperative programme is an international agreement under U.S. law since it is approved by the Secretary of State pursuant to State Department Circular 175.[22] This clarification should appear at least in the legislative history of the Bill to avoid possible future misunderstanding and the MOUs concluded by NASA would have to develop a specific clause to that effect.

18. RESTATEMENT (THIRD) OF FOREIGN RELATIONS LAW OF THE UNITED STATES (1987).
19. *Id.* sec. 301.
20. 1 U.S.C. sec. 112(b) (1982).
21. Case Act Regulations, 22 C.F.R. sec. 181.2 (1981).
22. MOUs are also legally binding international agreements for ESA under article XIV, paragraph 1 of its Convention.

Another useful clarification which preferably should have been inserted in the Bill language itself (but at least should appear in the legislative history) is related to the meaning of "foreign State" or "State of registry." An international intergovernmental organization like the European Space Agency is to be considered for the purpose of the new law as a "foreign state," or a "launching state" or a "registering state." ESA was the first international organization having declared its acceptance of the Registration Convention[23] in accordance with the terms of the latter.

Therefore, ESA is maintaining a registry of its space objects. In the case of the International Space Station, the flight elements constituting the European contribution will be registered by ESA on behalf of the European partner States, all Participating States to the Columbus development programme. ESA will also register the Hermes space plane which could eventually dock the space station manned-base, as well as the European data relay satellite (space objects which could be used within the frame of the space station cooperation without being part of this cooperation).

The language of the initial Bill has also been improved in the revised version and put in line with the language used in space treaties, for instance, by referring to "space objects or components thereof" instead of "aeronautical and space vehicles" (even if the notion of "space object" is not well defined). Of course, other questions could be raised: what would happen in case of an invention made, used, or sold on the Moon? Would a facility erected on the Moon be considered as space object? Finally, one should seriously consider the need for an international convention for patents in space.

Conclusion

The U.S. patent in space bill, H.R. 2946, is an example of the particular importance of the increasing role of domestic legislation in the conduct of space activities which often are, and will be more and more, international in character and such a significant contribution to the laws of space activities. When developing such legislation, States should draw attention to the international issues involved; this assures coherence with their existing international commitments, thereby reducing the risk of conflicts between international agreements and domestic implementing legislation.

As the international cooperation in space is forced to develop in the future, by associating States which may not have similar legal systems,

23. BSA's Declaration of Acceptance of the Registration Convention was done on Jan. 2, 1979, under art. VII of the Registration Convention, *supra* note 12. *See* Letter of the U.N. Legal Counsel to ESA on Article II of the Registration Convention (quoted in part in Lafferranderie, *L'application, par l'Agence spatiale européenne, de la Convention sur l'immatriculation des objets lancés dans l'espace extraatmosphérique*, 11 ANNALS AIR & SPACE L. 229, 231-32 (1986).

domestic legislation will receive an important role as a secondary source of space law, thus enriching it. We could hope for a trend of domestic legislation of the various countries towards a minimum common core, thus contributing to achieve the necessary coherence between the three stages of the overall "legal transportation system" of space activities: the "space law," the international agreements, and domestic legislation.

LEGAL REGULATION OF SPACE ACTIVITIES: WHICH WAY WILL IT ADVANCE FURTHER?+

V.S. Vereshchetin*

Abstract

Public international law should continue to play a leading role in the regulation of space activities. However, another movement has manifested itself clearly alongside of that. This is the development of national legislation in the space field which has been called forth to a considerable degree by the commercial uses of space technology. The growth and diversification of special national and international rules in this area, pertaining to civil law relationships with "foreign elements," bear witness to the gradual formation of private international space law. Despite the great desirability of ensuring the unification of national laws governing space activities, such a unification cannot be ensured in practice by elaborating an artificial "transnational space law." The unification must be ensured by: (1) bringing national legislation into conformity with international law, (2) concluding new international agreements, including those of unificatory character, (3) giving due consideration to the interests of other states when elaborating and passing national legislation and (4) using the institution of international consultations for this purpose.

1. New Tendencies in the Legal Regulation of Space Activities

At the early stages of outer space exploration, states, or more precisely state's entities, were the only actors in outer space. The reason for this could be explained by the exceptionally high cost of space rocketry and technology, their close connection with defense, political and economic interests of states, as well as by the uncertainty of using commercially the achievements of outer space exploration. Hence, space law has been formed, primarily, as interstate law governing relations among states as sovereign entities in connection with their space activities.

It must be assumed that some of the above-mentioned factors, determining mainly the "state" character of national and international space activities, will remain important in the immediate future as well. This means that public international space law will continue to develop actively. Issues included in the agenda of the Legal Sub-Committee of the

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U.N. Committee on Peaceful Uses of Outer Space, revealing a number of complex, unresolved problems of international space law, bear witness to this tendency.

At the same time, in the recent years, another movement has clearly manifested itself in the development of legal regulation of space activities - the appearance of national legislation in the field of outer space. This national legislation is connected mainly with the growth of commercialization of space activities and the entry into the "space arena" of new actors: private organizations, firms, and companies. Such legislation has already been passed in the USA, the United Kingdom and Sweden. They are also under consideration in a number of other countries.[1]

The necessity of adopting national laws is dictated, of course, not only by the requirements of commercial uses of space rocketry and technology. The broad development and diversity of space activities in many countries must be accompanied by relevant national legal regulations which will affect many branches of domestic law, including those of constitutional, administrative, civil, criminal, and labor law as well as others.

The study of existing legal rules and the elaboration of new ones pertaining to personal property and personal non-property relations "with foreign elements" in them which have relevance to space activities, that is the sphere of legal regulation which traditionally comprises the subject of private international law, is of great interest.

The scientific and practical importance of these matters is explained by the evolution of space activities taking place before our eyes and is evident from the evolution of purely research tasks toward an ever widening economic use of space technology and the formation of an international market of space technology and services. At the same time, international cooperation which is developing on a broad scale in the field of exploration and use of outer space also requires an improvement of its juridical mechanism.

The rendering of "paid" services in launching spacecraft into orbit, the allocating of telephone and television communication channels via artificial earth satellites, the selling of data acquired by remote sensing of the earth, the conducting of works in the field of space processing, and other kinds of space activities are inevitably connected with the necessity of solving a number of private law issues so long as their conduct on an international basis takes place with the participation on one, or on both sides of natural or legal persons. This is so because the performance of such works requires the conclusion of civil contracts, the establishment of a procedure for settling disputes through courts or arbitration and also demands the solution of issues of property, insurance, copyright, and patent rights.

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1. Regretfully, there is no national law on space activities in the Soviet Union.

Many of these matters are being solved through choice of law rules or by reference to relevant rules of international agreements. This bears testimony to the fact that in spite of earlier expressed opinions on the inapplicability of private international law to space activities,[2] the latter already operates in an active manner in regulating such activities.

2. *International Private Space Law and "Space Law in a Broad Sense"*

The question arises as to what should be understood by "private international space law" and whether it is possible to say that such a body of law is already being formed.

Without undertaking the task of theoretically attempting to solve a debatable issue on the subject and system of private international law, but still considering the question raised, we proceed from the provisions universally recognized in the doctrine that international private law regulates property, and (related) personal non-property, relations with a "foreign element," arising not between states as sovereign entities, but between natural and legal persons.

If such relations arise in connection with space activities, they can be related, rather conditionally, to the sphere regulated by private international space law. At present, the degree of this conditionality is very high inasmuch as there has neither been a universally recognized definition of space activities nor a substantially large volume of national legislative rules adopted independently or by virtue of international treaties on unification specific to civil space law relations.

However, a clear tendency has become evident toward a quantitative growth of such special rules dictated primarily by requirements of the development of commercial space exploration. In particular, this has manifested itself in the field of space insurance in view of the exceptionally high risk associated with the operation of space technology and the specifics of relations between the insurer and the insured. Special solutions have been called for by matters relating to the protection of copyright and "neighbouring" rights when using Earth satellites for direct television broadcasting, as well as by the necessity of protecting patent rights on inventions resulting from direct activities in outer space. A complex set of specific legal issues arises in connection with the liability of manufacturers of space technology. A task has been set in the literature to elaborate international agreements unifying legal regulations governing space activities, in particular, as applied to the unification of contracts dealing with the launching of space objects.[3]

International agreements on outer space currently in force already have specific rules pertaining to private international law. For example,

2. *See* Kolossov, *On the Problem of Private Commercial Activities in Outer Space*, 27 PROC. COLLOQ. L. OUTER SPACE 66 (1984).

3. Dann, *Future Role of Municipal Law in Regulating Space Related Activities* in SPACE LAW: VIEWS FOR THE FUTURE 132 (Zwaan & others ed. 1988).

the provision of article VIII of the Outer Space Treaty[4] states that "ownership of objects launched into outer space, including objects landed or constructed on a celestial body, and of their component parts, is not affected by their presence in outer space or on a celestial body or by their return to the earth." This rule is directed at the settlement of disputes concerning ownership of space objects and their component parts in the event of the presence of these objects and their component parts on a foreign territory or in spaces beyond the jurisdiction of a state. States and legal persons, as well asphysical persons, can be the owners.

With the development of production activities in outer space, what will be the situation in the not too distant future? Everything seems to indicate that not only matters of industrial and intellectual property, but also matters of labor law and liability for damage caused to spacemen in the course of production activities in outer space, will require special regulation.

The quantitative growth and diversification in national legislation of special rules and unified rules of international treaties pertaining to civil law relations with a "foreign element," brought about by constantly developing international regulations in the field of space activities will gradually lead to the formation of private international space law which will coexist with the private international law of the sea, private international air law, and so on.

We stress the tentative nature of this terminology inasmuch as the division of private international law, in the doctrine, into branches, subbranches, or special independent sections is far from being universally recognized. Thus, the subject matter and system of this law, as it has been mentioned above, remains to be the topic of scientific discussions.[5]

However, there is no doubt that a combined study of private international law pertaining to space activities of natural and legal persons is not only of cognitive significance but also of exceptional importance to the practice as well.

For the same reasons (scientific, educational, and practical), in connection with the combined study of legal regulations pertaining, for instance, to commercial activities in outer space, we may go beyond the limits of private international space law and include relevant rules of public international space law into the scope of these studies. In this context, we can speak of space law in broad terms, encompassing both international and national regulations. However, we must not forget that, in reality, the corresponding rules of this artificially construed space law "live" either in acts of national legislation or in international treaties and

4. Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and other Celestial Bodies, Jan. 27, 1967, 18 U.S.T. 2410, T.I.A.S. No. 6347, 610 U.N.T.S. 205.

5. *See* PROBLEMS OF CONTEMPORARY INTERNATIONAL PRIVATE LAW (M.M. Boguslavsky ed., Moscow 1988).

customs. In addition, this system does not form an organic unity, a single totality of rules.

Therefore, it is hardly possible to agree with the statements of a number of authors on the necessity to proceed from the unity of space law or on the possibility of creating an "integrated space legal system," including both international and national legal rules.[6]

In our view, the notion that the term space law "is purely a functional one used to describe the sum of all legal rules (whatever their source), which are applicable to space related activities"[7] is a more correct opinion.

3. *"Transnational Space Law:" Is Its Creation Possible?*

Let us discuss in greater detail Prof. H. DeSaussure's proposal regarding the elaboration of "transnational space law." He has discussed this proposal in a number of works and presented it in the greatest detail in the report at a previous colloquium on the Law of Outer Space.[8]

Prof. H. DeSaussure believes that the "new era" of the space age, which he relates, first, to commercialization and privatization of space activities, requires the development of a "unique and special law," a new *corpus juris*.[9]

It follows from the title of the report and the analysis of the possible sources of future space law given in it, that Prof. H. DeSaussure believes transnational law to be the basis for this new law. According to the definition of adherents to this concept such law includes "all the law - national, international or mixed - that applies to all actors that perform or have influence across state lines."[10] While recognizing the vagueness of the notion of transnational law, Prof. H. DeSaussure, nevertheless, thinks that it has "relevance in establishing an extraterrestrial regime."[11] As to the content of future transnational space law, he also attaches special significance to the use of an analogy to the present law of the sea, which he considers as an independent branch of law that "embraces segments of both

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6. *See* Dutheil de la Rochere, *Les sources du droit de l'espace, in* DROIT DE L'ESPACE 11 (1988); DeSaussure, *An Integrated Legal System for Space*, 6 J. SPACE L. 253 (1978).
7. Dann, *supra* note 3, at 125.
8. DeSaussure, *The Unification and Development of Transnational Space Law*, 31 PROC. COLLOQ. L. OUTER SPACE 253 (1989).
9. *Id.* at 253. It is interesting to note that at the same Colloquium on the Law of Outer Space another U.S. author presented a report which denied at all the need for space law. He writes: "There is simply no need for a unique 'space law'" and then: "each nation must rely solely on its own domestic law."*See* Dribin, *What Space Law Will Govern Accidents and Breaches of Contracts in Outer Space? Id.* at 166, 167.
10. DeSaussure, *supra* note 8, at 257.
11. *Id.* at 257.

public and private law and regulates commercial as well as governmental activities."[12]

At the same time, Prof. H. DeSaussure thinks that international law cannot play a leading role as a source of future "transnational space law." To substantiate this thesis, he refers to the premise that international law regulates only governmental functions of states which do not include commercial activities of governments and private persons. He also notes that international law is based on the principle of state sovereignty over the territory; he believes this to be inapplicable to outer space.[13] Finally, he stresses that in a number of countries, in particular the U.S.A. and the U.K., in the event of a conflict between rules of international and national law, the latter could prevail.[14]

Prof. H. DeSaussure proposes a mechanism for the elaboration of a new space law - a Space Law Commission of the U.N. General Assembly, set up in a fashion similar to the U.N. International Law Commission, from among the most well-known specialists, appointed on a personal basis which would ensure work "from a universal rather than a state centred viewpoint."[15] He thinks that the U.N. Committee on Peaceful Uses of Outer Space or an International Space Agency, proposed by a number of states, is unsuitable for this work.[16]

The report by Prof. H. DeSaussure raises issues of principal importance for the future regulation of space activities and contains a number of interesting and useful considerations and remarks.

In particular, one cannot disagree with the author's statement that "there must be some international or universal consistency in the enactment and application of national law."[17] He notes quite correctly that "[i]ndividualistic and unrestrained extension of domestic law into outer space will fragment the legal order. Instead of outer space unification, there will be disarray and confusion."[18] He stresses that "[s]tates must legislate for their national programs with due regard for the interests and programs of other states."[19] In this connection, Prof. H. DeSaussure makes an interesting proposition that, in order to consolidate international law and order in outer space, national laws should be applicable to outer space only "after international consultation and approval."[20]

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12. *Id.* at 255.
13. *Id.* at 257.
14. *Id.*
15. *Id.* at 258.
16. *Id.*
17. *Id.* at 257.
18. DeSaussure, *The Interaction of Domestic and International Law*, 30 PROC. COLLOQ. L. OUTER SPACE 295 (1989).
19. *Id.* (Emphasis added by original author, Prof. H. DeSaussure).
20. *Id.*

The crucial question is whether a unified or integrated legal system for space activities is possible. If so, what should it be and how can it be created. Although Prof. DeSaussure puts the time frame for the creation of this system beyond the end of the twentieth century,[21] the present state of legal development in the world provides no ground for optimism on that account.

In essence, it is a matter of unifying into a single body already existing legal rules (international and national) related to space activities, by giving them legally binding force for all actors in outer space. It is also a matter of elaborating a mechanism for the development, adoption, and enforcement of future rules governing any space activity which would be binding on national and international levels. This proposition, however attractive it might seem, raises a multitude of issues to which we have no answers at this time. The most important issue is what should be the mechanism for the elaboration and enforcement of the law, encompassing the totality of present and future national laws and international agreements.

The reference to the precedent of the law of the sea does not sound convincing. From the viewpoint of a majority of states, it is not considered to be transnational law. As in other similar fields of legal regulation (air, outer space, environment, etc.), it belongs to the corresponding branches of national and international law.

4. *How Is the Unification of National Legislation in the Field of Space Activities to Be Ensured?*

As mentioned earlier, from scientific, cognitive, and educational viewpoints, a combined comprehensive study of international and national legal rules, pertaining to a sphere of regulation or a region, seems to be useful and fruitful. In this sense, the notion of transnational law, at this time of the growing interdependence and integrity of the world, is worthy of further study. However, study is one thing, law-making and law-enforcement is another, when they relate simultaneously both to the domestic and international spheres. Who will have authority to act as a legislator, even if these rules are elaborated by the U.N. Space Law Commission as proposed by Prof. H. DeSaussure? How can universal acceptance and action of such rules be ensured?

By thinking in categories of today's state of legal development, it is more realistic to proceed from the assumption that the unification of national laws in the field of space activities must be ensured by: (1) bringing national legislation into full conformity with the international obligations of a state, (2) actively developing new international agreements, including those which would unify national legislative rules, (3) paying due regard to the interests of other states when elaborating and adopting

21. DeSaussure, *supra* note 8, at 253.

national legislation on outer space, and, (4) using for that purpose the procedure of international consultations.

At the same time, we presume that public international law must play, as it has before, the leading role in the regulation of space activities. We must not forget that agreements, unifying matters of international private law, be they uniform substantive law rules or conflict of law rules, are also concluded between states, that is to say, they also relate to public international law. In all areas, including the field of space activities, it is necessary to assert the primacy of international law over domestic legislation. This is becoming more and more the imperative of contemporary international life. If we do not succeed in obtaining the universal recognition of the primacy of international law over domestic law, where is the guarantee that transnational law in this respect will have a better destiny? If transnational law is understood as a simple sum of existing international law and national legal systems, what innovations will it bring to the unification of regulation of space activities?

INTERACTION BETWEEN SPACE TECHNOLOGY AND SPACE LAW

Lubos Perek*

Introduction

Developments of space law were triggered, as a rule, by important developments of space technology. The effect, however, has not always been proportional to the cause. In some instances, a technical development, perhaps important but restricted in scale, was followed by a very fast development of space law. In other cases, vast amounts of technical data, achievements and established facts needed a very long time to be reflected in space law or had no effect at all. The reason is that there is a third ingredient in the cause-and-effect process. It is the political will of the international community or of one or more of the leading actors. If the political will was strong at the crucial moment, a solution was found speedily. If it was weak or absent, the question used to return to the United Nations Committee on the Peaceful Uses of Outer Space (COPUOS) year after year with the regularity of migrating birds.

A few examples will illustrate the above proposition. If applied to unsolved questions of space law, it could indicate in what cases the missing ingredient is insufficient facts and where a stronger political will could advance space law in the interest of a close and smooth cooperation among states.

The Emergence of Artificial Satellites

The first and the most decisive development of space technology was the launching of the first Sputnik in October 1957. In the course of 1957 and 1958 it was followed by nine other artificial satellites launched by the Soviet Union and the United States. Compared with the frequency of launchings today, it represents an average month's activity. All the first nine satellites were on scientific missions with promises, but not proofs, of feasible and useful applications. This rather meager factual basis was sufficient to initiate a very fast reaction by the international community. An *ad hoc* committee was created in the United Nations as early as December 1958 to deal with outer space matters. One year later, it was transformed into a U.N. General Assembly Committee on the Peaceful Uses

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of Outer Space (COPUOS). Members of the Committee had a wide perspective foreseeing many of the developments that followed.

In April 1961, another event of paramount importance happened: the first flight of man in space. A few months later, a General Assembly Resolution[1] was passed and two years later was enlarged into the Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space.[2] The two documents contain many general legal principles which later appeared in the Outer Space Treaty.[3] They are of a high moral value and correspond to the global character of space activities by giving precedence to global points of view over partial views.

The work done in the law of outer space at that time deserves deep admiration. The power of thought was stronger than the power of facts and experience available. The political will was present. Within a few years, results had been achieved which needed centuries to attain in other fields of international law.

Another example of a fast reaction of the international community to an important step in space science and technology occurred after the landing on the Moon by the first man in 1969. One year later, Aldo Armando Cocca proposed an agreement on the principles governing activities in the use of the natural resources of the Moon and other celestial bodies. The political will, however, was declining at that time and it took more than ten years to conclude the Moon Treaty.[4] Even worse, only very few of the supporters of the Treaty in the COPUOS found their way to sign and ratify it.

The development of space activities and space technology has been spectacular in the last thirty years. Up to the end of October 1989 there were 3,180 launches carrying a total of 3,868 payloads.[5] Between 1,800 and 1,900 payloads were still in orbit at that date but only 200 to 350 of them still active.[6] The number of manned flights is equally impressive. There were 125 launchings with 365 flights by more than 200 astronauts

1. International Co-operation in the Peaceful Uses of Outer Space, G.A. Res. 1721 (XVI) (1961).
2. Declaration of Legal Principles Governing Activities of States in the Exploration and Use of Outer Space, G.A. Res. 1962 (XVIII)(1963).
3. Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, Jan. 27, 1967, 18 U.S.T. 2410, T.I.A.S. No. 6347, 610 U.N.T.S. 205 (*entered into force for the United States* Oct. 10, 1967)[hereinafter "Outer Space Treaty"].
4. Agreement Governing the Activities of States on the Moon and Other Celestial Bodies - adopted by the U.N. Gen. Assembly on 5 December 1979, *opened for signature* 18 Dec. 1979, U.N. Doc. A/RES/34/68 (1979) (*entered into force* 11 July 1984) [herein "Moon Treaty"].
5. The figures given have been compiled from issues of SPACEWARN BULLETIN up to SPX-432 of October 25, 1989.
6. Kessler, *Orbital Debris Issues*, 5 ADVANCES SPACE RES. 3 (No. 2, 1985); Ducrocq, *Survie de SPOT 1*, AIR ET COSMOS 37 (Dec. 13, 1986).

and cosmonauts.[7] The total time spent by man in space was well over 20 years.[8]

Byproducts of space activities include many dead objects in orbit. These are payloads which had terminated their functions and debris. The total number of dead objects large enough to be detected is at present around 7,000, some decaying everyday and some being generated.[9] The number of debris which are too small to be detected has been estimated at about 8 times the number of trackable debris, *i.e.* at about 50,000 to 60,000 pieces.[10] Though small in size, they move so fast that they can damage an active satellite in case of a close encounter or destroy it in case of a collision.

Definition of Outer Space

This perennial item has been on the agenda of the COPUOS for many years, in recent times under a title counting 47 words. At the most recent session of COPUOS,[11] all the various views have been reiterated, from an opinion that a conventionally defined boundary between air and outer space is necessary or that any object launched into outer space be considered as being in outer space at all stages of its flight when its altitude exceeds 110 km, to the opinion that the need for a definition has not yet been established and that a prematurely adopted definition might complicate and impede progress in the exploration and use of outer space.

The fact is that all launching agencies know where outer space begins. Operators of satellites and authors of manuals, such as the manual for the space shuttle,[12] have used specific numerical values for the "entry surface" or similar concepts for a long time. Also, research workers engaged in the computation of orbits of space objects know where the lowest perigees of orbits lie and at what altitudes space objects can move in orbit around the Earth.

Another fact is that the reluctance of the international community to define the area of application of space law has already led to some difficulties; in the agenda of COPUOS, two entirely unrelated subjects have been linked together, namely the definition and/or delimitation of outer space and the status of the geostationary orbit. The result was a loss of

7. A. VITEK, KOSMONAUTIKA 1988, at 61 (Czechoslovak Press Agency, Prague, Apr. 1989).
8. *Id.*
9. NASA SATELLITE SITUATION REPORT (Goddard Space Flight Center).
10. TAFF, ET AL., *Low Altitudes, One Centimeter, Space Debris Search at Lincoln Laboratory's (MIT) Experimental Test System*, 5 ADVANCES SPACE RES. 35 (No. 2, 1985)
11. Report of the Committee on the Peaceful Uses of Outer Space, U.N. Doc. A/44/20 (1989).
12. K. M. JOELS & G. F. KENNEDY, THE SPACE SHUTTLE OPERATOR'S MANUAL (1982).

time and effort in the work of the relevant U.N. bodies and the inability to solve not one but two problems.

This is a case where no amount of reliable scientific data has been able to overcome the lack of political will to come to a solution.

Protection of Science

At the time the technology of rocket flight was developed to a degree allowing the reaching of space, the laws of motion of celestial bodies, and thus the ability to compute orbits of space objects, had been known for a long time. Workable methods of orbit determination go back to the 19th century when they were applied to planets, asteroids, and comets. Those methods had to be adapted to the flight of artificial space objects. In particular, the drag of the atmosphere at altitudes of a few hundred kilometers had to be taken into account. The theoretical basis for space flight, however, was available, thanks to theoretical astronomy.

Since the beginning of the space era, artificial satellites have been used for scientific research, providing opportunities of observation in the ultraviolet and infrared parts of the spectrum, inaccessible from ground-based astronomical observatories. At the same time, the many space objects and radio communications started to interfere with scientific research.

One such interference is radio pollution which poses a threat to radio astronomy. Ground-based radio telescopes can be built at remote sites to avoid interference from radio traffic between ground stations. But on the surface of the Earth there is no hiding from signals coming from a satellite when it passes over the horizon. Moreover, some satellite systems used for navigation purposes have several satellites distributed in the sky in such a way as to have at all times and at all places of the globe three or four satellites over the horizon. Frequency bands which are important for radio astronomy are protected within the framework of the ITU (International Telecommunication Union) system of allocating frequencies but there is overspill from strong sources in neighbouring bands and interference from other services sharing bands with radio astronomy. A more efficient protection of radio astronomy might require some legislative action.[13]

Astronomical observatories working in the visible light are facing the problem of light pollution. Street illumination is just as efficient in illuminating the night sky as the streets. About one half of the energy spent in street lights is lost in the atmosphere.

Space debris are another source of interference. Even a tiny object reflects sunlight and produces - under certain conditions - a point or a line on an astronomical photographic plate or affects measurement with a

13. Cohen, *The Threat to Radio Astronomy from Radio Pollution,* 5 SPACE POL'Y 91 (1989).

light detector. Such traces may lead to misinterpretation or to loss of unique observations. The scientific community expressed its concern on several occasions.[14] A speedy tackling of this problem by the legal community is highly desirable.

Satellite Communications

The first experiments with active communication satellites were performed in low earth orbit. They were very successful but the low orbit allowed only short times of transmission at each overflight. Therefore, in the 1960's, the proposal by Arthur C. Clarke[15] was followed. Clarke had suggested, as early as 1945, the placing of three satellites into the geostationary orbit at regular intervals in the equatorial plane. The satellites would form a system reaching ground stations on the entire globe with the exception of high-latitude regions. Under the present systems, sometimes more than three satellites are used for global networks, such as INTELSAT; sometimes one satellite is used for communications within a continent or across an ocean. There are close to 200 communication satellites in the geostationary orbit and their numbers are growing fast.[16] There are plans, notified to the International Frequency Registration Board, to launch over 500 satellites within the next five years.[17]

In addition to communications transmitted by satellites between points on the ground, communication links are vital for the operation of all satellites. Ground-to-satellite communication is used, *inter alia* for transmission of commands, while satellite-to-ground links are used for receiving information on the activities and state of the satellite.

Thus, satellite communications are indispensable for the correct function of any satellite. The regulation and coordination of this vast area has been taken up by the International Telecommunication Union because it had dealt with radio communications before. The problem of avoiding harmful interference between a newly introduced satellite system and all systems already in use has been successfully solved. The regulation appeared in the ITU Convention,[18] in the Final Acts of several World

14. *Environmental Effects of Space Activities Report by COSPAR and the IAF*, U.N. Doc. A/AC.105/420 (1988).
15. Clarke, *Extra-terrestrial Relays*, WIRELESS WORLD 305 (Oct. 1945).
16. This information was compiled by examining the sources listed earlier in notes 5 & 9, *supra*.
17. Data gathered from relevant tables in the 27TH REPORT BY THE INTERNATIONAL TELECOMMUNICATIONS UNION ON TELECOMMUNICATION AND THE PEACEFUL USES OF OUTER SPACE (Geneva 1988).
18. International Telecommunications Convention (Nairobi 1982) (*entered into force for the United States* Jan. 10, 1986).

Administrative Radio Conferences[19] and in the extensive Radio Regulations.[20] The ITU, however, declined to assume a wider role in regulating space traffic, although the technical expertise of its consultative body, the Comite Consultatif International des Radiocommunications (CCIR) was adequate for the purpose.

It is of interest to note that the ITU Radio Regulations contain definitions of several terms frequently used in papers on the law of outer space, such as "Satellite," "Spacecraft," "Orbit," "Geosynchronous Satellite," "Geostationary Satellite," "Deep Space," etc.[21] The definition of "Outer Space" does not appear in the list.

The United Nations was involved in a specific area of satellite communications pertaining to direct television broadcasting. The discussions were conducted for a number of years and led to the adoption of a set of principles[22] calling for consultations and agreements on international direct broadcasts. The impression arises that, at present, the attention is shifting to very practical questions of availability and cost of parabolic antennas and other receiving equipment.

Satellite Remote Sensing

Remote sensing satellites have been launched by the United States (LANDSAT), Soviet Union (in the COSMOS, METEOR and OKEAN series), France (SPOT), and India (IRS). Typical is the LANDSAT orbit at about 900 km altitude with orbital elements chosen so as to compensate the annual rotation of the Sun-Earth line with perturbations caused by the flattening of the Earth.[23] The essential characteristic of the orbit, called sunsynchronous, is the crossing of the equator always at about 9:30 local time.[24] Thus, advantage is taken of a better chance of clear skies in the morning hours and morning shadows can be used as an important indicator of ground features.

Remote sensing imagery has been successfully used for studying renewable as well as non-renewable natural resources in agriculture, forestry, land use, mapping, geology, management of water resources,

19. I.T.U., World Administrative Radio Conference (WARC) for the Planning of the Broadcasting-Satellite Service (Geneva 1977). *See also* I.T.U. WARC (Geneva 1979), WARC ORB-85 (Geneva 1985) and WARC ORB-88 (Geneva 1988).
20. International Telecommunications Union, Radio Regulations, (edition 1982, revised 1985, ITU Geneva)(hereinafter "ITU Radio Regs").
21. ITU RADIO REGS, *supra* note 20; Final Acts of WARC ORB-88, art. 1, para. 169 (Geneva 1988).
22. Principles Governing the Use by States of Artificial Earth Satellites for International Direct Television Broadcasting, G. A. Res. 37/92 (1982).
23. *E.g.* in W. GILG *et al.*, MISSION STUDY FOR AN OPERATIONAL REMOTE SENSING SATELLITE SYSTEM 61 (Dornier System GmbH, Friedrichshafen 1975).
24. *E.g.* in THE EROS (Earth Resources Observations Center) DATA CENTER 8 (1977).

oceanography, environment, etc. Such studies are of particular importance for developing countries where ground-based surveys are scarce or non-existent.

The discussions in the United Nations concentrated mainly on the problem of third countries getting possibly more information on the sensed country than the sensed country itself was capable of obtaining. A set of principles on remote sensing of the Earth from space has been adopted in 1986.[25] It encourages cooperation between sensing and sensed states and regional arrangements among sensed states. Recently, questions of availability and cost of remote sensing imagery to sensed states have become important.

Applications Without a Specific Legal Regulation

Developments in space technology have not been followed by developments in space law in all fields of application; in satellite meteorology, space technology has been incorporated into all major programs of the World Meteorolocial Organization,[26] research as well as meteorological and hydrological services, but no specific legal regulation followed. Evidently, the global usefulness of the system and the long tradition in freely exchanging meteorological data has made good cooperation possible.

Satellite navigation was discussed in the United Nations in the early years and a working group was created. In 1967, the working group presented a report and adjourned *sine die*. The work continued in the International Civil Aviation Organization and in the International Maritime Organization. The International Maritime Satellite Organization (INMARSAT) is a descendant of these efforts.

Another highly beneficial and efficient system in the field of position determination is the COSPAS/SARSAT system between the United States, the Soviet Union, Canada, and France for search and rescue in case of an accident. The system has already saved hundreds of lives.

Technically very promising is materials processing in space, making use of the very high vacuum and microgravity available on board of satellites. Relevant projects have been run within national or cooperative international programs making thus far no requirement on international regulation.

Large-scale applications such as satellite systems for collecting solar energy and transmitting it to ground stations, or building permanent space settlements, are still rather far in the future. When such projects will be nearing realization, their legal consequences, already discussed in

25. *Report of the Committee on the Peaceful Uses of Outer Space*, U.N. Doc. A/41/20, at 24 (1986).
26. Space Activities of the U.N. and International Organizations, U.N. Doc. A/AC.105/358, at 95 (1986).

many papers presented at the Colloquia of the International Institute of Space Law, will assume a more detailed form.

Large international crews on manned long-duration flights will undoubtedly require detailed legal regulation. Up to now, crews have been relatively small, between two to seven astronauts. Since their roles in flight have been well-defined and because close friendship bonds developed in the course of long training, no specific general regulation was required.

Military satellites are being used for many tasks, such as geodesy, meteorology, navigation, communications, early warning, surveillance, electronic and photographic reconnaissance, and antisatellite systems. Some of these systems play a positive role by strengthening confidence among states and verifying compliance with international agreements. Other systems play a negative role. These developments are reflected in international law, in particular, in treaties dealing with disarmament or arms control. They go far beyond what is generally understood by the law of outer space which mainly deals with peaceful uses of outer space. These questions are beyond the scope of these remarks.

Safety of Space Activities and Protection of Environment

As a consequence of the increasing density of space traffic, safety of space activities and the protection of space environment are emerging as important questions. At the 40th International Astronautical Congress of the International Astronautical Federation (IAF), held in Torremolinos, Spain, 7-13 October 1989, for the first time several speakers in the Colloquium on the Law of Outer Space advocated the elaboration of a treaty dealing with these subjects.[27]

The 7,000 trackable space debris and dead objects in orbit and the 50,000 to 60,000 debris which escape detection pose a hazard to active satellites and in particular to manned missions.[28] The hazard was recognized by the scientific community several years ago and has been widely reported in periodicals, monographs, COSPAR (Committee on Space Research) workshops on space debris, and the IAA (International Academy of Astronautics) symposia on safety and rescue. A position paper was published by the AIAA (American Institute for Aeronautics and Astronautics) in 1981.[29] Quite recently, studies have been published by

27. 29 PROC. COLLOQ. L. OUTER SPACE (1990).
28. *See infra* p. 23; *see also supra* notes 9 & 10.
29. SPACE DEBRIS: AN AIAA POSITION PAPER (July 1981) (PREPARED BY THE AIAA TECH. COMM. ON SPACE SYSTEMS).

the European Space Agency[30] and by a special working group for the USA National Security Council.[31]

In the United Nations, COPUOS requested the IAF and COSPAR to prepare a study on space debris which was before the 1989 session of the Scientific and Technical Sub-Committee. There was also a proposal by several states to put the issue of space debris on the agenda of the Sub-Committee. COPUOS considered it essential that more attention be paid by Member States to the problem of collision with space debris and other aspects of space debris. The Committee called for the continuation of national research on this question. Thus, in spite of the wealth of information, there has been no significant action by COPUOS. Let us recall the years 1959-1961 when rather meager data were sufficient to trigger the work on the Outer Space Treaty.[32] This time, the political will to deal with the problem of space debris has not yet emerged.

A similar reluctance had appeared earlier at the ITU World Administrative Radio Conference on the Use of the Geostationary-Satellite Orbit. At the first session, in 1985, a request was directed to the CCIR to prepare a report on the subject of space debris. The Report,[33] very brief and rather lukewarm,[34] was put before the second session of WARC ORB in 1988 but no action on the report appeared in the Final Acts of the Conference.[35]

The situation as regards space debris is typically ecological. The collision probabilities and the pollution of outer space are still fairly small and a legal instrument would not bring about many cases. However, the numbers of debris are steadily growing and the collision probabilities keep increasing. When the day comes that the risk will become unacceptable, it could be too late to do anything about it. The error in allowing the pollution of the world ocean to get out of control will quite possibly be repeated in the case of pollution of outer space by debris. It would be tragic, if we had to wait for an accident to make us aware of the problem. All the facts, all the studies and all the knowledge needed for tackling the problem are already before us.

In fact, one accident involving space debris has already happened and led to the introduction of an item dealing with space safety in COPUOS. It was the malfunction of COSMOS 954 and its subsequent disentegration over northern Canada in 1978. In the years that followed, the item on

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30. SPACE DEBRIS: A REPORT FROM THE ESA SPACE DEBRIS WORKING GROUP ESA-SP-1109 (Nov. 1988).
31. REPORT ON ORBITAL DEBRIS BY INTERAGENCY GROUP (SPACE) FOR THE NATIONAL SECURITY COUNCIL (Washington, D.C. 1989).
32. Outer Space Treaty, *supra* note 3.
33. PHYSICAL INTERFERENCE AT THE GEOSTATIONARY SATELLITE ORBIT, 1986, CCIR Report 1004 of 1986 to WARC-88, paras. 2.15 & A.2.15 (Geneva 1988).
34. Perek, *Safety in the Geostationary Orbit After 1988*, Paper IAA-89-632, I.A.F. Congress (1989).
35. I.T.U. Final Acts, WARC ORB-88 (Geneva 1988).

nuclear power sources has been discussed in COPUOS. The progress achieved so far is encouraging and an agreement could be reached soon. There is, in addition, a shortcut to a most desirable solution: a ban on the use of nuclear reactors in the near-Earth outer space, as proposed by the Committee of Soviet Scientists Against the Nuclear Threat and by the Federation of American Scientists.[36] The proposal is based on the fact that nuclear reactors in Earth orbit are not used for peaceful purposes. The use of nuclear reactors could, however, be permitted in deep space where no alternative sources of energy are available.

The question of the use of nuclear power sources in space is just a part of the general question of safety of space activities and protection of space environment. It is unavoidable to deal with the general question, not with only a part of it. The following items, and possibly others, should be included:

- Coordination of satellite communications (already dealt with by the ITU),
- Collision avoidance through partial traffic separation,
- Removal of inactive satellites from low orbits by speeded up decay or by landing,
- Removal of inactive satellites from the geostationary orbit into disposal orbits,
- Minimizing the amount of debris,
- Avoiding unintentional explosions of space objects and prohibiting intentional explosions,
- Restricting human error and technical malfunction,
- Improving the information flow on motions of space objects, and
- Minimizing pollution of the atmosphere.[37]

A new international treaty on the subjects listed above would solve the matter. A less ambitious, but possibly equally effective, alternative has been proposed by N. Jasentuliyana.[38] A group of experts could agree on international standards and procedures as it is done in other fields. The Radio Regulations are a good example. The least that the international community could do is to adopt relevant recommendations in COPUOS. This modest step would go a long way toward increasing safety of space activities and reducing the danger posed by space debris. It can be

36. *Joint Proposal to Ban Nuclear Power in Earth Orbit*, 4 SPACE POL'Y 262 (1988); Aftergood, *Towards a Ban on Nuclear Power in Earth Orbit*, 5 SPACE POL'Y 25 (1989).

37. For details, see Perek, *Traffic Rules for Outer Space*, 25 PROC. COLLOQ. L. OUTER SPACE 37 (1983).

38. Jasentuliyana, *Environmental Impact of Space Activities: An International Law Perspective*, 27 PROC. COLLOQ. L. OUTER SPACE 395 (1985).

expected that launching agencies and operators of satellites, being in responsible hands of governments, would comply with measures of universal benefit, even without a strict obligation to do so. A minimum of political will of the international community is indispensable. Let us hope it will emerge soon.

EVENTS OF INTEREST

A. PAST EVENTS

Reports

*The Twenty-Seventh Session of the Scientific and Technical Sub-Committee of the United Nations Committee on the Peaceful Uses of Outer Space, 26 February to 9 March 1990**

The Scientific and Technical Sub-Committee of the United Nations Committee on the Peaceful Uses of Outer Space held its twenty-seventh session in New York from 26 February to 9 March 1990. The important discussions and recommendations are summarized below. The Sub-Committee adopted the reports of its two Working Groups: the Working Group of the Whole to Evaluate the Implementation of the Recommendations of the Second United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE 82) and the Working Group on the Use of Nuclear Power Sources in Outer Space. The report of the Sub-Committee to the Committee on the Peaceful Uses of Outer Space (COPUOS) is U.N. document A/AC.105/456, with the reports of the two Working Groups contained in its Annexes.

(A) *Implementation of the Recommendations of UNISPACE 82*

The Sub-Committee considered this agenda item through the Working Group of the Whole. As in past years, the Working Group worked on the basis of a draft text of recommendations prepared by the Group of 77. The Working Group recognized that a number of the recommendations of UNISPACE 82 had not yet been fully implemented.

As a result, the Working Group recommended that the Outer Space Affairs Division of the UN Secretariat should make efforts to arrange an increase in the number of fellowships offered by Member States for long-term, project-oriented on-the-job training in space technology and its applications.

In light of the ongoing development of space activities, the Working Group recommended that all States, in particular those with major space or space-related capabilities, and international organizations be requested to inform the Secretary-General annually on those space activities that are or could be the subject of greater international cooperation.

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* The views expressed herein are those of the author and do not necessarily reflect those of the United Nations.

With a view to promoting better access to space-related education, the United Nations should arrange to provide expert consultants to States for assistance in preparing an integrated national plan of action for initiating, strengthening, or reorienting space applications programmes.

The United Nations should encourage intensive participation of international and regional financial and development institutions in cooperative programmes and projects formulated by States.

The Outer Space Affairs Division should prepare a report on the economic aspects of the strengthening and expansion of data banks at the national and regional levels, and the establishment of an international space information service in the Division as a centre of coordination, as recommended in paragraph 9(b) of the General Assembly resolution 44/46.

The Working Group recommended that the United Nations lead an international effort to set up regional educational centres on space science and technology in existing educational institutions in the developing countries.

Noting that some of the space application studies recommended by UNISPACE 82 are incomplete, the Working Group recommended that information from different reports should be integrated and new information should be compiled in the case of priority studies recommended by UNISPACE 82, and that studies should be done to demonstrate the potentials of the use of space technology on specific areas: integrated land and water resources management for rural development, remote and rural area communications and broadcasting, forest resources management, flood monitoring and control, desertification, ocean resources development, upper atmosphere studies for weather and environment monitoring.

(B) *Use of Nuclear Power Sources in Outer Space*

The Sub-Committee considered this agenda item through the Working Group on the Use of Nuclear Power Sources in Outer Space. While the Legal Sub-Committee considers draft principles on this question, the Scientific and Technical Sub-Committee considers its technical aspects, in particular its safety aspects.

The Working Group was successful in reaching consensus on a comprehensive set of recommendations on the safe use of nuclear power sources in outer space, which included recommendations agreed to in substance in past sessions as well as new recommendations. Among the former, there was a recommendation defining a "sufficiently high orbit" (SHO), in which the orbital lifetime is long enough to allow for a radioactive decay of the fission products to an acceptable level. Among the latter, there were recommendations that reactors should use only highly enriched uranium-235 as fuel, and a recommendation on the design goal for nuclear power sources, indicating specific dose limits to individuals in accident scenarios, namely a principal limit of 1 mSv per year, and a

subsidiary limit of 5 mSv per year for some years on the condition that the average annual dose equivalent over a lifetime does not exceed the principal limit.

These achievements have provided a good scientific and technical basis for the Legal Sub-Committee's consideration during its April 1990 session, of principles on the use of NPS in outer space, particularly Principle 3 on guidelines and criteria for safe use.

In its report to COPUOS, the Sub-Committee stated that the Working Group "has completed the elaboration of scientific and technical criteria for the safe use of nuclear power sources in outer space." Instead of recommending the reconvening of the Working Group next year, the Sub-Committee recommended that COPUOS consider the question of the reconvening of the Working Group in light of the work carried out by the Legal Sub-Committee at its April 1990 session. With regard to the future consideration of this agenda item by the Scientific and Technical Sub-Committee, the Sub-Committee recommended that COPUOS should consider it at the June 1990 session.

(C) *Remote Sensing*

In the course of the discussions on remote sensing, Member States reviewed their national and international cooperative programmes in remote sensing of the Earth from space. The Sub-Committee recommended that information and data from remote sensing should be disseminated at a reasonable cost and in a timely manner to meet the needs of developing countries. Recalling General Assembly resolution 41/65 of 1986 adopting Principles relating to Remote Sensing of the Earth from Space, the Sub-Committee recommended that, at its next session, it consider remote sensing activities conducted in accordance with those principles.

(D) *Scientific Symposium and Presentations*

A scientific symposium on the theme "The use of space technology in terrestrial search and rescue and in disaster relief activities," sponsored by COSPAR and IAF, was held in two sessions. COSPAR also made a special presentation on progress in the international geosphere-biosphere (global change) programme.

In addition to the above, twelve scientific and technical presentations were made by Member States (including Canada, the Federal Republic of Germany, India, Sweden, the USSR and the United States) and non-governmental organizations.

While these special presentations provided delegates with some general educational material on space science, technology and applications, this trend of increasing the scientific content of the sessions was viewed with some concern by several delegations. The Soviet Union mentioned that the presentations should not interfere with the substantive work of the

Sub-Committee, and Brazil stated that the task of the Sub-Committee was "to discuss policies and guidelines for international cooperation in space activities and to provide agreed technical parameters in order to help the development of the international regulation of the peaceful uses of outer space."

As the theme fixed for special attention at its 1991 session, the Scientific and Technical Sub-Committee recommended "Applications of airborne and satellite remote sensing for prospecting mineral and ground-water resources and for monitoring and managing biological resources, with emphasis on agriculture, taking into particular account the needs of developing countries."

(E) *Other Matters*

Since the General Assembly, in its resolution 44/46, had endorsed the initiative of international scientific organizations and bodies to designate 1992 as International Space Year (ISY), the discussions of the Sub-Committee on this subject focused on practical questions. The proposed programme for the participation of the United Nations in ISY has been prepared by the Outer Space Affairs Division, and the USSR, the United States, ESA and INTELSAT submitted proposals to support this participation, mainly through the Programme on Space Applications. Since the primary focus of ISY activities will be on the use of space technology for studying and monitoring the environment, the Sub-Committee recommended that United Nations activities should be complementary to the activities of international organizations such as COSPAR, IAF and the Space Agency Forum for International Space Year (SAFISY). The Sub-Committee also recommended that Member States, in planning their activities for ISY, consider ways in which those activities could complement the efforts underway for the Conference on Environment and Development planned for 1992.

This year again there was a growing concern among the delegations over environmental problems. Brazil considered outer space as an integral part of the human environment and urged proper treatment of questions relating to the harmful effects of space activities. In this connection, Sweden again raised its proposal to include the question of space debris into the Sub-Committee's agenda. This attempt, supported by India and Pakistan, was not successful because the United States, while recognizing the importance of the subject, took the position that such consideration was premature until further national research on the problem of space debris had been completed.

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*The Legal Sub-Committee of COPUOS Achieves Progress in the Legal Dimension in Outer Space Activities**

From 2 to 20 April 1990, the Legal Sub-Committee of the Committee on the Peaceful Uses of Outer Space (COPUOS) held its twenty-ninth session at the United Nations Palais des Nations in Geneva. During its session, the Sub-Committee considered the following agenda items: the elaboration of draft principles on the uses of nuclear power sources in space; questions on the definition and delimitation of outer space, including the character and utilization of the geostationary orbit; and the newest item, the legal aspects relating to the application of the principle that the exploration and utilization of outer space should be carried out for the benefit and in the interests of all states. The Sub-Committee elected Mr. Vaclav Mikulkas of Czechoslovakia as its new Chairman, to succeed Mr. Stanislav Suja, also from Czechoslovakia.

The Sub-Committee considered the *Elaboration of Draft Principles Relevant to the Uses of Nuclear Power Sources in Outer Space* through its Working Group on the item, chaired by Hans Winkler of Austria. The Working Group had before it a number of documents, including a working paper submitted by Canada at the conclusion of the 1989 session (document A/AC.105/2.2/L.154/Rev.5) containing agreed and proposed draft principles; the report of the Scientific and Technical Sub-Committee (document A/AC.105/456) containing the scientific and technical criteria for the safe use of nuclear power sources (NPS) in outer space that were agreed upon in the Working Group on NPS of that Sub-Committee; and a new working paper submitted by Canada, Federal Republic of Germany and France (document A/AC.105/C.2/L.177) containing a proposed text on guidelines and criteria for safe use based on the criteria adopted in the Scientific and Technical Sub-Committee.

At previous sessions of the Legal Sub-Committee Working Group, consensus had been reached in the texts of a number of principles: the applicability of international law; notification of re-entry; consultation; assistance to states; and settlement of disputes.

At this session, the Working Group reached consensus on Principle 3, guidelines and criteria for safe use. In negotiating the agreed text, the Working Group held extensive informal consultations, based largely on the proposed text submitted by Canada, Federal Republic of Germany and France in their working paper (A/AC.105/C.2/L.177).

The agreed text of Principle 3 provides that the use of NPS in outer space shall be restricted to space missions which cannot be operated by non-nuclear energy sources in a reasonable way. It also provides general goals for radiation protection both during planned NPS operations and in case of accidents; defines a "sufficiently high orbit" for long-term

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* The views expressed in this report are those of the author in his personal capacity and do not necessarily reflect those of the United Nations.

placement of nuclear reactors; and establishes criteria for the safe use of both nuclear reactors and radio-isotope generators, for interplanetary missions and for operations in Earth orbit. The goals for radiation protection are based on the recommendations of the International Commission on Radiological Protection (ICRP).

With agreement on the guidelines and criteria for safe use, the Working Group achieved a major step towards the goal established when it began work in 1980. Elaboration of the Principles would now appear to be nearly complete, since the new principle resolves some of the most comprehensive and essential issues. Agreement on draft Principle 3 will assist in the negotiation of the remaining unresolved draft principles on notification of the use of NPS, safety assessment, international responsibility, and compensation for damage. Negotiation of these issues will also be based on established space law, including the Outer Space Treaty, the Liability Convention and Registration Convention. It appears possible that the draft principles on nuclear power sources could be finalized at the forthcoming COPUOS session in June 1990 and adopted by the General Assembly at the end of the year. If not, the Legal Sub-Committee should reach consensus on the complete set of principles at its 1991 session.

On the agenda item *Matters Relating to the Definition and Delimitation of Outer Space and on the Character and Utilization of the Geostationary Orbit, Including Consideration of Ways and Means to Ensure the Rational and Equitable Use of the Geostationary Orbit Without Prejudice to the Role of the International Telecommunication Union,* the Working Group was chaired by Mr. Estanislao Zawals of Argentina. In its work, the Working Group referred to General Assembly resolution 44/46, which called on the Sub-Committee to continue to take into account the concerns of all countries, particularly the developing countries, in its work on matters relating to the character of outer space and utilization of the geostationary orbit. The Working Group organized this item in two parts, with the question on definition and delimitation of outer space and the question of the geostationary orbit discussed separately.

In the Working Group, some delegations, including the Soviet Union, reiterated the view that the definition and delimitation of outer space was a practical and legal necessity in order to achieve a clear distinction between the legal regime of air space, with its inherent features of state sovereignty, territorial integrity and security, and the legal regime of outer space, which provides for the free exploration and use of outer space by all nations. In general, these delegations felt that a boundary should be established just below the minimum altitude of an orbiting satellite, at about 90 to 110 km. They argued that prospects for aerospace vehicles with characteristics of both satellites and aircraft supported the arguments in favor of a boundary. They felt that it was time to resolve this question, which had been on the agenda since 1968.

Other delegations, including the United States, continued their opposition to such a definition, arguing that the establishment of an arbitrary boundary would tend to inhibit the successful continuation of the peaceful exploration of outer space for the benefit of all countries. For these delegations, the development of hybrid aerospace vehicles constituted an argument against establishment of a boundary.

In the face of this continuing disagreement, some delegations proposed that the item be dropped from the agenda, and some suggested that the Working Group might discuss the specific legal issues raised by hybrid aerospace vehicles. However, there was no agreement on these proposals either.

The delegates also continued to have divergent views of the geostationary orbit. Some delegations, particularly those representing the equatorial states, reiterated the need to establish a *sui generis* legal regime, in addition to existing space law, to regulate equitable access to and rational utilization of the geostationary orbit. These delegations felt that COPUOS is the competent international body to deal with political and legal questions relating to the geostationary orbit, while the ITU provides a forum to discuss technical issues.

Most delegations reiterated their opposition to the establishment of a new legal regime, considering that the geostationary orbit was an integral part of outer space and was covered by the Outer Space Treaty. The Western delegations reiterated their opinion that the ITU provided the competent forum for regulation of the orbit and that provisions regarding its equitable utilization should be formulated in conformity with the relevant ITU decisions.

Some developing countries argued that the principle of equitable access to the geostationary orbit required that special treatment should be given to developing countries that do not have the technical and economic means to use the orbit. Developed countries argued that the principle of equitable access precludes special treatment for particular countries.

The newest agenda item, *Consideration of the Legal Aspects Related to the Application of the Principle That the Exploration and Utilization of Outer Space Should be Carried Out For The Benefit and In The Interests Of All States, Taking Into Account The Needs of Developing Countries* was discussed in the Sub-Committee itself. A Working Group on the item was established and Mr. Raimundo Gonzalez of Chile was elected Chairman, but the Working Group will begin its work next year. This item, derived from Article I of the Outer Space Treaty, was initiated by the developing countries following the adoption in 1986 of the principles on remote sensing. The objective of this initiative was to assess and define the benefits and interests that developing countries can expect to obtain through the exploration and utilization of outer space.

For the work on this item, the Sub-Committee had before it replies to two notes verbale from the Secretary-General, one requesting Member States to provide their views on priority issues for this agenda item and to

provide information on relevant national legal frameworks (A/AC.105/C.2/15 and Adds. 1-5) and one inviting Member States to submit their views on the subject of international agreements that Member States have entered into that are relevant to the principle that the exploration and use of outer space shall be carried out for the benefit and interest of all countries (A/AC.105/C.2/16 and Adds.1-8).

For delegations from developing countries, as well as some from other countries including the Soviet Union, the objective of this item is the development of a legal framework that would take into account the needs of developing countries. Other delegations, including the United States, felt that the emphasis in developing a legal framework should be on promoting the actual utilization of outer space.

In support of the position of the developing countries, the Nigerian delegation made a statement offering several proposals for promoting international co-operation and development, including: (1) establishment of an international framework for the development of indigenous capabilities in space science; (2) institutionalization of exchange of information and technology; (3) establishment of joint partnerships between space powers and developing countries; (4) establishment of a legal framework for access to remote sensing data; (5) creation of a special technical assistance network to facilitate transfer of expertise and technology; and (6) establishment of a framework for distributing the benefits of spin-off technologies.

Some delegations pointed out that the common interests principle in Article I of the Outer Space Treaty provided the foundation from which to work, taking into account existing national and international legal instruments and agreements and procedures for international co-operation including the multilateral agencies. To assess the present legal situation, particularly that of the developing countries, some delegations felt that information on space law and international space organizations should be compiled and disseminated.

In addition to the discussions of the agenda items, a few delegations, including Cuba and Mexico, continued to express concern over the militarization of outer space. These delegations pointed out that the legal Sub-Committee, which had elaborated the Outer Space Treaty with its restrictions on military space activities, was competent to consider the question of the prevention of the arms race in outer space. Other delegations, including France and the United States argued that such issues were exclusively a matter for the Conference on Disarmament. They were of the view that COPUOS and its Sub-Committee should not deviate from its mandate of promoting international co-operation in the peaceful uses of outer space.

While these perennial military questions were raised, there was substantially less discussion of them than in previous years. This session thus saw a continuation in the decline of interest in this confrontational area since the intense confrontations of the mid-1980s.

The Sub-Committee held a total of 12 formal meetings as well as working group consultations and numerous informal discussions. The views expressed in those meetings are contained in documents A/AC.105/C.2/SR.527 to 538. On 20 April 1990, the Sub-Committee adopted the report contained in A/AC.105/457 and concluded its twenty-ninth session.

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Comments

*Activities of the National Space Development Agency of Japan in the Field of Exploration and Use of Outer Space with a Focus on International and Legal Areas**

Japan's space development activities are carried out by two organizations, the National Space Development Agency of Japan (NASDA) and the Institute of Space and Astronautical Science (ISAS). NASDA has been engaged in practical space application while ISAS has been working in the field of space science in cooperation with other related organizations.

Since its foundation on October 1, 1969, NASDA has been engaged in the exploration and use of outer space for peaceful purposes through research and development of an infrastructure in outer space, satellites and launch vehicles, and their applications. Through the experiences accumulated for more than twenty years, NASDA has been interacting internationally in various fields. With regard to launch vehicle development, NASDA initially introduced the U.S. Delta launch vehicle technology under a space agreement established between the United States Government and Government of Japan in 1969. NASDA had developed N-I and N-II type launch vehicles based upon introduced technology and, thereafter, H-I type launch vehicles in which domestically developed cryogenic second stage, inertial guidance system and solid upper-stage were introduced. Now, NASDA is developing new launch vehicles called H-II with Japanese technology. With respect to satellite development, NASDA also initially learned U.S. satellite technology and then developed its own satellite technology through development of Engineering Test Satellite (ETS) series satellites, earth observation satellites, and others. Through these activities, NASDA has developed Japan's unique and flexible space technology, and Japan is now ready to contribute to international space development activities and promote international collaboration.

* The views expressed herein are those the author and do not reflect any official position of NASDA.

The decade of the 1980s was the era of internationalization; it was the same in the field of exploration and use of outer space. One of the most perspective and exciting internationally agreed projects in the decade was the International Space Station Program "FREEDOM," which was proposed to the European countries, Canada and Japan. Japan has been participating in the Space Station Program providing the "Japanese Experiment Module" (JEM). From a legal point of view, "FREEDOM" is the most complex international space program. There are various legal issues, such as jurisdiction over the multinational station crew, patent law application, and others; some legal issues are yet to be resolved. "FREEDOM" is expected to serve as an appropriate example for future multinational space programs.

Another type of international space program, in which Japan offers participating possibilities internationally, was initiated with the Japanese remote sensing program called "Advanced Earth Observation Satellite" (ADEOS). We hope to contribute to the so-called Global Environment Change Monitoring program with our remote sensing projects.

In this context, I would like to point out that the International Space Year (1992) will give many space agencies in the world a chance to cooperate with each other more than before through activities, such as the Space Agency Forum taking place on the 17th and 18th of May this year.

The establishment of a world-wide network on Global Environment Monitoring will be another exciting international space cooperative program, where a functional split of the Outer Space Treaty takes place. I quote its Article I: "The exploration and use of outer space shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic and scientific development, and shall be the province of all mankind." This task will require additional legal work, embodying a good example of a future international space cooperative program. It will necessitate coordination of various countries' related projects.

Through these activities, multinational cooperation will play a more important role in outer space exploration and utilization. It will demand interesting legal tasks involving the formulation of an international framework, with due consideration of the characteristics of each country in order to achieve the most productive results.

Current international space law, the Outer Space Treaty, the Liability Convention and others have focused on conventional space activities, such as telecommunications, direct television broadcasting, or remote sensing, which all make use of a space object's position in relation to the Earth. Eventually, the human race will actually start using outer space itself by manufacturing something there and exploring the Moon and other celestial bodies. In these fields, new international space law will be needed. For example, the number of space debris has been increasing rapidly in one of the most important areas for human activities located in Earth orbit. We have to prevent the increase of space debris in order to

maintain human activities around the Earth. Both the Outer Space Treaty's Article XI and the Moon Treaty's Article 7 specify that States Parties should avoid harmful contamination of outer space, the Moon, and other celestial bodies. However, they lack specific procedures to deal with the problem. We, therefore, must develop a kind of international regime which creates a space debris monitoring system, a code of conduct of nations and providing for other important actions.

Furthermore, in the next century, exploration and use of other celestial bodies will take place. Programs will follow a human endeavor accomplished almost twenty years ago by the United States. "Human Lunar Landing" and Moon and Mars programs, which are discussed among various countries, will open a new era in which human beings will go beyond the planet Earth.

The next legal task which will be required is a formulation of an international legal regime which would govern human activities in the exploration of the Moon and other celestial bodies. The Moon Treaty, already developed in the United Nations COPUOS, defines terms and conditions by which the exploration and use of Moon and other celestial bodies are to be carried out. The Moon Treaty specifies that States Parties shall be guided by the principles of cooperation and mutual assistance with international cooperation being as wide as possible and taking place on a multinational or bilateral basis or through international intergovernmental organizations. The development of an international organization which implements the exploration of the Moon and other celestial bodies may be required. Its development will involve hard legal tasks, which will lead to a formulation of new international law to be applied in outer space.

Consequently, it can be said that NASDA will make efforts to contribute to a formulation of space law to be applied in the near future, by international cooperation through various programs.

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Case Law

Appalachian Insurance Co. v. McDonnell Douglas Corp. 262 Cal. Rptr. 716 (1989)

The question of who should bear the financial responsibility for failures of telecommunications technology is an issue of increasing importance in space law. Thus, when new technology and innovative telecommunications equipment malfunction during a launch or fail to operate, it is important to know who is to shoulder the burden of loss: the manufacturers, the insurers, or the buyers utilizing the equipment? The California Court of Appeals examined this question and related issues in a

recent case, in which a telecommunications satellite owned by Western Union Telegraph Company failed to reach its desired orbit. The instant case raised the question of enforceability of exculpatory contractual provisions which allocated loss. The California Court of Appeals took the position that "a contract is a contract" and, therefore, the exculpatory provisions would be enforced.[1] The ramifications of this decision will receive attention in the discussion that follows.

Appalachian Insurance Co. v. McDonnell Douglas Corp. involved the failure of Western Union Telegraph Company's Westar VI satellite to reach its desired geosynchronous orbit (22,000 miles above the earth) when launched on February 3, 1984.[2] The satellite was launched from the Space Shuttle using a McDonnell Douglas power assist module (PAM) to propel the satellite into its final orbit.[3] The PAM in question utilized components made by Morton Thiokol and Hitco. Unfortunately, the PAM burned out within seconds leaving the satellite in an orbit only 655 miles from earth, which was ineffective for telecommunications use.[4]

Subsequent to the rocket failure which rendered the satellite useless, Western Union took the failure as a "total loss" and recovered $105,000,000 from its five insurers causing the instant litigation. In January 1986, the five Western Union insurers [hereinafter referred to as Appalachian] sued McDonnell Douglas, Morton Thiokol and Hitco for strict liability and negligence.[5] The trial court granted summary judgment in favor of the defendants concluding that contractual exculpatory clauses between McDonnell Douglas and Western Union barred this litigative attempt at indemnification by the insurers. This appeal followed.

In reviewing the challenges raised by the plantiff on appeal, the appellate court systematically reviewed the issues and affirmed the lower court decision.[6]

The contractual provisions governing liability and loss allocation between Western Union and Morton Thiokol were set forth in two provisions, articles 7 and 14, respectively.[7] McDonnell Douglas made a complete warranty disclaimer in article 7 which provided, "[McDonnell Douglas] extends no warranty of any kind, express or implied" . . .[8] Similarly, article 14 set forth an "inter-party waiver of liability pursuant

1. Appalachian Insurance Company v. McDonnell Douglas Corp. 262 Cal. Rptr. 716 at 718 (1989).
2. *Id.*
3. *Id.* at 719.
4. *Id.* at 719.
5. *Id.* at 717.
6. *Id.* at 718.
7. *Id.* at 721.
8. *Id.* at 721.

to which each party agrees not to bring a claim against the other party."[9] Appalachian contended that the article 7 waiver of liability did not extend to subcontractors, here Morton Thiokol and Hitco, and that the provision was misconstrued. Finding Appalachian's arguments "unpersuasive," the Court of Appeals found the contract unambiguous and that the contract precluded Western Union from suing McDonnell Douglas, Morton Thiokol or Hitco.[10] This effectively bars the suit by Western Union's insurers.

Appalachian continued to pursue several other theories for their suit, but each was rejected by the appellate court. For example, Appalachian sought reformation of the McDonnell Douglas and Western Union agreement to achieve the "true agreement."[11] The court found no evidence of a contrary intent by the parties and concluded that Appalachian sought an agreement "that might have [been] made" between the parties. The court refused to indulge Appalachian in this.[12]

Taking another tact, Appalachian argued that both articles 7 and 14 of the McDonnell Douglas and Western Union contract were unconscionable and unenforceable. Appalachian promulgated the idea that McDonnell Douglas exercised unfair bargaining power in forcing this contract on Western Union. Appalachian evinced the idea that McDonnell Douglas possessed a monopoly on the sale of PAMs, leaving Western Union no alternative but to accept the contract. This was patently untrue as Western Union had other means, such as the Ariane rockets, to launch its satellite.[13] The court found unconscionability lacking. Similarly, the court ruled that with " . . . a highly specialized, risky new technology it was not commercially unreasonable for the parties to agree Western Union would obtain insurance to protect it against risk of loss . . . ."[14] Certainly, there is a likelihood that it would be much cheaper for Western Union to obtain its own insurance. Finally, as to enforceability the appellate court upheld the validity of the exculpatory provisions as part of a "private voluntary transaction" that allocated risk and did not harm the public interest.[15]

Finally, the Appalachian motion for a new trial was denied as the Western Union and McDonnell Douglas agreement was deemed to encompass all limitations and disclaimers that formed the "sole basis of the parties'

9. *Id.* at 722,
10. *Id.* at 720.
11. *Id.* at 725.
12. *Id.* at 727.
13. *Id.* at 730-31.
14. *Id.* at 731.
15. *Id.* at 734.

agreement."[16] In addition, the decision ruled that the commercial business setting precluded the appellate strict liability claim.[17]

The defendants cross appealed for attorneys fees and challenged the court's statute of limitations decision. All issues raised by the defendants were rejected.[18]

Thus, in conclusion, the contractual exculpatory provisions negotiated by Western Union and McDonnell Douglas were upheld by the appellate court. This decision precluded any litigation by the parties against one another on a strict products liability theory and left responsibility for the loss on the buyer. Here the buyer, Western Union, allocated the loss to its insurers. The insurers were effectively deprived of indemnification due to the outcome of this litigation. Thus, the potential exists for insurance costs to soar for this type of launching effort. Rising insurance costs may make this type of transaction cost prohibitive. The other potential consequence is that the public (which reaps the benefits of telecommunications developments) will have the costs passed on to it in the form of more expensive services. Time will reveal the long range impact of this decision on telecommunications business practices.

*J. Lee Haney**

Short Accounts

Report on the first Pan-American Space Conference, San Jose, Costa Rica, 13-16 March 1990

The Pan-American "Conference on Space: Perspectives for Cooperation," the first of its kind, was convened under the auspices of several international and national organizations, including the Ministry of Science and Technology of Costa Rica, and the United Nations Development Program (UNDP). The Space Expert of the United Nations Outer Space Affairs Division, *Dr. Adi Abiodun,* was also present. Over 300 people attended, including official government delegates, representatives from various space agencies, scientific organizations, educational institutions, and the private sector. The majority of the participants were Latin American professionals involved in some aspect or other of space activities.

In his opening remarks, Costa Rica's Minister of Science and Technology stated that "this isn't just another conference. It is a hemispheric forum, with 21 countries and 10 space agencies in attendance.

16. *Id.* at 735.

17. *Id.* at 735.

18. *Id.* at 741-42.

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Our purpose is to produce concrete results from this forum; the big issue is what we will do with these results."

The conference sessions (which were held simultaneously) were divided according to four main topics: basic space science, applied science or technology, education (via satellite), and legal/political aspects of space activities. There were also two plenary sessions - one at the opening and the other to close the conference. At the first plenary, delegates from the space agencies spoke on their programs, focusing mostly on remote-sensing or earth observation satellites. At the closing plenary, each of the Chairmen of the four sessions presented the results and suggestions of his group. These will be forwarded to all participants in the near future.

The session on legal/political issues was chaired by *Dr. Aldo Armando Cocca* of Argentina, with the assistance of *Dr. Eduardo Gaggero* of Uruguay. The majority of the presentations on legal issues dealt with the interpretation of the main treaties governing outer space activities, and their relation to remote sensing satellites, or earth observation systems. Ease and cost of access to both images and data obtained by earth observation satellites were discussed, as were the legal implications for small countries with limited budgets.

One of the main issues raised in the legal/political forum referred to earth observation activities, the transfer of this information (which large corporations can purchase) to the countries whose natural resources are being observed, and the legal protection of this information. In this respect, the Principles on Remote Sensing, adopted by the U.N. Committee on the Peaceful Uses of Outer Space (COPUOS) in 1986, were considered to be a good starting point, but they are not seen as sufficient. It was suggested that a treaty be drafted, incorporating these Principles and others, to safeguard the economic well-being of smaller and developing countries.

Until now, most remote-sensing technologies have centered on the economic aspects of these satellites, rather than on their benefit to all mankind, regardless of their state of economic development (as urged by the 1967 Outer Space Treaty). Several of the lawyers made some interesting proposals in this respect. *Dr. Raimundo Gonzalez* of Chile suggested a consultation with the International Court of Justice on the meaning of "international cooperation," and whether it includes the dissemination of remotely sensed data and information. Another suggestion was to establish an "International Center of Remote Sensing," which would give out the information on an equitable basis, and in accordance with the precepts of the Outer Space Treaty.

Many of the presentations in the Legal/Political sessions related to environmental issues, both terrestrial and in outer space. It was suggested that earth observation satellites be used to monitor ecological/environmental changes, to prevent and avoid man-made and natural disasters. Several speakers mentioned the need to prevent "eco-cide" by using the latest in space technologies as a means of monitoring

changes. There was much agreement on the need to cooperate in outer space activities in order to prevent further deterioration of our terrestrial environment. Interestingly enough, most of the suggestions for greater cooperation in space activities came from delegates of the USSR's Intercosmos Agency, as well as from the Latin American delegates.

At another level, much concern was expressed in regard to the harm being done to the outer space environment by the increasing number of debris in low earth orbit (LEO). Although some of the arguments made for containing or preventing the proliferation of space debris appeared to be somewhat theoretical, they became quite real when the newly launched INTELSAT VI failed to attain its proper orbit, and was left in LEO. The consensus seemed to be that the entities involved in launching objects to outer space should devote more time and energy to minimize the amount of 'junk" left in outer space, and its potential damage to future objects launched.

Perhaps because telecommunication satellites are so widely used nowadays - and taken for granted - only two presentations dealt with this type of satellite. One of them, presented by a Costa Rican lawyer, *Carlos Vargas*, focused on the content of television transmissions by satellite. His concern centered on the growing number of TV programs with violent or "pornographic" content, particularly "transborder" transmissions from the USA. He noted the similarity among the transmission of violence and pornography programs, space debris, and remote sensing activities. In all instances, the developing countries have little choice or say regarding these activities or their impact on their countries, because they have no control over the satellites or their uses. These issues - how to keep out undesirable television programs, and how to prevent the dissemination to third parties of data obtained by earth observations satellites - are sensitive points, with no easy solution.

The second presentation on telecommunication satellites, by *Sylvia Ospina* of COMSAT, dealt with space law and telecommunications in Latin America, with specific reference to the Andean Pact's Project CONDOR. This presentation analyzed international legal issues, including ratification of several of the space treaties, that need to be resolved by the five Andean Pact countries prior to launching any satellite. Also mentioned were issues relating to financing and utilization of the system.

At the closing Plenary session, it became obvious that mobile satellite systems elicited much interest in the non-legal sessions. Access to INMARSAT and other systems (including PANAMSAT), the use of VSATs and other small antenna, were also discussed at length during the conference.

The Pan-American space conference was extremely valuable, as it provided a forum for Latin American professionals engaged in space-related activities to meet, share their concerns, and formulate concrete proposals and projects for future cooperation among themselves. It is hoped

that there will be many such conferences, involving the countries in the Americas.

Sylvia Ospina
Senior Advisor, International Policy
COMSAT World Systems
Washington, D.C.

Leaving the Cradle: Human Exploration of Space in the 21st Century

"Leaving the Cradle: Human Exploration of Space in the 21st Century" was the theme of the American Astronautical Society's 28th Goddard Memorial Symposium in Washington, D.C., March 14-15, 1990.

Conference papers analyzed requirements for implementing U.S. policy to return to the Moon permanently and send a manned mission to Mars. During the session on the "Impact of Human Exploration Initiatives," *John Logsdon* spoke on "International Cooperation: A U. S. Perspective." *Eilene Galloway* gave a paper on "Space Law and Legal Aspects of Human Space Settlements," an analysis of existing space law that applies to the Moon and Mars with estimates for future legal requirements.

The Symposium papers will be published by the American Astronautical Society later this year.

Eilene Galloway
Honorary Director,
International Institute of Space Law (IAF)

Space Commerce '90, Montreux, Switzerland, March 26-29, 1990

This conference brought together industry, government, and academic leaders from space programs all over the world. Although concentrated on recent and prospective developments involving commercial use of space, the conference involved legal discussions, governmental policy bases applicable to commercial space in many countries, and scientific and technical aspects of relevant developments. The conference also offered a major exhibit in which governments and commercial enterprises were well represented.

Extended discussion in selected sessions dealt with financing of commercial space ventures and problems of liens on space artifacts as collateral for loans. Insurance and risk management involved another full session, and aspects of legal problems under various treaties and international organization arrangements were also discussed.

An important aspect of this biennial conference was the constructive exposure of many commercial operators to some of the real and pressing legal problems involved in the introduction of commercial space ventures. Among issues explored was the general impact of the emerging consolidation of Europe 1992 on the conduct of space activities by and

within the European Community. The start-up problems of financing, risk management, and the expanding international competitiveness of space activities were well illuminated. In this latter regard, two of the major exhibits, located in diagonally opposite corners of the exhibit hall, were the General Dynamics exhibit of the commercial Atlas launch vehicle, which is in direct competition with the Soviet displayed stable of launch services offered. In addition, Arianespace exhibited effectively the Ariane expendable launch vehicle. In one of the legal survey papers, a comprehensive list was presented of almost 50 topics of necessary concern of launch vehicle customers and operators, issues which any effective launch services contract should address. Proceedings of the conference are planned to be published by Gordon and Breach, Science Publishers, P.O. Box 197, London WC2E 9PX, United Kingdom.

At the Space Commerce '90 Conference held in Montreux, Switzerland in March 1990, several speakers focused on an apparent gap between the educational communities (colleges and universities) and the aerospace industry. Ways were being sought to strengthen bridges between the universities and the business community.

There is a relatively easy, low cost, and potentially highly effective way to close this apparent gap. The colleges and universities have an assembly of people in search of knowledge and experience and they have the facilities in which these people can be assembled easily and at a very modest cost. The industry, on the other hand, has the cadre of experts with knowledge and experience who can help bridge the gap.

In some California communities, experts in business visit colleges and universities to lead informal seminars, outside of the formal curriculum, to describe aspects of work in industry and needs for skills in industry to inform the emerging talent bank about work in the aerospace industry. These programs involve no exchange of funds. The schools provide interested audiences and meeting facilities and the companies provide qualified speakers and experienced experts who can discuss industrial needs and opportunities. The colleges and the companies absorb their own costs of this collaboration but both derive substantial benefits, probably well in excess of the costs incurred.

There is no doubt that in the United States, as well as in many countries around the world, business and academia need to find more and better ways to work together. Business experts can offer valuable, effective supplemental education to support the formal curricula as presented by the full-time academic faculty.

Stephen E. Doyle
Senior Program Manager,
Office of Strategic Planning
Aerojet Solid Propulsion, Sacramento, CA

What Should the U.N. Do About Space Debris?

During the Annual Meeting of the American Society of International Law, the Society's Space Law Interest Group held an open forum on March 29, 1990, to discuss what the United Nations should do about space debris. The meeting was moderated by *Prof. Stephen Gorove* of the University of Mississippi Law Center and invited discussants included *Stefan Noreén*, Counsellor at the Swedish Mission to the United Nations, *Peter G. Smith*, Director of NASA's International Relations Division and *Dr. Elena Kamenetskaya* of the Institute of State and Law of the Soviet Academy of Sciences who all spoke in their personal capacities.

In his lead-off presentation, *Mr. Noreén* stressed that the major spacefaring nations will have to assume a special responsibility in addressing the debris problem and that this problem cannot be solved by one or two nations alone. He noted that space debris is a global concern which requires the attention and active involvement of the international community. He felt that the appropriate international forum to discuss this serious and growing problem is the United Nations and more particularly its Committee on the Peaceful Uses of Outer Space (COPUOS).

Mr. Noreén recalled that at the 1989 session of COPUOS, Sweden together with Australia, Belgium, Canada, the Federal Republic of Germany, the Netherlands and Nigeria proposed that the issue of space debris be placed on the agenda of the Scientific and Technical Subcommittee. While the committee did not include space debris as an independent item on its agenda or those of its subcommittees, the committee agreed that space debris is an issue of concern to all nations and it called for the continuation of national research on this question. A U.N. General Assembly Resolution in December 1989 incorporated the committee's recommendation and added that more attention should be paid to all aspects related to the protection and the preservation of the outer space environment, especially those potentially affecting the earth's environment.

While *Mr. Noreén* did not propose that the United Nations should start working out regulations or elaborating legal principles regarding space debris, he did not believe that it was premature to bring the issue of outer space environment to the attention of the United Nations.

Mr. Smith pointed out that apart from the United States several other nations and organizations (ESA, Arianespace, INTELSAT, INMARSAT) have also contributed to the debris environment through their space activities. He noted that the Soviet Union has become the largest generator of new space debris and the most significant debris incident in recent years was the explosion of an Ariane upper stage in late 1986. He added that responsibility for space debris also extends to all nations and organizations that operate launchers and satellites, and includes "the customers" of activities conducted in space - such as telecommunications.

Mr. Smith disagreed with *Mr. Noreén* regarding the appropriateness of having the space debris issue included on the agenda of COPUOS and its Subcommittees at the present time. He pointed out that the cost factors which may involve hundreds of millions of dollars are significant. He felt that we need to know much more about space debris and more technical research needs to be done at the national level in defining the nature and extent of the debris problem. All in all, a much better data base is needed than what is currently available before the topic should be taken up in COPUOS. He added that, where appropriate, the U.S. has already solicited interest in cooperation with other countries in orbital debris research and coordination of debris minimization policies and practices.

Dr. Kamenetskaya noted that more and more attention is being paid to the debris problem in the Soviet Union as evidenced in some official publications and articles written by high officials. While these publications are mainly devoted to the description of present and future situations, she noted that few have concrete recommendations on what to do in connection with space debris. *Dr. Kamenetskaya* stressed that the problem is of a global character and cannot be solved by one country alone but only by international effort hopefully on the multilateral level, but perhaps more effectively on a bilateral and regional level. Such international agreements must be based on a profound knowledge of the technical aspects and possibilities in this field. Although she expressed hope that perhaps in a short period of time enough technical and legal investigation would be done to put space debris on the agenda of the Legal Subcommittee of COPUOS, she felt it would be too early to include this item on its agenda. She suggested that the U.N. should call upon member states to adopt some rational legal and technical measures directed at the minimization of space debris. In addition, other international bodies and organizations, as for instance the I.A.F., could make a contribution to the solution of the space debris problem.

In the ensuing discussion, *Prof. S. Gorove* suggested and *Mr. Noreén* agreed, that the U.N. should send out a questionnaire to all nations and international organizations participating in space activities in order to find out what is currently being done with respect to space debris and to get the U.N. involved. In disagreeing with earlier speakers *Prof. Ioannou* stressed that law must play a part now because ten years will probably pass before the Legal Subcommittee will develop standards. He argued that lawyers must push governments to have studies in the Scientific Subcommittee and then in the Legal Subcommittee. *Gen. Menter* agreed, noting that at the International Institute of Space Law's Colloquium in Brighton, England, there was a consensus that space debris should be a major item on the U.N. agenda. *Ms. Sterns* suggested that a good forum for discussion could be the Scientific-Legal Roundtable at the International Astronautical Federation's annual meeting. *Prof. Christol* contended that all recognize that space debris is a real international challenge, requiring international legal responses, which would point to U.N. involvement. *Lt.*

Col. Schwetje believed that a study by the U.N. is not going to reveal anything new, although agreement has to be reached on how to treat large satellites that can be identified: the same as debris or diffferently. *Mrs. Galloway* felt that there should be one place which compiles all information on space debris. She pointed out that to send out a questionnnaire would require a mandate from the General Assembly and that past requests had been made by the General Assembly for national research to be done by states, but that the requests had been vague.

Professor Katherine M. Gorove
University of Mississippi Law School

AIAA Technical Committee on Legal Aspects of Aeronautics and Astronautics Meeting, May 3, 1990

The AIAA Technical Committee on the Legal Aspects of Aeronautics and Astronautics met on May 3, 1990 in Crystal City, Virginia. The meeting was chaired by *Daniel Cassidy* of Marsh & McLennan Inc., Washington, D.C. Committee members heard a status report from the Subcommittee on Space Debris presented by *Paul Uhlir* of the National Research Council who stated that the Subcommittee is expected to accomplish three tasks: (l) prepare a survey of existing law relevant to space debris; (2) assess and propose standards and procedures for debris mitigation; and (3) provide recommendations on possible methods of implementation. As a follow-up, *Prof. S. Gorove* highlighted the difficulties encountered in the U.N. of having the item of space debris placed on the agenda of COPUOS and suggested possible approaches to move the matter off dead center.

The next speaker, *Elaine David* of the Department of Transportation (DOT), reviewed DOT regulations and orders for U.S. commercial space launches, including license applications procedures, pre-application consultations, financial responsibility and insurance requirements. *Mark Owensby* of the Department of Commerce spoke on the status of cases and trade policy issues of international sales and procurement of space transportation and satellite/space systems, pointing out that prevailing international rates created a most difficult problem.

Thomas N. Tate of the Aerospace Industries Association presented the Association's report on space exploration initiatives (SEIs), requested by the Vice President. Because of the price tag running into billions of dollars, there appeared no way that the SEI could be done alone. *Yvonne Lodico* of the U.N. Outer Space Affairs Division summarized the issues discussed and actions taken by the Legal Subcommittee of the U.N. Committee on the Peaceful Uses of Outer Space during its recent meeting in Geneva, stating that the Subcommitte had finalized Principle 3 (criteria for safe use) while working on the elaboration of draft principles relevant to the use of nuclear power sources in outer space.

William C. Anderson of Boeing addressed recent developments regarding government rights in data delivered under contract. He noted that while some progress has been made in the matter, a number of major issues remain unresolved. He highlighted a set of unified industry recommendations which were jointly developed by a committee of defense industry representatives in order to remedy the situation and improve Department of Defense regulations on technology and technical data.

Finally, *William D. English*, attorney at law, spoke on some key issues of commercial space applications, reviewing briefly recent U.S. national space policies and suggesting a reevaluation of the potential (financial, technical, institutional and legal) of a joint industry-government venture to establish (with substantial government support) a national expendable launch vehicle capability.

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

National Aerospace Plane: Congressional Developments

Currently, Congress is attempting to appropriate funds for one of the National Aeronautics and Space Administration's most advanced developments: the National Aerospace Plane (NASP). The development of the plane is a joint venture between NASA, the Air Force, and private contractors. The goal of the NASP Program is to explore a region of high-space flight never before attempted by mankind. The NASP will be a cross between an airplane and a rocket.[1] Using supersonic ramjet technology, it will be able to take off from an ordinary airport runway, accelerate to 25 times the speed of sound, and achieve low Earth orbit. It will have the flexibility to land at any airport in the world, on a normal runway, and be prepared for another flight in only a few hours. This would give private industry and the military the ability to launch satellites with minimal hours of preparation time and cut costs significantly.

Several foreign countries are mounting serious efforts designed to take the lead in hypersonics away from the United States. These countries include the United Kingdom, West Germany, Japan, France, and the Soviet Union. The country that pioneers application of this technology will have significant business advantages around the world.

Currently, NASA is urging Congress to appropriate sufficient funds to make the National Aerospace Plane a reality. On September 21, 1989, the House of Representatives passed a NASA multiyear authorization bill, H.R. 1759. The bill went to the Senate and was referred to committee. When the Senate subsequently acted on November 9, it chose to use its bill,

1. 135 Cong. Rec. S11807 (daily ed. Sept. 26, 1989).

S. 916, and retain the House-passed bill in committee.[2] On November 20, 1989, the House of Representatives agreed to send to the Senate the rest of the multiyear NASA authorization bill passed by the House, with the hope that the Senate will choose to act on the bill before the end of this session. This plan calls for the Defense Department to be responsible for not less than two-thirds of the funding for the program and NASA not responsible for more than one-third of the funding for the program.[3]

A recent development for the National Aerospace Plane came on January 23, 1990. On this date, five entities, representing four aerospace companies, announced a consortium to build the National Aerospace Plane. The corporations include Pratt & Whitney, the North American and Rocketdyne divisions of Rockwell International, McDonnell Douglas, and General Dynamics. These companies have contributed nearly half of the 1.5 billion dollars that has been spent on development of the plane.[4]

Other Events

Toulouse has become the center of a number of European space activities, as home to such well known space ventures as CNES (Centre National d'Etudes Spatiales), Spot-Image, Aérospatiale, Matra-Espace, and Alcatel-Espace. To meet the demands in this field, Toulouse University created an optional course on "Space Law" for Master of Law students. Also, Ph.D. students in Economic Law are required to attend special lectures on "Commercial Space Activities."

A European Conference on the Profitable Exploitation of Technology took place **March 27-28, 1990** in London. Discussions included issues of commercialization, technology transfer and intellectual property.

The United States Space Foundation held the Sixth National Space Symposium **April 9-11, 1990** in Colorado Springs. The program included a Congressional Forum, a NASA presentation, earth environmental monitoring and treaty verification issues.

The AIAA/NASA/DOD organized a conference, **April 16-19, 1990,** in Baltimore on Orbital Debris with emphasis on technical issues and future directions.

On **April 21, 1990** a Solar Power Satellite Symposium was held in McLean, Virginia.

New Technology Week and Defense Week sponsored a conference on technology policy in the 1990s, **May 1-2, 1990** in Washington, DC.

The National Space Society arranged a 1990 International Space Development Conference, **May 26-27, 1990** in Los Angeles. Topics for discussion included the colonization of Mars, lunar settlements, solar power satellites, new economics of space and a mock "Asteroid Miner Trial".

2. 135 Cong. Rec. S15410 (daily ed. Nov. 9, 1989).
3. 135 Cong. Rec. H9135 (daily ed. Nov. 20, 1989).
4. 136 Cong. Rec. E239 (daily ed. Feb. 7, 1990).

EUROTELECOM/MADRID '90 was held, **June 5-7, 1990,** in Madrid for entities involved in the creation of a common European Space for Telecommunications.

Brief News

The second satellite revolution is underway with direct TV broadcast and mobile telecommunications. Mobile Satellite Service makes use of small, portable receivers that pick up messages through L-band and Ku-band satellites . . . The first commercial launch on December 31, 1989, by Martin Marietta Company's Titan rocket placed a British and a Japanese communications satellite into orbit . . . The Pegasus launcher was dropped from its B-52 carrier and successfully rocketed into orbit two small satellites. *"Brilliant Pebbles,"* an advanced network of small orbiting satellites could be used to track, monitor, and destroy hostile warheads and a similar number of *"Brilliant Eyes"* (satellites) could be used for intelligence gathering, pollution detection and weather forecasting at a cost much lower than that under other current systems.

NASA contemplates 9 shuttle flights this year. Its plans for the Freedom space station are scaled back after Congressional budget cuts. Scientists are considering alternative platforms from the proposed NASA space station due to the decreased scientific ability of a budget restricted station . . . Reduced Congressional funding by $1.1 billion for SDI research programs is expected to affect NASA and independent contractors . . . NASA has added emergency landing sites for U.S. shuttles in Hawaii and has vowed not to send astronauts to a permanent space station until an emergency escape vehicle is developed . . . NASA and DOT disagree on what constitutes a commercial launch . . . NASA has completed its Moon-Mars Exploration Feasability study which includes five possible scenarios for the manned exploration of the Moon and Mars . . . Some scientists believe that the U.S. can put men on Mars within ten years at a cost of less than ten billion dollars if risk levels of previous Mercury, Gemini, and Apollo missions are accepted . . . President Bush wants Americans land on Mars by 2019.

The space shuttle **Columbia** saved the huge Long Duration Exposure Facility satellite which had been in a decaying Earth orbit. Columbia completed its 10 day 21 hour orbital flight on January 20, 1990, marking the longest flight in shuttle history . . . The **Hubble** space telescope, launched on April 24, 1990 is the most sensitive optical telescope ever utilized outside the Earth's atmosphere. It will pierce into the far reaches of the universe which are 14 billion light years away. . . Early data returns from COBE (Cosmic Background Explorer) do not support Big Bang theories . . . Congress's Office of Technology Assessment (**OTA**) reports loss of another shuttle will severely disrupt space station development and recommends developments of another shuttle, Shuttle C., the National Aerospace Plane and space station escape vehicles.

AT&T requests FCC approval of use of Intersputnik satellites to expand services between the **US and USSR** . . . Payload Systems was the first U.S. company to fly experiments (protein crystals exposed to weightlessness) on the Soviet space station MIR . . . The U.S. and the Soviet Union are considering for 1992 an astronaut exchange in which an American astronaut would fly aboard the Soviet Mir space station and a Soviet cosmonaut would travel aboard a U.S. space shuttle . . . NASA's Office of Exploration is analyzing the possibility of a multinational exploration project of Mars involving the Soviet Union and other European countries . . . The National Research Council, an arm of the National Academy of Sciences, considers a joint U.S.-Soviet Mars flight a distant goal in view of differing space procedures, language barriers and other problems.

The **Soviets** ended 1989 with the lowest total of launches (63) since 1974 and attributed the decline to longer life satellites and reduced redundancy. They plan a commercial radarsat to distribute radar images commercially. They enlarged their MIR space station with a 20-ton "Kristall" module which has a docking port for the Buran shuttle. The Buran is not scheduled for liftoff until early in 1991, and that flight is expected to be unmanned. Soviet scientists speak out against the Soviet shuttle program as an expensive boondoggle.

The Soviets launched their first orbital astronomical observatory "Granat" on December 1, 1989. They were the first to test and ride a "motorcycle" (resembling a floating armchair) in free space . . . A Soviet journalist is to visit the MIR space station in 1990 to become the first broadcast journalist in space . . . Soviet plans call for a manned Mars expedition as early as 2014 . . . The abandoned Soviet Space Station Salyut-7 will be the largest artificial object to reenter our atmosphere since Skylab, when it falls to Earth in early 1991, or possibly toward the end of this year unless action to prevent its crash is taken.

President Bush approved export licenses for three satellites launched by **China**'s Long March launch vehicle despite strained U.S.-Chinese relations. This action appears to preserve the space technology agreements covering technology transfers between the two nations . . . The final two candidates to become **Britain**'s first astronauts in space have been selected . . . The U.K. agrees to funding increase of European Space Program in exchange for an independent review of its costs and management . . . **Europeans** ponder building treaty verification satellites . . . European Satellite Communications Commission continues to develop a satellite services framework for European unification in 1992 . . . Research efforts on the development of a hypersonic spacecraft (X-30 in the U.S., Hotol in England, Saenger in Germany) capable of flying into space and using conventional runways for takeoffs and landings continue . . . **ESA** approved the building of an astronaut training center in Cologne, Germany. ESA's future payloads for Ariane include a remote sensing satellite (ERS-1) to be launched in October 1990 and an Infrared Space Observatory (ISO),

planned to be launched in 1993 to give a "thermal view" of the Universe. ESA accepts NASA's offer to orbit Columbus in 1997. ESA's free-flying space station laboratory may be replaced every five years in lieu of being thoroughly reserviced in space . . . An unmanned French Ariane rocket carrying two Japanese satellites blew up on February 22, 1990, shortly after lift-off from Kourou, French Guiana . . . "Telecommunications and Industrial development" was the theme for **ITU**'s World Telecommunications Day on May 17, 1990. ITU is to assist in organizing AFRICA TELECOM 90 in Harare, Zimbabwe, in December 1990. **INTELSAT's** communications satellite was boosted into a higher, safer orbit following an unsuccessful launch by a Titan rocket into a low, useless orbit on March 14, 1990.

Japan became the third nation to launch a spacecraft to the Moon and is currently developing an orbital space plane of its own . . . Japan has agreed to end its ban on government purchases of foreign-made satellites ... **Israel** launched its second satellite, and **Iraq**'s successful launch of a three-stage rocket in December 1989 made it the ninth nation capable of placing satellites in orbit The tenth and eleventh could well be **South Africa** and **Brazil.** Acquisition of two satellites is being considered by **Taiwan** . . . It is estimated that at least 17 developing nations are working on rocket and missile technology which may lead to space launch capability.

B. FORTHCOMING EVENTS

The American Institute of Aeronautics and Astronautics and the U.S. Department of Commerce are organizing a two day conference on "The Aerospace Challenge: How to Grow in a Changing World Market," to be held, **July 10-11, 1990,** in Washington, DC.

The 64th International Law Association Conference will be held in Brisbane, Australia, **August 19-29, 1990.** Its theme will be "New Challenges and New Prospects for International Law." The Association's Space Law Committee is expected to discuss issues of the peaceful settlement of disputes and environmental issues arising from space activities.

The 33rd International Colloquium on the Law of Outer Space will take place in Dresden, German Democratic Republic, during the week of **October 6-13, 1990.** Topics for discussion include: (1) the legal implications of space commercialization; (2) space activities and the legal aspects of protection of the global environment; (3) recent developments in space law; and (4) other legal subjects. Subjects proposed for the **1991** Montreal Colloquium are: (1) legal aspects of settlements on the Moon; (2) definitional issues in space law (only invited papers followed by audience discussion); (3) legal implications of nuclear power for satellites; (4) other legal subjects.

The Third TECHNOSPACE Conference is to meet, **November 6-10, 1990,** in Brussels. An International Symposium on Artificial Intelligence, Robotics and Automation in Space (I-SAIRAS) is scheduled for **November 18-20, 1990** in Kobe, Japan under the sponsorship of AIAA, NASA and the Japanese SAIRAS.

The Second Annual Symposium of the University of Arizona/NASA Space Engineering Research Center on the natural resources of the inner solar system will be held in Tucson on **January 7-10, 1991.**

JAPAN AEROSPACE '91 will be held at the Nippon Convention Center located near Tokyo, **February 14-18, 1991** and will feature the latest developments in new technologies through co-production, joint ventures and other forms of cooperation between international aerospace manufacturers and the emerging 6 billion dollar Japanese aerospace industry.

BOOK REVIEWS/NOTICES

Reviews

Environmental Aspects of Activities in Outer Space: State of the Law and Measures of Protection. Proceedings of an International Colloquium, Cologne, May 16-19, 1988 (K.-H. Böckstiegel ed. Carl Heymanns Verlag, Köln, 1990), pp. 318

This work contains papers, by both space scientists and space lawyers, presented at the International Colloquium organized by the Institute of Air and Space Law of Cologne University from May 17-19, 1988. The first of three chapters entitled "Establishing the Actual Risk" had papers focusing on space debris and pollution. The Space Debris section of the first chapter contained articles, authored by *Dr. L. Perek, Dr. W. Flury, Lt. Col. F. K. Schwetje, and Dr. V. Kopal,* demonstrating various theses including the decay and fall of debris and the collision risk in the geostationary orbit (estimating that the probability of at least one collision by the year 2000 was approximately 1 in 1000). Also presented was an overview of the present legal basis for protecting outer space and the recent developments in the United Nations pertaining to space debris, including the fact that the U.N. COPUOS had been considering the problems relating to the use of nuclear power sources in outer space, with a Working Group analyzing certain problems in greater detail and the Legal Subcommittee attempting to elaborate draft principles relevant to the use of nuclear power sources in outer space. Only one of the papers contended that presently space debris is not yet a serious problem, although its author stressed that action should be taken now to prevent further debris, fearing that waiting will render clean-up difficult.

The second half of the first chapter contained papers scientifically analyzing pollution in and from space, with *R. S. Eaton* focusing on "The Use of Nuclear Power Sources in Outer Space," *Dr. G. H. Schwehm* writing on "Planetary Protection," and *Dr. S. Van den Bergh* addressing "The Effects of Space Debris and Satellite Interference on Astronomy."

The second chapter focused on the "The Present Status of the Law," with the first section dealing with outer space treaty law pertaining to space debris and the second section addressing the role of customary law and general principles of law in creating space law for debris. Setting a theme for the papers on treaties, *Dr. Ph. Diederiks-Verschoor* outlined four primary questions for lawyers to discuss: "are the treaties as they stand at present adequate to cover all subjects? is it possible to adapt them to today's hazards as they develop? if there are gaps, how to make new rules? is this a matter that ought to be handled by the Legal Subcommittee of the United Nations?" The authors, *Mrs. E. Galloway, Dr. E. G. Zhukova-Vasilevskaya, Prof. S. Gorove, Dr. E. Konstantino, and Dr. A. A. Cocca,*

analyzed one or more of the environmental space law provisions in the Outer Space Treaty, Moon Agreement, the Rescue and Return Agreeement, the Liability and Registration Conventions, the Nuclear Test Ban Treaty, and the ENMOD Convention. They referred to compulsory resolutions, *i.e.*, those of the European Commmunity, and noncompulsory recommendations, such as the the 1972 U.N. Stockholm Declaration and the 1982 Nairobi Declaration. One author mentioned that the World Commission on Environment and Development considers space as a key to planetary management and another author suggested a protocol supplementary to the Outer Space Treaty, outlining the provisions to be included.

The second section of the Chapter contained papers by *Judge M. Lachs, Judge R. Jennings, Dr. M. Williams, Dr. J. A. Frowein, Dr. G. Danilenko,* and *Dr. D. Rauschning,* addressing the contribution of customary international law and general principles of law to the treatment of space debris. One author advocated a systematic review and restatement of existing environmental customary law applicable to space activities, perhaps initially on a nongovernmental level, such as by the ILA; another contended that customary international law cannot be expected to help protect space from pollution by debris, while others disagreed, contending that the obligations to prevent, inform and consult were well-established in international law, but conceded that enforcement of such obligations was problematic. *Judge Jennings* posed several interesting questions, including whether general principles of law were of use in space law and whether there were any municipal law analogies useful for substantive space law.

The third chapter, "Suggestions for the Future," was divided between papers from the point of view of natural sciences and technology and those discussing Legal Measures and Instruments. In the former section, *Dr. Ing D. Rex, Dr. J. H. Carver, Dr. L. Perek,* and *Dr. N. Jasentuliyana* presented papers. In the latter section, articles were submitted by Session Chairman *Dr. N. M. Matte, Dr. He Qizhi, Dr. G. Jaenicke, Prof. C. Q. Christol, Dr. G. Gal,* and *Dr. J. Reifarth.* Suggestions submitted in the various articles included, *inter alia,*: (1) defining terminology in current agreements, (2) banning intentional destruction and fragmentation of space objects, (3) adopting by agreement practical measures to minimize the production of debris, (4) forming an international expert group to review, assess and set standards of environmental effects of space activities, (5) determining norms for liability, that cover damage to common resources of mankind not under the jurisdiction of any state, (6) setting up a mandatory consultation regime to be used by states before engaging in potentially dangerous activities, (7) strengthening international cooperation, (8) drafting a convention for the establishment of rules for the operational conduct of space activities that include some or all of the foregoing items, (9) creating a universal space organization with broad powers, or a specialized space organization dedicated to the problem of debris, (10) treating the problem of debris

differently from environmental harms, because the former is much more of a "traffic problem of space activity" which requires regulatory rules, such as collision avoidance through traffic separation, removal of inactive satellite, monitoring movements of satellites, etc., and (11) the drafting of an international agreement on space debris by the space nations alone.

The legal treatment of space debris is critically dependent on scientific knowledge. Consequently, this compilation of articles from both a scientific and a legal perspective provides international lawyers with an excellent overview of the problems presented by space debris. It points up the lacunae in current international law and in science for offering solutions to the problem and proposes a number of interesting remedies. One of the most attractive features of the compilation is that the articles are generally short and precise, allowing a number of views to be presented. This work provides an excellent source for lawyers, scientists and policy makers who desire a broadbrush overview of the problems created by space debris and their possible solutions.

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The Proceedings of the Latin American Conference on International Air Transport and Activities in Outer Space, published by the International Institute of Air and Space Law, Leiden University, The Netherlands, 1989, pp. 557.

This publication records the proceedings of a unique conference dealing with air law, air policy, space law, and space policy, which was organized by the Universidad Nacional Autonoma de Mexico and the International Institute of Air and Space Law at Leiden University, in Mexico City on 14-18 August 1988. In this conference, many subjects in the field of international air transport and outer space activities were discussed from legal, political, economic, and financial viewpoints; special attention was paid to the *"lex ferenda"* and the need for both international and regional cooperation in these fields.

The publication is divided into two sections, which are the air transport section (pp. 31-354) and the space law section (pp. 355-553). This review will focus upon the latter section in consideration of the scope of this journal; the former will be reviewed briefly.

The air transport section consists of five subjects, such as the Latin American air transport market, financial aspects, the need for a reform of the Warsaw System, criminal law, security aspects, and the Western views on the regulation of international air transport. In regard to the first subject, three articles are presented respectively by *Prof. Francoz Rigalt, Dr. Elcizalde Petitt*, and *Dr. Vasquez Rocha*. These articles include analysis of the threat of take over of Latin American airlines by the major

international airlines, and the need for regional cooperation in Latin America.

The second subject concerns financial aspects and is presented by *Prof. Haanappel* and *Brig. Pinto de Fonseca.* The former deals with tariff-setting and airline revenues taking account of currency fluctuations and ticket taxes; the latter deals with aircraft financing techniques including "lease financings" and many examples are given.

On the third subject, two contributions are presented. *Prof. Cheng* deals with the need for a reform of the Warsaw System in an interesting way. He suggests an unlimited and absolute liability system instead of the one presently used. In the other contribution, *Dr. Medina Urbizu* discusses airline insurance aspects.

The fourth subject consists of criminal law and security aspects. *Dr. Bauza Araujo* examines three legal instruments, such as the Conventions of Tokyo, The Hague and Montreal, and *Prof. Videla Escalada* examines the new Article 3 bis of the Chicago Convention. *Dr. van Dam* analyzes the suppression of unlawful violence at international airports, discussing a proposed Protocol to the Montreal Convention. *Dr. Milde* finally focuses on the role of ICAO in the suppression of drug abuse and illicit trafficking, pointing to the U.N. Draft Convention.

The last subject concerns the Western views on the regulation of international air transport. *Judge Guillaume* illustrates the liberalization of European air transport by the application of the Rome Treaty; *Prof. Levine,* in his turn, observes that the deregulation has worked rather well in the United States. *Professor Wassenbergh* suggests a future framework for the global regulation of international air transport. To sum up, these Western views are very optimistic in comparison with those of Latin America.

The space law section is composed of three subjects: general space law, remote sensing, and international telecommunications. In the general space law section, three contributions are presented. *Dr. Cocca* explains the role of Latin American countries not only in the doctrine but also in the codification of space law, indicating some examples of the "res communis Humanitatis." *Dr. van Fenema* puts forward his views regarding the space law of the future. He states that countries which allow private commercial space enterprises must create national legislation in order to take care of their obligations under present space law; one example is the U.S. "Commercial Space Launch Act" of 1984, where pressure by these private enterprises tends to discourage the U.S. government in adhering to multilateral treaties dealing with private commercial space activities within the United Nations. He concludes that the international regulation of space activities of private enterprise will form the subject of separate arrangements between the countries holding the relevant industries and these space industries organized in multinational associations will increasingly influence the contents of the space law of the future. *Dr. Kopal* outlines the progressive development of space law in the United

Nations. *Dr. Kopal* divides the work of the UNCOPUOS into three periods: 1963 to 1979, the 1980s, and the future. He observes that the 1967 Outer Space Treaty and other instruments of the first period and the principles adopted or drafted during the second period will bear visible traces of the ideas and initiatives developed by the Latin American countries. He also states that these endeavors and activities will deserve full recognition from the whole international community of space lawyers.

In the remote sensing section, *Prof. Gorove* makes interesting comments on the U.N.-approved Principles on Remote Sensing with due regard to their scope of applicability and contextual setting; he also distinguishes certain established principles from ones newly introduced and indicates some of the unresolved issues. In his conclusion, he states that a delicate balancing of the interests of both advanced and developing nations has been undertaken in order to enable them to take advantage of the great benefits of remote sensing technology. He expresses the hope that this balancing, coupled with mankind's interest in environmental protection, will serve to reduce possible future friction arising from provisions susceptible to divergent interpretations. *Prof. Gaggero* explains Latin America's contribution to the elaboration of these Principles. He sets forth the proposition that the adopted Principles constitute an adequate framework for the aspirations of Latin American states as well as of other developing nations, which must find in them support for unavoidable cooperation, sharing their abilities in space activities.

The last subject consists of international telecommunications. *Prof. Ferrer* explains Latin America's views on the legal status of the geostationary satellite orbit, dealing with the "Bogota Declaration" of 1976. He also points out the fear of developing countries that this orbit will be overcrowded before they are able to explore it. *Prof. Christol* gives an interesting overview of the work of WARC-ORB '88, indicating the "dual planning procedure," *i.e.*, an allotment plan and improved procedures. In his conclusion, he states that it will be necessary for the competitors to look for their long term interests in achieving basic accommodations, if these new regulations are to be meaningful. He believes that this will be no small accomplishment since there are security, political, social, economic, and legal problems to be resolved within the technical framework imposed by the physical nature of the orbit/spectrum resource.

Finally, this publication includes a variety of updated subjects concerning international air transport and activities in outer space; Western views and those of Latin American countries on these matters are provided. It would be very useful for world-wide cooperation to identify the differences between these views.

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Law and Policy in the Space Stations' Era, by Dr. Andrew J. Young (Nijhoff, 1989), pp. 323.

Dr. Young, Solicitor of the Supreme Court of Judicature in Northern Ireland, wrote this book as a thesis for McGill University in Montreal, Canada. The study is the second of a series sponsored by the Utrecht Studies in Air and Space Law.

The author begins with a discussion of the motivating factors underlying the emergence of the Space Stations' Era and traces the programs and policies of the Soviet Union, the United States, Japan, and Canada, and several international organizations. The possible functions of a space station are listed. Space stations are viewed as a dividing point between passive and active space involvement. In addition, *Young* deals with constitutional issues, past international space ventures, the management of the U.S./International Space Station, and proposes solutions to some existing problems. Noteworthy are his matrices which illustrate his ideas on the utilization and management of the U.S./International Space Station. *Dr. Young* evaluates military issues and analyzes the legal and political implications of nuclear technology in outer space, in particular the future making of space legislation and what such legislation will involve. There is also an assessment of past U.S. and Soviet space programs and a more detailed examination of space object registration. Young concludes on a high note with a hope of a new cooperation in the utilization of outer space for the benefit of all nations.

The book has a selected bibliography and appendices but unfortunately contains no index.

Outer Space Problems of Law and Policy, by Glenn H. Reynolds and Robert P. Merges (Westview Press, 1989), pp. 349.

This book begins with a look at space history and space environment. The authors describe briefly several space environmental characteristics such as microgravity, meteoroids, and rocket propulsion and the procedure of getting into space, staying there, and using it. The text includes an analysis of the basic principles of the international law of outer space and the major space treaties which are accompanied by various notes by prominent authors in the field of space law.

The book touches upon space communication, U.S. commercial space policy, and direct broadcasting satellites, the economics of space industry and export controls. The study also includes a chapter on private commercial activity in outer space focusing on aspects of tort law, liability, contracts, intellectual property, remote sensing regulations, and a sample launch agreement. Finally, some future issues of the governance of space societies and contacts with extraterrestrials are discussed.

The format of the book is such that the authors touch upon a topic and then include excerpts from various notes and articles written by

eminent scholars in the field. The text provides a useful overview of the treaties, laws, and policies which influence and govern human activities in relation to the use of outer space.

Space Enterprise Beyond NASA, by David P. Gump (Praeger, 1990) pp. 221.

The author aptly discusses the future role of private industry in the commercialization of space. He asserts that private industry will assume the primary responsibility for future commercial development of space with limited intervention from governmental entities. This assertion is based on the presumption that NASA's dominance in space development has waned since the Challenger tragedy because of the agency's extreme caution in venturing into new areas. Consequently, private industry has assumed the responsibility for future space commercialization by seeking to foster an atmosphere of competition and free enterprise.

The first part of the book is an analytical study of the factors that will influence the creation and development of a commercial space industry as countenanced by private industry. The author sets out a hierarchy in which competing private companies will start private initiatives, thereby creating a dynamic conduit through which space commercialization will flourish. Consequently, governmental entities such as NASA will never be able to regain dominance of the field and, thus, growth will not be stagnated again.

In one chapter, *Gump* represents a bird's eye view of the rockets and spaceplanes of the 1990s and, in another that he calls "The $5000 Ticket to Space," he articulates the role private industry will play in the future development of space communications. The author gives a brief discussion of previous attempts by private companies such as AT&T to deploy communications satellites and outlines their future growth.

Perhaps the most interesting chapter deals with space stations. *Gump* predicts that many of these space stations will be owned and operated by private industrial interests. He believes that these privately owned space stations will resemble huge industrial parks because of the variety of commercial activities including research and development, as well as manufacturing that will take place within them.

At the end of the book, the reader may find a brief list of useful addresses for contacts and further information.

Priorities in Geolunar Space, by Gordon N. Patterson (University of Toronto Institute for Aerospace Studies, 1989) pp. 121.

This brief study is a discussion of improvement of humanity's quality of life through the utilization of geolunar space.

The book is composed of five sections, categorized in order of priorities. The author's Priority I calls for the recognition of humanity's need for access to the reaches of geolunar space. Here, Patterson

emphasizes the historical growth of physical, social, economic, and political problems which are in need of contemporary solutions. It is suggested that the resources of geolunar space will provide the answer in the long run.

Priorities II and III, respectively, consist of a comprehensive transportation system in geolunar space and the establishment of an infrastructure of functional facilities in geolunar space, designed as closed ecological systems for permanent occupancy. Essentially, these priorities deal with the technical requirements of gaining access to the geolunar environment with the aspiration of permanent inhabitation.

Logically, the next priority holds as an ideal the establishment and maintenance of stable social organizations in geolunar space. Given the confined nature incidental to the geolunar environment, special attention must be given to the creation of a socio-cultural system in space. The paradigm here is stability through symbiosis of diversity with respect to socio-culture, government, and economy.

Mankind's essential obligation in preparation for the permanent occupation of geolunar space is the fifth and final priority. Patterson suggests humanity's obligation to use space in a manner beneficial to the whole of humanity since the geolunar environment is part of a heritage common to all. To do this, global cooperation is needed for the establishment of a management authority for conducting operations on the Moon. Such authority should make decisions by consensus and should promote in a responsible and equitable manner the principle of common heritage by: ensuring efficiency and investor confidence, assuring the global community of some appropriate participation, controlling the exploitation of the Moon's natural resources, prohibiting contaminants and pollution on the Moon, and adopting rules for operational safety.

It is this type of "forward thinking" legal policy that - in the author's view - will provide worldwide harmony necessary to access geolunar space in an effort to achieve the objective of improving the quality of life.

While this book lacks annotation, its appendix gives a list of authors "whose outstanding writings" provided the background for the study.

Notices

The United Nations' Efforts to Outlaw the Arms Race in Outer Space, by P.K. Menon (Edwin Mellen Press, 1988), pp. 209.

In this work, the author reviews the legality of military uses of outer space, and notes that the current myriad of possible military uses of outer space has made the United Nations' efforts to promote arms control and disarmament increasingly more difficult. *Menon* also notes that many

of the space treaties have ambiguous provisions that could be permissively interpreted to sanction almost any reasonable military use.

The book's appendix includes the Outer Space Treaty of 1967, the Moon Agreement of 1979, and the Salt I and Salt II Treaties, respectively.

Space Station Directory and Program Guide - 1989 Edition, edited by Melinda Gipson, Jane Glass, and Mary Linden (Pusha Publications, 1988), pp. 368.

The editors have compiled a vast amount of information into a single, concise compendium. *Melinda Gipson* and *Andrew Luwler*, a contributing author, begin the book with a detailed analysis of the political, economic, and budgetary battles which NASA has fought in its efforts to build the Space Station "Freedom."

The book is replete with organizational charts for the various NASA programs, as well as for the many private constructors involved in building Freedom. The editors have undertaken an exhaustive review of the international partners -- both private and governmental organizations -- working with the United States in the monumental effort.

Researchers will find the section on "Proposed and Planned Payloads" useful. Included are not only a description of the purpose of the mission but the scheduled date and other information. The Directory concludes with several detailed appendices and a geographical index of organizations contributing to the Freedom Project.

1989 International Satellite Directory (Design Publishers, 4th ed., 1989), pp. xviii, 970.

This annually published reference book is organized into nine categories and gives useful information on international organizations, satellite operators, manufacturers of space and ground equipment, providers of satellite services, and geosynchronous satellites. The directory contains a list of standard industrial classifications applicable to the satellite industry, a list of system standards, and electromagnetic spectrum information. Also included is a satellite communications calendar of events for 1989.

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Legal Aspects of Protection of the Outer Space Environment

Legal Status of the Geostationary Orbit in the Light of the Recent Activities of International Telecommunications Union (ITU)

Other Issues of Space Law

Addendum

100TH CONGRESS
2D SESSION

H. R. 1510

IN THE SENATE OF THE UNITED STATES

OCTOBER 5 (legislative day, SEPTEMBER 26), 1988
Received

OCTOBER 6, 1988
Read twice and referred to the Committee on the Judiciary

AN ACT

To amend title 35, United States Code, and the National Aeronautics and Space Act of 1958, with respect to the use of inventions in outer space.

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

SECTION 1. SHORT TITLE.

This Act may be cited as the "Patents in Space Act".

SEC. 2. SPACE INVENTIONS.

(a) AMENDMENTS TO TITLE 35, UNITED STATES CODE.—(1) Chapter 10 of title 35, United States Code, is amended by adding at the end the following:

"§ 105. Inventions in outer space

"Any invention made, used or sold in outer space on an aeronautical and space vehicle (as defined in section 103(2) of the National Aeronautics and Space Act of 1958 (42 U.S.C. 2452(2)) under the jurisdiction or control of the United States

6 shall be considered to be made, used or sold within the
7 United States for purposes of this title, except with respect to
8 any space vehicle or component thereof that is specifically
9 identified and otherwise provided for by an international
10 agreement to which the United States is a party.".

11 (2) The table of sections of chapter 10 of title 35, United
12 States Code, is amended by adding at the end the following:
"105. Inventions in outer space.".

13 (b) AMENDMENT TO NATIONAL AERONAUTICS AND
14 SPACE ACT.—Section 305 of the National Aeronautics and
15 Space Act of 1958 (42 U.S.C. 2457) is amended by adding at
16 the end the following new subsection:

17 "(m) Any invention made, used or sold in outer space on
18 an aeronautical and space vehicle (as defined in section
19 103(2)) under the jurisdiction or control of the United States
20 shall be considered to be made, used or sold within the
21 United States for purposes of this Act, except with respect to
22 any space vehicle or component thereof that is specifically
23 identified and otherwise provided for by an international
24 agreement to which the United States is a party.".

1 SEC. 3. EFFECTIVE DATE.

2 (a) IN GENERAL.—Subject to subsections (b), (c) and (d)
3 of this section, the amendments made by section 1 shall apply
4 to all United States patents granted before, on, or after the
5 date of the enactment of this Act, and to all applications for
6 United States patents pending on or filed on or after such
7 date of enactment.

8 (b) AMENDMENTS NOT TO AFFECT PRIOR DECI-
9 SIONS.—The amendments made by section 1 shall not affect

10 any final decision made by a court or the Patent and Trade-
11 mark Office before the date of the enactment of this Act with
12 respect to a patent or an application for a patent, if no appeal
13 from such decision is pending and the time for filing an
14 appeal has expired.

15 (c) AMENDMENTS NOT TO AFFECT CERTAIN PENDING
16 CASES.—The amendments made by section 1 shall not affect
17 the right of any party in any case pending in a court on the
18 date of the enactment of this Act to have the party's rights
19 determined on the basis of the substantive law in effect before
20 such date of enactment.

21 (d) AMENDMENTS TO BE PROSPECTIVE IN APPLICA-
22 TION.—Subject to subsections (b) and (c) of this section, the
23 amendments made by section 1 shall not apply to any proc-
24 ess, machine, article of manufacture, or composition of

1 matter, an embodiment of which was launched prior to the
2 effective date of this Act.

Passed the House of Representatives October 5, 1988.

Attest: DONNALD K. ANDERSON,
Clerk.

II.

101ST CONGRESS
1ST SESSION

H. R. 2946

To amend title 35, United States Code, with respect to the use of inventions in outer space.

IN THE HOUSE OF REPRESENTATIVES

JULY 20, 1989

Mr. KASTENMEIER (for himself, Mr. ROE, and Mr. MOORHEAD) introduced the following bill; which was referred jointly to the Committees on the Judiciary and Science, Space, and Technology

---

A BILL

To amend title 35, United States Code, with respect to the use of inventions in outer space.

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

SECTION 1. SHORT TITLE.

This Act may be cited as the "Patents in Space Act".

SEC. 2. SPACE INVENTIONS.

(a) AMENDMENTS TO TITLE 35, UNITED STATES CODE.—Chapter 10 of title 35, United States Code, is amended by adding at the end the following:

"§ 105. Inventions in outer space

"(a) Any invention made, used, or sold in outer space on a space object or component thereof under the jurisdiction

4 or control of the United States shall be considered to be
5 made, used, or sold within the United States for the purposes
6 of this title, except with respect to any space object or com-
7 ponent thereof that is specifically identified and otherwise
8 provided for by an international agreement to which the
9 United States is a party, or with respect to any space object
10 or component thereof that is carried on the registry of a for-
11 eign state in accordance with the Convention on Registration
12 of Objects Launched into Outer Space.

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

21 (b) CONFORMING AMENDMENT.—The table of sections
22 at the beginning of chapter 10 of title 35, United States
23 Code, is amended by adding at the end the following:

1 SEC. 3. EFFECTIVE DATE.

2 (a) IN GENERAL.—Subject to subsections (b), (c), and
3 (d) of this section, the amendments made by section 2 shall
4 apply to all United States patents granted before, on, or after
5 the date of the enactment of this Act, and to all applications
6 for United States patents pending on, or filed on, or after
7 such date of enactment.

8 (b) AMENDMENTS NOT TO AFFECT PRIOR DECI-
9 SIONS.—The amendments made by section 2 shall not affect
10 any final decision made by a court or the Patent and Trade-
11 mark Office before the date of the enactment of this Act with
12 respect to a patent or an application for a patent, if no appeal
13 from such decision is pending and the time for filing an
14 appeal has expired.

15 (c) AMENDMENTS NOT TO AFFECT CERTAIN PENDING
16 CASES.—The amendments made by section 2 shall not affect
17 the right of any party in any case pending in a court on the
18 date of the enactment of this Act to have the party's rights
19 determined on the basis of the substantive law in effect before
20 such date of enactment.

21 (d) AMENDMENTS TO BE PROSPECTIVE IN APPLICA-
22 TION.—The amendments made by section 2 shall not apply
23 to any process, machine, article of manufacture, or composi-
24 tion of matter, an embodiment of which was launched before
25 the date of the enactment of this Act.

III.

INTERNATIONAL INSTITUTE OF SPACE LAW
of the
INTERNATIONAL ASTRONAUTICAL FEDERATION

Standing Committee on The Status of International Agreements Relating to Activities in Outer Space

Second Annual Report - October 1989

Background

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

Institute members who can contribute substantively to the work of the Committee are invited to serve on the committee. Membership is open to any interested IISL member. The committee members help collect, review, and verify data concerning selected space agreements. Agreements of general global applicability or regional applicability are selected for reporting. Bilateral agreements are not being included in the report at this stage. In general, the agreements being included and their status are believed to be valid as of July 1, 1989.

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

Coded entries are used in the table as follows:

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

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

AGREEMENTS INCLUDED

1. Treaties & Agreements of General Scope and Applicability

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

2. Charters and Conventions of International Organizations

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

3. Special Topic and Regional Agreements

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

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

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

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

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

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

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

ABBREVIATIONS

Dem. Rep. - Democratic Republic

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

Rep. - Republic

SSR - Soviet Socialist Republic

USSR - Union of Soviet Socialist Republics

THE TEACHING OF SPACE LAW AROUND THE WORLD

STEPHEN GOROVE

The purpose of this book is twofold: First, to review the current status of space law teaching around the world with due regard to its background, multidisciplinary dimension and outlook for the future, second, to provide a ready reference work and guide to members of the teaching profession interested in the mechanics of space law teaching in law schools, political science departments and other institutions of higher learning.

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