JOURNAL OF SPACE LAW

VOLUME 19, NUMBER 2
1991

JOURNAL OF SPACE LAW

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

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Short Accounts

THE USE OF NUCLEAR POWER SOURCES IN OUTER SPACE: A NEW SET OF UNITED NATIONS PRINCIPLES?

Vladimir Kopal+

Introduction

During the last decade, the use of nuclear power sources in outer space became one of the most discussed topics on the agendas of the United Nations Committee on the Peaceful Uses of Outer Space (COPUOS) and both of its subcommittees. The consideration of this topic has advanced in recent years and is now approaching its end in the form of a new set of principles addressed to States and international organizations launching objects with nuclear power sources (NPS) on board into outer space. This article deals with the progressive emergence of these principles in the joint efforts of COPUOS and its subcommittees.

The deliberations on NPS developed in two stages, the dividing line being 1986 when the Legal Subcommittee started a systematic elaboration of draft principles on this subject. Nevertheless, the most significant result was recorded in 1990 when an agreement on the principle including "Guidelines and criteria for safe use" was reached. Another important step was made in 1991 when COPUOS reached consensus on "Responsibility" and "Liability and Compensation." In connection with them, the ensuing article will also outline some questions relating to the concepts of responsibility and liability in the wider context of the development of present international law.

In the last section of the article, attention will be drawn to a number of issues concerning the draft principles which are still under discussion. In particular, the problem of defining the term "launching State" for the purpose of these principles, as well as the question of what legal form the new set of principles should take, will be discussed.

It is likely that "Principles relating to the use of NPS in outer space" will be finalized soon and, thus, become a new contribution to the progressive development of international space law by the United Nations.

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The First Stage of Deliberations on NPS

Initiated by Canada in 1978 following the accident of the Soviet nuclear powered satellite Cosmos 954, the use of NPS in space was first raised in the Scientific and Technical Subcommittee. As a follow up in 1979, the Subcommittee established, in accordance with General Assembly resolution 33/16 of 10 November 1978, a working group of experts to consider the technical aspects and safety measures relating to the use of nuclear power sources in outer space.[1] This group, which was open to all members of the Subcommittee, met three times during the sessions of the Subcommittee from 1979 to 1981, and again in 1984 and 1985. After a certain break, when the item of NPS was considered only in the Subcommittee, the working group was reconvened in 1988 and has continued its deliberations in 1989 and 1990, producing valuable reports reflecting the progress reached in its discussions.[2]

Among the conclusions reached in the early stages of the deliberations of the working group, two key elements have served as cornerstones for further work not only in this particular group of experts but in all considerations of this issue within the purview of COPUOS.

The first basic element was laid down in the first report in 1979 and repeated in the 1981 report, which summarized the outcome of the considerations of the working group during the first period of its activities, in the following terms: "Nuclear power sources can be used safely in outer space provided that all necessary safety requirements are met."[3] The safety requirements were then elaborated by the working group in greater detail in its third report.

The second basic element implemented the request of the General Assembly, spelled out in resolution 33/16, calling on launching States to inform other States concerned in case a space object with a nuclear power source on board malfunctions and thereby creates a risk of reentry of radio-active materials to the earth. While the idea of the earliest possible notification of reentry of such an object emerged already at the first session of the working group of the Scientific and Technical Subcommittee, the format of notification was worked out and agreed upon at its third session in 1981.[4] These first results established a basis not only for the further work of this working group, but also for the work of the Legal Subcommittee of COPUOS on the subject of NPS.

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1 *Cf.* Report of COPUOS, 34 U.N. GAOR Supp. (No. 20), para. 44, at 9.

2 Up to now, eight reports have been published by the working group which are reproduced in Annexes to the Reports of the Scientific and Technical Subcommittee from its above-mentioned sessions.

3 *Cf.* U.N. Doc. A/AC.105/287, Annex II, para. 38, at 9.

4 *Id.*, para. 19, at 4-5.

Notwithstanding the fact that the attention of the Legal Subcommittee to NPS was also drawn for the first time in 1978,[5] the decision on the inclusion of an agenda item entitled "Review of existing international law relevant to outer space activities with a view to determining the appropriateness of supplementing such law with provisions relating to the use of nuclear power sources in outer space," was not made until 1980.[6] But still in the same year, the General Assembly decided, in its resolution 35/14 of 13 November 1980, to change the title of the agenda item of the Legal Subcommittee to "consideration of the possibility of supplementing the norms of international law relevant to the use of nuclear power sources in outer space," and to establish a working group on the item.

In 1981, due to disagreement about the necessity of establishing new norms on the subject, discussions in the new working group of the Legal Subcommittee remained without any practical results. In 1982, however, the working group began substantive discussions on the theme of assistance to States affected by accidental re-entry of a space object with an NPS on board.[7] The first results were achieved in 1983 when the working group of the Legal Subcommittee translated *the format of notification*, which had been worked out in the working group of the Scientific and Technical Subcommittee, into an agreed legal text. The principle that "any State launching a space object with nuclear power sources on board should timely inform States concerned in the event this space object is malfunctioning with a risk of reentry of radio-active materials to the earth" was included in this text. This principle was followed by two paragraphs specifying information to be provided. The first paragraph was partly identical with the information required by Article IV of the 1975 Convention on Registration of Objects Launched into Outer Space,[8] with the addition of "information required for best

5 The issue was raised in a working paper submitted by 15 countries which recommended: "In order to ensure the highest degree of safety of human life and the protection of the environment of the earth and of outer space from harmful contamination, the Legal Subcommittee should, in close co-operation with the Scientific and Technical Subcommittee, review existing international instruments, with the objective of recommending any necessary additional legal measures, including possibly a further convention or legal instrument, concerning the use of nuclear power sources in outer space." *Cf.* U.N. Doc. A/AC.105/218, Annex IV, at 1 (1978).

6 The decision was made on the basis of a consensus reached at COPUOS in 1979. *Cf.* Report of COPUOS, 34 GAOR Supp. (No. 20), para. 51, at 10.

7 *Cf.* U.N. Doc. A/AC.105/305, Annex II, at 1*ff.* (1982).

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

prediction of orbit lifetime, trajectory and impact region." The second paragraph of the agreed text requested "information on the radiological risk of nuclear power source(s)," namely the type of NPS (radio-isotopic/reactor) and the probable physical form, amount and general radiological characteristics of the fuel and contaminated and/or activated components likely to reach the ground. This information was also to be transmitted to the Secretary-General of the United Nations.[9]

Elaboration of the Draft Principles Relevant to the Use of Nuclear Power Sources in Outer Space

In 1986, the Legal Subcommittee renamed the agenda item concerning NPS, which has since been called "Elaboration of draft principles relevant to the use of nuclear power sources in outer space." On the initiative of the working group, this was recommended by COPUOS and endorsed by the General Assembly in it's resolution 40/162 of 16 December 1985. Under this new title, Canada submitted, on 25 March 1986, the first comprehensive draft, which included principles on Safety assessments and notification, Guidelines and criteria for safe use, Notification of re-entry, Assistance to States, and Responsibility and Liability of States.[10]

The Subcommittee, acting through its working group, continued the discussions on *the format of notification* and expanded the original text agreed in 1983 by two additional paragraphs. In these new provisions, the launching State was requested to provide the information "as soon as the malfunction has become known," to update it as frequently as practicable and to increase the frequency of dissemination of the updated information "as the anticipated time of re-entry into the dense layer of the Earth's atmosphere approaches so that the international community would be informed of the situation and would have sufficient time to plan for any

9 *Cf.* U.N. Doc. A/AC.105/320, Annex II, para. 6, at 22-23 (1983). For more detailed analyses of the deliberations in COPUOS and its two Subcommittees on the subject of NPS during the first half of the 1980s, see M. BENKÖ, W. DE GRAAF AND G. C. M. REIJNEN, SPACE LAW IN THE UNITED NATIONS, at 49*ff.* (1985); He, *Towards a New Legal Regime for the Use of Nuclear Power Sources in Outer Space*, 14 J. SPACE L. 95*ff.* (1986), and Jasentuliyana, *Multilateral Negotiations on the Use of Nuclear Power Sources in Outer Space*, 14 ANNALS AIR & SPACE L. 297*ff.* (1987). *See also* the papers of Cocca, Espada, Haanappel and Terekhov in 27 PROC. COLLOQ. L. OUTER SPACE 202*ff.* (1985).

10 *Cf.* U.N. Doc. A/AC.105/C.2/L.154 (1986). This draft was later revised, on the basis of progress made in the working group, in ten succeeding revisions. Starting from the seventh revision of this draft, the Federal Republic of Germany has been its co-sponsor. The most recent version of this document was submitted, but not discussed, during the 1991 session of COPUOS in Graz (Austria). *Cf.* U.N. Doc. A/AC.105/C.2/L.154/Rev.10 (1991).

national response activities deemed necessary." This updated information was also to be transmitted to the UN Secretary-General with the same frequency.[11] Thus the first principle relevant to the use of nuclear power sources in outer space was completed.

Simultaneously, the discussions on the theme of *assistance to States* continued. They concentrated mostly on the question, to whom should the request for assistance be addressed and in what order should it be done. The agreed principle, as adopted by the working group of the Legal Subcommittee in 1986, together with the principle relating to the theme of notification, spelled out first the duty of all States possessing space monitoring and tracking facilities, "to communicate the relevant information that they may have available on the malfunctioning space object with a nuclear power source on board to the Secretary-General of the United Nations and the State concerned as promptly as possible to allow States that might be affected to assess the situation and take any precautionary measures deemed necessary." This should be done upon notification of an expected re-entry into the Earth's atmosphere of a space object containing nuclear power source on board and its components, *i.e.* before this re-entry occured. After the re-entry into the Earth's atmosphere of such an object, "the launching State shall promptly offer, and if requested by the affected State, provide promptly the necessary assistance to eliminate actual and possible harmful effects;" and "all States, other than the launching State, with relevant technical capabilities and international organization with such technical capabilities shall, to the extent possible, provide necessary assistance upon request by an affected State." Thus the agreed principle laid the assistance of both the launching and the other States on the same footing, leaving the affected States the right to choose the addressee for its request. However, in providing assistance in any of these ways, the special needs of developing countries should be taken into account.[12]

In the following years, the working group of the Legal Subcommittee has succeeded in enlarging the agreed texts by further principles. Though some of these texts were dealing with less difficult problems and were couched in more general terms, the consensus recorded on these texts was evidence of a new spirit which started in the latter part of the 1980s, not

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11 *Cf.* U.N. Doc. A/AC.105/370, Annex II, subparas. 5.2 and 5.3, at 16-17 (1986). This additional part of the text on notification of re-entry was agreed upon on the basis of two working papers submitted by the Federal Republic of Germany in 1983 and 1984 (U.N. Doc. A/AC.105/C.2/L.138 (1983) and U.N. Doc. A/AC.105/C.2/L.146 (1984). They reflected the experience with the unplanned re-entry of Cosmos 1402 in January 1983 when the Secretary-General was informed by the USSR, through a series of additional notifications, of the separation, descent and burning up of component parts of this malfunctioning space object.

12 *Cf.* U.N. Doc. A/AC.105/370, Annex II, subparas. 5.4 and 5.5, at 17-18 (1986).

only in COPUOS and its subsidiary bodies, but in international relations in general. The effect of the catastrophe in Chernobyl also played an important role in changing attitudes towards the risks arising from malfunctioning space objects with nuclear power sources on board re-entering the earth or remaining in space. After Chernobyl, two new conventions dealing with nuclear problems were quickly elaborated under the auspices of the International Atomic Energy Agency and adopted on 26 September 1986, namely the Convention on Early Notification of a Nuclear Accident and the Convention on Assistance in the Case of a Nuclear Accident of Radiological Emergency.[13] Both instruments entered into force soon thereafter.

In the working group of the Legal Subcommittee, a principle relating to the theme of *applicability of international law*, including in particular the UN Charter and the 1967 Outer Space Treaty,[14] to activities involving the use of nuclear power sources in outer space, was agreed upon in 1988.[15] The following year, the working group recorded consensus on principles relating to the themes of *consultations* and *settlement of disputes*. While the former would bind States providing information "to respond promptly to requests for further information or consultations sought by other States," the latter would obligate States to resolve any dispute resulting from the application of the principles by peaceful means, in accordance with the Charter of the United Nations, leaving to parties to the dispute to choose between negotiations and other established procedures for the peaceful settlement of disputes.[16]

At the same time, discussions continued on the "hard core" issues that still remained unresolved. These discussions, sometimes rather repetitive, are duly reflected in the reports of the chairman of the working group on this agenda item, which grew in length, particularly during the period since 1987. They offer an adequate picture of the complexity of the issues under consideration.[17]

Apparently the most significant step forward was recorded in 1990 due to close cooperation of the two Subcommittees of COPUOS. During the

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13 *Cf.* the texts of both of these conventions in IAEA Gen. Conf. Doc. GC(SPL.I) 12 (1986).

14 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"].

15 *Cf.* U.N. Doc. A/AC.105/411, Annex I, paras. 8 and 9, at 17 (1988).

16 *Cf.* U.N. Doc. A/AC.105/430, Annex I, para. 42, at 24 and para. 53, at 26 (1989).

17 *Cf.* U.N. Doc. A/AC.105/385, Annex I, at 14-22 (1987); U.N. Doc. A/AC.105/411, Annex I, at 16-27 (1988); U.N. Doc. A/AC.105/430, Annex I, at 16-27 (1989); U.N. Doc. A/AC.105/457 and Corr. 1, Annex I, at 16-23 (1990); and U. N. Doc. A/AC.105/484, Annex I, at 13-20 (1991).

eighth session of the working group of the Scientific and Technical Subcommittee, an agreement was reached on a set of recommendations for the safe use of nuclear power sources in outer space.[18] A joint working paper prepared by Canada, France and the Federal Republic of Germany[19] in the working group of the Legal Subcommittee translated these recommendations into legal language and served as a basis for a thorough consideration of this subject from the legal point of view under the heading of *guidelines and criteria for safe use*. At the 1990 session of the Subcommittee, the working group concentrated on this question and recorded consensus on the text of this principle, which is now listed as principle 3 and represents the most extensive - and also the most complicated - part of all the principles so far elaborated.

The text of this principle[20] begins with an important general statement according to which "the use of nuclear power sources (NPS) in outer space shall be restricted to those space missions which cannot be operated by non-nuclear energy sources in a reasonable way." The aim of this general policy is the effort at minimizing the quantity of radio-active material in space and the risks involved.

The agreed text then establishes general goals for radiation protection and nuclear safety, in particular the duty of States launching space objects with NPS on board to endeavor "to protect individuals, populations and the biosphere against radiological hazards." This is a characteristic goal of the new document, differentiating it, for example, from the goals of the 1972 Liability Convention, which defined the term "damage" as loss of life, personal injury or other impairment of health, or loss of or damage to property of States or of persons, natural and juridical or property of international intergovernmental organizations. For these kinds of damage the prompt payment of a full and equitable measure of compensation to victims of such damage should have been ensured under the terms of the Liability Convention. Here, however, in addition to individuals and populations, "the biosphere," *i.e.* the environment in which life had been developed, should also be protected. It is to be noted that the biosphere is not limited to areas under the jurisdiction of States but also includes areas beyond the national jurisdiction of States ("the global commons").

During the normal operation of space objects with NPS on board, including re-entry from a sufficiently high orbit (SHO), the appropriate radiation protection objective for the public recommended by the International Commission on Radiological Protection (ICRP) shall be observed. Systems important for safety shall be designed, constructed and operated in accordance with the general concept of defense-in-depth. Pursuant to this concept, forseeable safety-related failures or

18 *Cf.* U.N. Doc. A/AC.105/456, 1990, Annex III. para. 15, at 34-37 (1990).

19 *Cf.* U.N. Doc. A/AC.105/C.2/L.177 (1990).

20 *Cf.* U.N. Doc. A/AC.105/457, para. 12, at 18-20 (1990).

malfunctions must be capable of being corrected or counteracted by an action or a possibly automatic procedure.

Principle 3 then proceeds with specific rules, first concerning nuclear reactors. They may be operated on interplanetary missions, in sufficiently high orbits (SHO), which are defined as those "at which the orbital lifetime is long enough to allow for a sufficient decay of the fission products to approximately the activity of the actinides," and in low Earth orbits if they are stored in SHO after the operational part of their mission. It is interesting to note that the general definition of SHO is completed by two specific criteria: the SHO must be such that the risks to existing and future outer space missions and of collisions with other space objects are kept to a minimum, and the necessity for the parts of a destroyed reactor also to attain the required decay time before re-entering the Earth's atmosphere shall be considered in determining the SHO altitude.

In a similar way, specific rules for the use of radio-isotopic generators are established. This kind of fuel may be used for interplanetary missions and other missions leaving the gravity field of the Earth, and also in Earth orbit if, after conclusion of the operational part of their mission, they are stored in a high orbit. Radio-isotope generators shall be protected by a containment system that is designed and constructed to withstand the heat and aerodynamic forces of re-entry in the upper atmosphere under forseeable orbital conditions, including highly elliptical or hyperbolic orbits where relevant. Upon impact, the containment system and the physical form of the isotope shall ensure that no radio-active material is scattered into the environment so that the impact area can be completely cleared of radio-activity by a recovery operation.

These are but the highlights of the text of principle 3 dealing with guidelines and criteria for safe use which is, as already mentioned, fairly complex and loaded with technical terms.

At its meeting in 1990, the working group of the Legal Subcommittee also considered the remaining principles on which agreement was not yet reached. Notwithstanding the exchange of views which brought some new elements, no other consensus could be recorded during the 1990 session of the Legal Subcommittee.

During the session of COPUOS, which was held in June 1990 and considered, *inter alia*, the report of the Legal Subcommittee on the work of its twenty-ninth session, some further progress was made in an informal meeting and in consultations among interested delegations. They reached

"a basis for consensus in the near future" on a text for draft principle 8 dealing with responsibility.[21]

Moreover, the delegation of Canada and the Federal Republic of Germany submitted a revised version of the working paper originally prepared by Canada, in order to facilitate the discussions on the document at the 1991 session of the Legal Subcommittee.[22]

The progress achieved at the 1990 session of the Legal Subcommittee was generally considered as a breakthrough which removed what had been regarded as the main stumbling block on the way to the final goal. The optimists even predicted that due to this advanced stage of negotiations, the NPS principles might be finalized at the 1991 session of the Legal Subcommittee so that COPUOS, which was invited by the government of Austria to hold its 1991 session in Graz, could endorse the full set of principles and recommend it for adoption to the General Assembly. However, the situation developed in a way different from what was expected.

At the Twenty-eighth session of the Scientific and Technical Subcommittee, which was held in New York from 19 February to 1 March 1991, the United States submitted a working paper which revisited certain portions of the Subcommittee's recommendations underlying draft principle 3. A number of specific modifications were required in this document "to ensure the technical accuracy of the recommendations, as a step towards contributing further to the substantial progress made in the Subcommittee on this subject."[23]

A similar document was then submitted by the United States delegation to the thirtieth session of the Legal Subcommittee held in New York from 25 March to 12 April 1991.[24] Some of the improvements

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21 *Cf.* Report of COPUOS, 45 GAOR Supp. (No. 20), para. 104, at 17. - In these informal discussions, it was also concluded that the text of draft principle 11 dealing with relations with international treaties and agreements, which would confirm that "application of these principles shall not prejudice the rights and obligations of States and international organizations under international treaties and agreements," could be deleted. This was then in fact decided at the 1991 session of the Legal Subcommittee. (*Cf.* U.N. Doc. A/AC.105/484, Annex I, para. 25, at 20 (1991).

22 *Cf.* U.N. Doc. A/AC.105/C.2/L.154/Rev. 7 in Report of COPUOS, 45 GAOR Supp. (No. 20), Annex II, at 36-38.

23 *Cf.* U.N. Doc. A/AC.105/C.1/L.176 (1991) and Report of the Scientific and Technical Subcommittee on the Work of its Twenty-eigth session, U.N. Doc. A/AC.105/483, para. 58, at 14 (1991). The U.S. working paper was later reissued as COPUOS Doc. A/AC.105/485 (1991).

24 *Cf.* U.N. Doc. A/AC.105/C.2/L.185 (1991). The text of this document consists of two parts: the first one is explanatory, the second one (Annex) provides the proposed U.S. changes as they would appear in the text adopted by the Legal Subcommittee in 1990.

suggested in this document have been of a rather detailed or drafting character. Some others, however, have been of substantive nature. Thus, for instance, it has been proposed to delete the general statement of policy, in the beginning of principle 3, according to which the use of NPS in outer space should be restricted to those space missions which cannot be operated by non-nuclear energy sources in a reasonable way. Furthermore, the requirements to restrict radiation exposure have not been laid down in the new U.S. text in exact doses but only in general terms. Similarly, the above-mentioned concept of defense-in-depth has been redrafted. Finally, the requirements concerning a containment system for the nuclear fuel in radio-isotope generators have also been modified, particularly by substituting the need for localization of the radioactive material scattered into the environment, so that the impact area can be cleared of radio-activity by a recovery operation, for the absolute duty, which was spelled out in the text agreed in 1990, to ensure that no radio-active material is scattered into the environment.

Since other members of the Legal Subcommittee were not inclined to reopen the discussion of principle 3 and the U.S. delegation did not insist on an immediate attempt at redrafting the agreed text of this principle, the Subcommittee turned to the remaining themes on which agreement had not been reached.[25]

Therefore, most of the attention of the Legal Subcommittee and its working group at the 1991 session was devoted to draft principles 8 and 9 dealing with responsibility and compensation. A new impetus to the discussions on these subjects was given by a working paper submitted jointly by the delegations of Canada, China, Czechoslovakia, France, Germany, Italy, the Nehterlands, Sweden and the United Kingdom.[26] This document, together with an earlier version of those draft principles contained in the working paper submitted by the delegations of Canada and

25 On the other hand, a certain step forward relating to the theme of principle 3 was done at the 1991 session of the Legal Subcommittee with regard to the question of the proper location of a provision reflecting the content of former paragraph 1.5 of draft principle 3, which was originally contained in the text agreed in the working group of the Scientific and Technical Subcommittee, and was deleted from the text of draft principle 3 adopted by consensus at the 1990 session of the Legal Subcommittee. It was proposed that this text might be included in para. 2(a) of principle 7 dealing with assistance. The working group of the Legal Subcommittee "believed that a consensus could be reached in the near future" on an additional sentence according to which the assistance provided under principle 7 should include "assistance to identify the location of the area of impact of the nuclear power sources on the Earth's surface, to detect the re-entered material and to carry out retrieval or clean-up operations." (*Cf.* U.N. Doc. A/AC.105/484, Annex I, para. 13, at 16-17 (1991).

26 *Cf.* U.N. Doc. A/AC.105/C.2/L.184 (1991)..

the Federal Republic of Germany,[27] served as the basis of a thorough consideration of the relevant issues in the working group.[28]

Notwithstanding the fact that these discussions opened the way to a rapproachment on several aspects, consensus on the final wording of principles 8 and 9 could not be recorded at the Legal Subcommittee. However, this goal was reached during the 1991 session of COPUOS in Graz where informal consultations on these draft principles continued. Due to the efforts of the delegations of Canada and Germany, and the understanding and support of the other delegations, the Committee recorded consensus on these principles which is enshrined in its report from this session.[29]

The agreed text of principle 8 dealing with *responsibility* is parallel to that of Article VI of the 1967 Outer Space Treaty. Moreover, it spells out *expressis verbis* that the national space activities for which States shall bear international responsibilitiy include the use of NPS in outer space. States shall also bear this responsibility for assuring that these activities are carried out in conformity with that treaty "and the recommendations contained in these principles." When activities in outer space involving the use of NPS are carried out by an international organization, responsibility for compliance with the Outer Space Treaty and "the recommendations contained in these principles" shall be borne both by the international organization and by the States participating in it.

In a similar way, the agreed text of principle 9 dealing with *liability and compensation* is closely linked with the existing principle laid down in article VII of the 1967 Outer Space Treaty and the respective provisions of the 1972 Liability Convention.[30] Thus, the text declares that the principle, according to which each State which launches or procures the launching of a space object and each State from whose territory or facility a space object is launched shall be internationally liable for damage caused by such space objects or their component parts, "fully applies to the case of such a space object carrying a nuclear power source on board." Also in the case, whenever two or more States jointly launch such a space object, they shall be jointly and severally liable for any damage caused in accordance with article V of the Liability Convention.

In the second paragraph, the adopted text remains very close to the Liability Convention saying that "the compensation that such States shall be liable to pay under the aforesaid Convention for damage shall be determined in accordance with international law and the principles of

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27 *Cf.* U.N. Doc. A/AC.105/C.2/L.154/Rev.7 (1990).

28 This consideration is adequately reflected in the Report of the Legal Subcommittee on the Work of its Thirtieth session (25 March - 12 April 1991). *See* U.N. Doc. A/AC.105/484, Annex I, paras. 14-24, at 17-20 (1991).

29 *Cf.* U.N. Doc. A/AC.105/L.192.Add.3/Corr.1 (1991).

30 Convention on International Liability for Damage Caused by Space Objects, March 29, 1972 24 U.S.T. 2389, T.I.A.S. No. 7762; 961 U.N.T.S. 187 (*entered into force for the United States Oct. 9, 1973*) [hereinafter "Liability Convention"].

justice and equity in order to provide such reparation in respect of the damage as will restore the person, natural or juridical, State or international organization on whose behalf a claim is presented to the condition which would have existed if the damage had not occurred." From this wording, it can be concluded that the duty to compensate the damage caused also fully applies to the cases of space objects carrying an NPS on board.

Probably the most significant compromise, however, is included in para. 3 which declares: "For the purposes of this principle, compensation shall include reimbursement of the duly substantiated expenses for search, recovery and clean-up operations, including expenses for assistance received from third parties." By this provision the longstanding dispute, whether expenses incurred in recovery and clean-up operations have already been encompassed in the compensation required by the Liability Convention, or not,[31] was settled. For the adherents of the first interpretation, para. 3 of principle 9 will have only a declaratory value, while for the opponents of this interpretation, this provision will establish a new rule. Furthermore, by limiting the duty to compensate the expenses to those which would be "duly substantiated," the issue whether reference should be to all expenses or only to some of them (those qualified as "necessary", "reasonable", "justified" and the like) was overcome.[32]

The final outcome of a lengthy discussion of these principles, notwithstanding the evident features of a compromise solution, seems to be reasonable. It also reflects the up-to-date development of international law in general and international space law in particular. Present international law, as evidenced by the work of the United Nations International Law Commission, differentiates two types of responsibility: State responsibility for wrongful acts violating the rules of international law, and liability for damage caused by certain types of activities which do not technically breach any norm of international law but for which States assume the responsibility on the basis of specific agreements because of the risk involved or harmful effects they cause.[33]

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31 *Cf. e.g.* U.N. Doc. A/AC.105/484, Annex I, para. 22-23, at 19 (1991).

32 *Cf.* U.N. Doc. A/AC.105/385, Annex I, para. 43, at 21-22 (1987) and U.N. Doc. A/AC.105/430, Annex I, para. 52, at 26 (1989). See also the view recorded in U.N. Doc. A/AC.105/457, Annex I, para. 19, at 22-23 (1990).

33 For the latest stage of considerations in the International Law Commission of the topic "International Liability for Injurious Consequences Arising out of Acts not Prohibited by International Law," the purpose of which is to elaborate draft articles including a general regulation of this kind of responsibility, *cf.* Report of the ILC on the Work of its Forty-second session, 1 May - 20 July 1990, 45 GAOR Supp. (No.10), Ch. VII, at 242-285. See also the Seventh Report on international liability for injurious consequences arising out of acts not prohibited by international law by Mr. Julio Barboza, Special Rapporteur, U.N. Doc. A/CN.4/437 (1991).

The 1967 Outer Space Treaty deals both with international responsibility and international liability for damage, and the respective principles are included in two separate provisions, article VI and article VII. However, it is questionable whether responsibility under article VI of the Outer Space Treaty, which was negotiated before the International Law Commission draft articles on State responsibility crystallized, really means responsibility for wrongful acts as conceived in the International Law Commission,[34] or it simply declares the duty of States and international organizations to exercise control over activities in outer space.

As far as liability for damage is concerned, this principle, as enshrined in article VII of the Outer Space Treaty, was later developed in the 1972 Liability Convention, which elaborated in greater detail the concept of damage, and procedures to be used for the presentation and settlement of claims. If the principle on the use of NPS, following the example of the 1967 Outer Space Treaty, should deal with all questions relating to liability in a single principle, this principle must be called "Liability for Damage and Compensation," and not only "Compensation" as was done before, for compensation is just one part of this complex. However, a still more suitable solution might have been the insertion of a general stipulation of liability in a separate principle, for the problem of compensation might arise not only on the basis of liability for injurious consequences of acts not prohibited by international law, but also on the basis of responsibility if this term is understood as responsibility for a wrongful act.[35]

The picture of the principles, which have been elaborated so far, would not be complete without mentioning draft principle 12, which provides for a *revision* of the NPS principles by COPUOS no later than 10 years after their adoption.[36] This text seems to be acceptable for most of the members of the Subcommittee. The only comment expressed at the 1991 session of the Legal Subcommittee in relation to it drew attention to the need for consideration of its wording in the light of all other draft principles when they are finalized.[37]

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34 *Cf.* the text of these articles in: Report of the International Law Commission on the Work of its Twenty-eighth session, 3 May - 23 July 1976, 31 GAOR Supp. (No. 10), at 170*ff.*

35 *Cf.* the views recorded in U.N. Doc. A/AC.105/457, Annex I, para. 19, at 22 (1990). See also U.N. Doc. A/AC.105/385, Annex I, paras. 37-42, at 20-21 (1987).

36 *Cf.* the draft of principle 12 in the working paper of Canada, U.N. Doc. A/AC.105/C.2/L.154/Rev.6 of 17 April 1990.

37 *Cf.* U.N. Doc. A/AC.105/484, para. 26, at 20 (1991).

Questions Relating to the Remaining Themes

In spite of the progress reached, a number of questions to be resolved still remain. First of all, a couple of principles which have been considered together, namely that on *notification of the presence on board a space object of an NPS* (draft principle 2) and that on *safety assessment* (draft principle 4) require further discussion.

One of the questions relating to the theme of *notification* concerns the relationship of the draft principle, which would provide for furnishing to the UN Secretary-General specific information as to the presence on board the space object of an NPS and its generic classification, with article IV of the 1975 Registration Convention, which does not oblige States to furnish information on the presence of an NPS on board a space object, although such information could be voluntarily given. The question arose whether draft principle 2 would not in effect amend the 1975 Registration Convention, which the General Assembly had recently reviewed[38] without recommending any amendment thereto.[39] This question, however, seems to be rather premature, for a draft principle cannot "amend" any established legal rule. Furthermore, it has not been decided yet what legal form will be given to the principles on NPS when they are finalized. Moreover, the general régime established by the Registration Convention cannot prevent States from adopting a special régime governing the notification of the presence of an NPS on board a space object, which would impose upon the parties concerned additional duties with regard to such space objects.

Furthermore, the question of whether this information should be furnished "prior to" or "as soon as possible after the launching" was also discussed several times in the working group in past years.

These issues, however, could be altogether removed if, as suggested by some delegations, draft principle 2 were completely left out because its purposes might be better achieved in practical terms by making publicly available the results of a safety assessment which should be conducted prior to each launch under draft principle 4. On the other hand, there seems to be some merit in the view of those objecting to this deletion on the ground that draft principle 2 and draft principle 4 serve different objectives.[40]

At the 1991 session of the Legal Subcommittee, a new basis for discussing the issue was provided by a working paper submitted jointly by Canada, France, Germany and Sweden.[41] In this proposal the former draft principles 2 and 4 were combined in a single draft principle 4 called "Safety assessment." The new text spells out the duty of a State launching a space object with an NPS on board to conduct a thorough and

38 *Cf.* G.A. Res. 41/66 (Question of the review of the Convention on Registration of Objects Launched into Outer Space) of 3 December 1986.

39 *Cf.* U.N. Doc. A/AC.105/457, Annex I, para. 11, at 17-18 (1990).

40 *Cf.* U.N. Doc. A/AC.105/457, para. 9, at 17 (1990).

41 *Cf.* U.N. Doc. A/AC.105/C.2/L.183 (1991).

comprehensive safety assessment prior to each launch in accordance with the guidelines and criteria for safe use in principle 3. The results of this assessment which should cover all relevant phases of the mission and should deal with all systems involved including, for example, the means of launching the space platform, the nuclear power source and its equipment, and the means of control and communication between ground and space, should be made publicly available prior to each launch through the Secretary-General of the United Nations.

This proposal, however, did not satisfy all members of the Subcommittee. Some of them proposed that the title of principle 4 should read as follows: "Safety assessment and notification of the presence on board a space object of a nuclear power source." Moreover, they suggested to include a new paragraph in the text in which the duty to communicate information as to the presence on board the space object of an NPS to the Secretary-General prior to each launching would be retained and the format of such information would be specified.[42]

Notwithstanding a detailed discussion on this issue, in which several aspects were clarified, it was not possible to reconcile the opposing views either in the working group of the Legal Subcommittee at its 1991 session, or at the COPUOS session during the discussion of the report of the Subcommittee later the same year.

Among the questions relating to the theme of safety assessment there is also a juridically subtle problem of who should perform, and who should be held responsible for, a thorough safety assessment prior to launch as provided in the draft principle 4. At the 1990 meeting of the working group of the Legal Subcommittee, some delegations held the view that the "launching State" would be the subject of this duty, and that this notion includes a State which launches space objects or procures the launching of a space object, as well as a State from whose territory or facility a space object is launched. This would be in accord with the 1972 Liability Convention and the 1975 Registration Convention, which have identical definitions in their articles I. On the other hand, the primary role of the State from whose territory the space object is to be launched, which has to give permission for the launch, was emphasized. Another view held that a safety assessment can be made only by the country which has manufactured, designed or constructed the space object with an NPS on board, particularly when the launching State is not the manufacturing State. A new text reformulating draft principle 4 was also suggested by the French delegation, which stipulated: "States from whose territory space objects with nuclear power sources on board are launched shall conduct, in

42 In the view of those delegations, prior notification of relevant information, which would allow States in the vicinity of launching sites to take precautionary measures, and which is therefore a confidence building measure in international relations, is not identical to the notion of prior safety assessment and both those notions should be clearly embodied in draft principle 4. *Cf.* U.N. Doc. A/AC.105/484, Annex I, para. 5, at 14 (1991).

co-operation, where relevant, with States which have designed or constructed or will operate the nuclear power source, a thorough safety assessment prior to each launch. This assessment shall cover all relevant phases of the mission and shall deal with all systems involved including the means of launching, the space platform, the nuclear power source and its equipment, and the means of control and communication between ground and space."[43]

None of these views prevailed at the 1990 session of the Legal Subcommittee and the discussion of this issue remained without any conclusion. However, the necessity of clarifying all related aspects by a definition of the "launching State" has become evident. A step toward this end was suggested in the seventh revision of the draft principles submitted by Canada and the Federal Republic of Germany at the thirty-third session of the COPUOS in June 1990.[44] This document included first a new draft principle 1A dealing with a general definition of the terms "launching State" or "State launching" which read as follows: "For the purposes of these principles the terms "launching State" or "State launching" are defined as the State on whose registry a space object is carried in accordance with the Convention on Registration of Objects Launched in Outer Space or, if the object is not registered in accordance with that Convention, the State which exercises or plans to exercise jurisdiction and control over such space objects as envisaged in article VIII of the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and other Celestial Bodies." Moreover, in accordance with this general definition, the duty of furnishing specific information as to the presence on board the space object of an NPS and its generic classification to the Secretary-General (draft principle 2) was *expressis verbis* assigned to "each State of registry" of such a space object. And the duty of performing a thorough safety assessment prior to each

43 *Cf.* U.N. Doc. A/AC.105/457 and Corr. 1, para. 17, at 21 (1990).

44 *Cf.* Report of COPUOS, 45 GAOR Supp. (No. 20), Annex II, at 36*ff.*

launch should be fulfilled by "a State having jurisdiction and control over nuclear power sources on board space object."[45]

At the 1991 session of the Legal Subcommittee, the issue of defining the term "launching State" was touched only marginally, because it was felt that such a definition should be considered thoroughly at a later stage. The problem was mentioned only with regard to draft principle 4, when some members of the Subcommittee maintained that in case of involvement of more than one State in the launching the safety assessment should be carried out by the State launching a space object with a nuclear power source on board as well as by other States which had cooperated in the launching, including those which had designed or manufactured the space object. In this connection, it was also stated that "the State which was in the best position to gather all the technical information on the mission and various systems involved should be responsible for the safety assessment, in order to allow such a safety assessment to be global and exhaustive."[46]

In further revisions of the draft principles submitted by Canada and Germany,[47] their above-mentioned approach was modified by introduction of two different definitions. According to the latest of these

45 It may be interesting to note that a similar position was already held by the United States in the 1960s during the discussions on the definition of "launching State" to be included in the Liability Convention. Commenting on its proposal (A/AC.105/C.2/L.8/Rev.1), the U.S. delegation considered it "preferable to define a "launching State" as a State that has notified the Secretary-General of the United Nations of its launching of a space object and provided the Secretary-General with the identification data necessary for the registration of the space object in the registry maintained at the United Nations."..."It would also cause no difficulty to States participating in a joint launching for they might decide as between themselves on the State which should be the State of registry, and then enter into arrangements as to the apportionment of liability as between them. Provisions to this effect would also give emphasis to the registry of space objects now maintained in the United Nations, and it was important to build up the system of registration." *Cf.* III MANUAL ON SPACE LAW, *Travaux Préparatoires and Related Documents* 295-96 (Comp. N. Jasentuliyana & Roy S.K. Lee 1981). In a later U.S. proposal of the Liability Convention (U.N. Doc. A/AC.105/C.2/L.19 (1967), the term "launching State" was defined in the following way: "Launching State means a Contracting Party, or an international organization that has transmitted a declaration to the Secretary-General under Article V, paragraph 1, of this Convention, that launches or actively and substantially participates in the launching of an object into outer space, or from whose territory or facility an object is launched into outer space, or that exercises control over the orbit or trajectory of such an object." *(Id. a*t 301).

46 *Cf.* U.N. Doc. A/AC.105/484, Annex I, para. 1, at 15-16 (1991).

47 *Cf.* U.N. Doc. A/AC.105/C.2/L.154/Rev.9 and Rev.10 (1991).

revisions, a general definition of "launching State," which would be valid for principles 3,4,5 and 7, would mean the State on whose registry a space object is carried in accordance with the 1975 Registration Convention, and which would retain jurisdiction and control over such an object according to article VIII of the 1967 Outer Space Treaty. Should the object be not registered in accordance with the Registration Convention, this term would mean the State which "exercises jurisdiction and control over such space object." At the same time, for the purpose of principle 9 (liability and compensation), the definition of the term "launching State" as contained in that principle should be applicable.[48]

As has been mentioned above, principle 9, as already adopted by consensus during the 1991 COPUOS session, refers in this respect to article VII of the Outer Space Treaty and to the provisions of the 1972 Liability Convention, thus keeping the definition which has been established in these instruments and which has been retained in article I of the Registration Convention. The main reason, why the definition of "launching State" was formulated in these treaties just in this way, was the intention of its drafters to enable the State damaged by a space object or its component parts, acting also on behalf of its natural and juridical persons, to present the claims at an interstate level and to address them to any of the States mentioned in the definition thus permitting the presenting State to act promptly in accordance with its political interests. The settlement of the legal aspects of a possible participation of other States or legal entities in the given case before and after the launching of the space object concerned was considered as an internal problem of these participants to be governed by their mutual agreements or civil law contracts.[49]

The considerations, which led the drafters of the three treaties to the above conclusions, seem to be equally valid with regard to the NPS principles. The concept of "the country which has manufactured, designed or constructed the space object," if applied to the NPS principle, would raise difficult problems if we take into account the possibility of involvement of several countries and of their private contractors in these

48 *Cf.* U.N. Doc. A/AC.105/C.2/L.154/Rev.10 (1991).

49 Professor Nicholas Mateesco Matte, in a study published already in 1977, drew attention to the difference between the liability of the launching State and the product liability of the manufacturer of a finished product or of a component part, of the producer of a natural product, and of the persons engaged in their supply and distribution, for damages which arise from the use of defective products. He concluded: "The point of reference remains always the launching, procurement of launching or lending of territory or facility for launching. To avoid confusion, reference should therefore not be made to the international liability of the launching state when speaking of products liability in relation to space transportation." *Cf.* Matte, *Product Liability of the Manufacturer of Space Objects*, 2 ANNALS AIR & SPACE L. 378-380 (1977).

activities. Similarly, the concept of a leading role for the State from whose territory the space object is launched might initiate many problems.

After all, it should be borne in mind that these principles would be complementary to and applied together with the respective provisions of the 1967 Outer Space Treaty, the 1972 Liability Convention and the 1975 Registration Convention. In order to avoid any confusion arising from different definitions in different documents applicable to a single case, it is advisable to retain, as much as possible, the uniform meaning of key juridical notions on which all these documents should be based. Moreover, the 1967 Outer Space Treaty, the 1972 Liability Convention and the 1975 Registration Convention will remain the basic and legally binding instruments to be applied by their parties in respect of damage caused by any space object, whether having an NPS on board or not, while the Principles relevant to the use of nuclear power source in outer space should only supplement the provisions of these treaties with regard to the use of NPS by a set of specific recommendations.

Last but not least, the question of *the form of this document* still remains to be decided. It is true that regulations of problems relating to liability for damage, which may have serious financial consequences, are usually included in international conventions as evidenced, *inter alia*, by the 1972 Convention on International Liability for Damage Caused by Space Objects. However, the debates on the principles on NPS in the Legal Subcommittee of the COPUOS and the character of the texts agreed (or expected to be agreed) indicate that very likely, the draft principles relevant to the use of nuclear power sources in outer space will follow the example of the 1986 Principles Relating to Remote Sensing, and will be adopted and declared by the United Nations General Assembly in a resolution to which these principles will be annexed.[50] The present political will of the negotiating States to finalize this document soon also speaks in favor of this alternative, for the transformation of the principles included in the present text into treaty provisions, together with a reconsideration of specific technical rules that are now contained in some of these principles,[51] which would be necessary for the purpose of a

50 As to the legal significance of principles declared by the United Nations General Assembly, *cf.* Kopal, *The Role of United Nations Declarations of Principles in the Progressive Development of Space Law,* 16 J. SPACE L. 17*ff.* (1988).

51 At the 1991 session of COPUOS, the observer for the IAEA drew attention to the revision of the recommendations of the International Commission on Radiological Protection (ICRP) made in 1990 and the establishment of Basic Safety Standards for Radiation Protection which should be reflected in the NPS principles, particularly in principle 3 dealing with guidelines and criteria for the safe use of NPS in outer space. Nonetheless, he made it also clear "that the IAEA believes that it is essential to retain the basis of the catalogue even if its present formulation is not optimal from a technical point of view." *Cf.* text of the IAEA Statement of 4 June 1991 to COPUOS.

legally binding instrument, would probably cause further delays in the adoption of this document.

Nevertheless, if everything goes well, the present momentum in the elaboration of the NPS principles is maintained, and the remaining issues are successfully resolved, this new contribution to the progressive development of space law by the United Nations might be completed soon.

THE MOON AND MARS MISSIONS: CAN INTERNATIONAL LAW MEET THE CHALLENGE?+

Carl Q. Christol*

Introduction

A massive reevaluation is presently being made respecting the Moon and Mars Missions, both manned and unmanned. Since successful long-term human exploitation of celestial bodies requires advanced space stations, any plans dealing with the latter will materially impact on the former. The practical problems confronting the future of space stations, the shuttle, an aerospace plane, and the contemplated human presence on celestial bodies vastly exceed possibly relevant and unresolved legal issues.

Illustrative of divergent outlooks concerning a greater human presence in space are the January 1990 Report of the International Academy of Astronautics (IAA) Ad Hoc Committee, "Return to the Moon,"[1] the December 1990 conclusions of the Advisory Committee on the Future of the United States Space Program,[2] and the March 1991 position of the Space Studies Board of the National Research Council of the National Academy of Sciences.[3] Of the eighty members of the IAA who responded to the Committee questionnaire, one-half agreed that an international institution "should plan and take steps towards realization of an International Lunar Base in the period from 1991 to 1995 with the International Space Year 1992 as a median."[4] The respondents declared that a primary objective should be the establishment of a human settlement on the Moon so that human activities would be expanded in the solar system. Of the eighty respondents forty-five percent suggested that the first priority should be the establishment of a suitable infrastructure, followed by thirty-two percent favoring lunar sciences, and twenty-three percent supporting lunar manufacturing. When queried as to subjects on

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+ This paper is an elaboration of the author's presentation at the 85th Anniversary Meeting of the American Society of International Law, April 18, 1991.

1 12 IAA Newsletter, p. 1 (Spring 1990). *See also* "The Case for an International Lunar Base," *1st Cosmic Study of the International Academy of Astronautics* (Paris, 1991).

2 54 Fed. Contracts Rep. 857 (Dec. 17, 1990); *Executive Summary*, 7 SPACE POL'Y 173 (1991).

3 L.A. Times, March 21, 1991, at A20, col. 1.

4 *Supra* note 1

which the Academy should focus its future Cosmic Planning Studies, twelve of the eighty identified manned Mars exploration, while ten favored unmanned Mars exploration.[5]

On the other hand, the December 1990 U.S. Advisory Committee Report on the future of the United States space program placed emphasis on existing deficiencies and on practical obstacles facing much less visionary space activities.[6] In questioning the future of the Shuttle Program, the Committee, which was chaired by Norman Augustine, Chairman and Chief Executive Officer of the Martin Marietta Corporation, concluded that NASA should focus on a program of heavy-lift rockets for space science missions. It accorded lower priorities to "space stations, aerospace planes, [and] manned missions to the planets . . . ."[7]

In February 1991 following the Augustine Report, President Bush issued a White House policy directive which, while seeking to encourage private firms to engage in commercial space activities without the governmental constraints of the past, determined that unmanned space objects would be accorded priority over manned launches.[8] In keeping with this approach the proposed NASA FY92 budget calls for $175 million dollars, to be matched equally by the Air Force, for the joint development of a new unmanned heavy lift-launch vehicle.[9] It would be designed to place 150,000 pounds into low Earth orbit.

At about the time of the Augustine Report in December 1990, the United States and the Soviet Union, following ministerial talks between Secretary of State Baker and Foreign Minister Shevardnadze concluded that a permanent presence on the Moon might be a common objective of the two countries.[10] However, their time frame was the 21st century.[11]

The Augustine Report did not call for the elimination of space stations, as such, but rather, contemplated a much simplified version. Its suggested focus was to be on life sciences research.[12] While these events were unfolding, Congress cut six billion dollars from the station's budget

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5 *Supra* note 1.

6 *Supra* note 2.

7 *Supra* note 2.

8 L.A. Times, Feb. 10, 1991 at A29 col. 5, 134 Av. WK. & SPACE TECH. 17 (No 7, Feb. 18, 1991).

9 29 AEROSPACE AMERICA 1 (March 1991).

10 U.S. Foreign Broadcast Information Service, Daily Report, Soviet Union, SOV-90-238, Dec. 11, 1990, p. 12; *Id.*, SOV-90-239, Dec. 12, 1990, p. 7.

11 Earlier, in April 1988, the two countries had arrived at an "Agreement for Cooperation in the Exploration and Use of Outer Space for Peaceful Purposes." This called for a common approach to solar system exploration.

12 *Supra* note 2.

over the next five years.[13] The FY 91 appropriations bill also directed that the station be built one stage at a time rather than all at once.[14]

These criticisms led NASA to a reevaluation of the space station. In 1990 it proposed a more modest project that would be reduced in terms of the size, in number of its personnel, and in the scope of its scientific inquiry.[15] The March 1991 findings of the Space Studies Board reported that NASA's new design could not be justified on the basis of scientific accomplishments. The Board concluded that "neither the quantity nor the quality of the research that can be conducted on the proposed station merits the projected investment."[16] This would mean, if the station were not to become a reality, that research would not go forward in scientific areas related to long-term human exploration or habitation of space nor could there be research pertaining to the weight-free conditions which must be resolved if there is to be a greater commercial use of space.

In March 1991, following a review of the conclusions of the Space Studies Board, the National Space Council announced plans to go forward with the revised space station. The treaty partners, according to NASA, have expressed their willingness to participate in the revised and more modest program.[17]

Since any hope of success for missions to the Moon and Mars must depend on adequate shuttle and space station operations, and since both of them have been questioned on financial and scientific grounds, it is probable that the proposed revised program must be employed if the basic project is to be implemented. One suggestion has been that scientific efforts should be continued in the area of microgravity automatic research

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13 This reduced NASA's forecast from $21.5 billion to a proposal of $15.754 billion for FY 92. Even so, this was an increase of almost $1.9 billion over the preceeding year. Of the total $2.028 billion was identified for Space Station Freedom. J. Padrón, *NASA Seeks Modest Budget Increase*,, 29 AEROSPACE AMERICA 16 (No. 4, April1991).

14 Lerner, *Space Station Changes its Course* , 29 AEROSPACE AMERICA 12 (No. 1, Jan. 1991). The 1991 contrast with President Reagan's assessment in 1985 is seen in his words: "When it becomes operational in the early to mid-1990s, the space station will be a catalyst for expanding the peaceful uses of space for scientific, industrial, and commercial gain. The station will serve as a laboratory for materials processing and industrial and scientific research; as a permanent observatory for astronomy and Earth observation; as a storage and supply depot; and as a base from which to service other satellites or satellite clusters that will form the World's first space-based industrialized park." II Pub. PAPERS OF THE PRESIDENT OF THE UNITED STATES: RONALD REAGAN 93 (1988). Background is provided by the OFFICE OF TECHNOLOGY ASSESSMENT, ACCESS TO SPACE: THE FUTURE OF U.S. TRANSPORTATION SYSTEMS (1990); D.P. GUMP, SPACE ENTERPRISE BEYOND NASA (1990).

15 L.A. Times, March 21, 1991, at A1, col. 4.

16 L.A. Times, March 16, 1991, at A28, col. 2.

17 L.A. Times, March 21, 1991, at A20, col. 2.

where human crews are not required. However, the new plans call for a four person crew.[18]

Because of the linkage between shuttle, space station, and proposed missions to the Moon and Mars, the foregoing facts will materially affect plans for the 1983 Space Exploration Intitative (SEI) with its focus on Moon and Mars research.[19] Further, since members of the European Space Agency, Canada, and Japan have already committed themselves to supply components for the originally proposed station, there will be new and important legal and political matters to be considered. Since all parties have invested heavily in the original design of the space station there will be a reluctance to cancel the project entirely.

From the foregoing it can be concluded that existing science and technology cannot efficiently and effectively provide an operational basis for successful space station operations. It should be added that demands remain strong in the United States to allocate federal funds to bail out its savings and loan institutions, for social security and medicare reform, to meet military costs occasioned by the Iraq invasion of Kuwait, and to confront legitimate concerns respecting America's educational productivity, deteriorating infrastructures, and the societal needs of the underclasses. While these illustrations apply principally in the United States, constraints of a similar kind and magnitude exist in many other advanced countries.

The contrast between the 1983 call for the Space Exploration Initiative and the 1990 IAA position on manned Moon and Mars facilities, compared with the current outlooks reflected in the White House, in Congress, in the Augustine Report, and in the findings of the Space Science Board, could not be starker. There is a present need to sort out the policy considerations which are generally supportive of this exploratory phase of the space program from financial and scientific capabilities. A less ambitious program seems to be forecast.

In light of these and other practical limitations, it is more than ever timely to examine the prospects for future space developments. As scientists and budgetary experts begin to think small, this may reduce the previously existing crisis mentality of some lawyers.

Let us suppose, that the foregoing scenario can be normalized so as to allow, over time, based in no small part on successes achieved in extended unmanned space operations, for human presences on space stations, on the Moon, and on Mars. The policy considerations favoring an immediate focus on unmanned activities would have general application to manned activities.

There are two primary considerations. First, there is the benefit to be derived from the acquisition of both scientific and material resources.

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18 L.A. Times, March 21, 1991, at A20, col. 2.

19 Logsdon, *America's Future in Space*, Part 1, 5 SPACE POL'Y 267 (1989); Part 2, 6 SPACE POL'Y 182 (1990); Part 3, 7 SPACE POL'Y 90 (1991); Lerner, *Space Station Changes its Course*, 29 AEROSPACE AMERICA 12 (No. 1, Jan. 1991).

Secondly, there is the real but less tangible benefit to be derived from efforts leading to successful international cooperation, *per se*.

As to resources, these can also be efficiently used and conservation measures can be implemented. Multiple broadcast facilities, for example, can be placed on a single orbiting space object, thereby reducing the number of objects in orbital positions. Through the operation of a limited number of versatile multinational space stations, where unique national contributions can be stressed, it would be possible to reduce the number of objects in orbit and thus contribute to the prevention of collisions and the avoidance of potential contamination and debris. Where there has been a pooling of operational resources there can be a more broadly based sharing in the resulting benefits. If the cooperative base can be extended very widely, thereby making use of the unique contributions of the developing as well as advanced countries, new opportunities would be presented for the wider sharing of the space-derived benefits. In working out such arrangements, it would of course be necessary to arrive at clearcut understandings respecting such controversial matters as the multinational transfer of technology. Issues as to what may be allowed to be transferred, what could be retransferred or disclosed to a third party, and the conditions for compensation would have to be resolved. Special as well as general interests would have to be considered within the larger framework of cooperation. Such relations could lead to cooperative effects in other similar or dissimilar areas.

Legal Problems

This inquiry confronts the interrelated subjects of "challenge" and "international law." They need to be addressed in the context previously identified. Fortunately, as challenges mount law can accommodate to them.

Existing law, consisting of general principles, and more specific rules, is in place, although in some areas somewhat abstract and untested. There are practical reasons why greater precision and creative new approaches should accompany each other into the future. Outlooks of immediacy will influence the process which will include both international agreements and supplemental national legislation. Over time international customary law will become applicable.

Although much productive scholarly and practical attention has been given to the present subject, there are modifying perceptions and unresolved matters which require a thoughtful review.

It becomes necessary to inquire if present prospects for a more modest space station program would reduce the legal complexities associated with it. In responding to an orbiting station (however constituted) or to a station situated on a celestial body, either manned or unmanned, and if manned, composed of either national or international crews, one can ask if this presents problems that have not previously been considered. Are the legal issues now and in the future the same as in the past, except for more realistic structures, and when new missions or a series of new missions are taken into account?

In assessing this situation it must be acknowledged that considerable literature exists.[20] A review of such materials, when examined in the light of changed circumstances, can be helpful in providing guidance for the future. Moreover, some of the thought which had previously been addressed to longer-term perspectives, although having lost part of its immediate relevance, will still be of use in the future. Future legal norms will obviously be based on past achievements.

It is evident that there is an abundance of existing law applicable to space activity taking the form of space stations, either orbiting or situated on a celestial body. However, it must be kept in mind that rapid progress in space technology may produce uncertainties augmented by "a number of abstract, imprecise, insufficient and sometimes contradictory legal rules which are likely to be subject to genuinely differing legal interpretations."[21] Even so, the five UN-based international space agreements and the law of the International Telecommunication Union (ITU)

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20 There has been a large number of articles on the legal aspects of the Moon and Mars missions in the Proceedings of the annual Colloquia on the Law of Outer Space. They include with the authors' names in parenthesis: 17 PROC. COLLOQ. L OUTER SPACE (1975), (Christol, Doyle, Lewis, Kopal, Pikus, Sarkar, and Stoebner); 22 *id.* (1980), (Bourély, Christol, Dupas, and Nauges); 25 *id.* (1983), (Böckstiegel, DeSaussure and Haanappel, Fekete, Kamenetskaya, Rosenfield, Sloup, and Stewart); 27 *id.* (1985), (Böckstiegel, Bourély, DeSaussure, Estradé, Fasan, Goldman, Gorbiel, Gorove, Kamenetskaya, Leaphart, Lederer, Marcoff, Nemes, Sloup, Toth, and Vassilevskaya); 28 *id.* (1986), (E. Galloway, and Ruder); 31 *id.* (1989), (Clayton, Diederiks-Verschoor, Schwetje, and Wirin); 32 *id.* (1990), (Sloup, Spradling, Zwaan and de Vries). Reference to additional sources can be found in the following publications: Bourély, *The Legal Hazards of Transatlantic Cooperation in Space*, 6 SPACE POL'Y 323 (1990); Christol, *Space Stations: A Lawyer's Point of View*, 4 INDIAN J. INT'L L. 488 (1964); DeSaussure, *The Impact of Manned Stations on the Law of Outer Space*, 21 SAN DIEGO L. REV. 985, (1984); Fasan, *Celestial Bodies and the Exploitative Use of Outer Space*, 12 ANNALS AIR & SPACE L. 227 (1987); Gore, *Outer Space, the Global Environment, and International Law into the Next Century*, 57 TENN. L. REV. 329 (1990); Lodico, *A Basis for Jurisdiction on the Space Station*, N.Y. INT'L L. REV. 4 (1989-90); Lessard, *Un pas géant pour l'humanité: aspects juridiques d'un accord pour l'établissement d'une base lunaire*, 14 ANNALS AIR & SPACE L. 377 (1989); March, *Authority of the Space Station Commamder: The Need for Delegation*, 6 GLENDALE L. REV. 73, (1984); Matte, *L'ére des stations spatiales: Coopération internationale et implications juridiques* 13 ANNALS AIR & SPACE L. 279 (1988); McCord, *Responding to the Space Station Agreement: The Extension of U.S. Law into Space*, 77 GEO. L. J. 1938 (1989); Reynolds, *Space Law in the 1990's: An Agenda for Research*, 31 JURIMETRICS J. 1 (1990). *See also* the Annual Reports of COPUOS and its two Subcommittees; SPACE STATIONS: LEGAL ASPECTS OF SCIENTIFIC AND COMMERCIAL USE IN A FRAMEWORK OF TRANSATLANTIC COOPERATION, 5 STUDIES IN AIR AND SPACE LAW (K.-H. Böckstiegel ed. 1985) NATIONAL COMMISSION ON SPACE, PIONEERING THE SPACE FRONTIER (1986); OFFICE OF TECHNOLOGY ASSESSMENT, SPACE STATIONS AND THE LAW: SELECTED LEGAL ISSUES (1986); A.J. YOUNG, LAW AND POLICY IN THE SPACE STATIONS ERA (1989).

21 Nauges, *Legal Aspects of Large Systems in Space: Problems and Prospects*, 25 PROC. COLLOQ. L. OUTER SPACE 269 (1980).

provide a sound and essential basis for understanding rights and duties relating to space stations and missions to the Moon and to Mars.

On the other hand the 1988 quadripartite international agreements between the United States, the members of ESA, Japan, Canada, relating to the construction of the International Space Station have produced some very serious legal problems.[22] In the light of the U.S. constitutional principles funding problems, caused by the U.S. Congress and the limited authority of NASA, the treaty partners of the United States have considered that the United States has not fully implemented its promises. This has been summed up by M. Bourély, who has concluded that "the agreements concerning cooperation in space activities between Europe and the USA are not satisfactory."[23] If the basic project is to succeed, fundamental changes will have to be undertaken.[24]

Since the utility of law can be measured in large part by its certainty there is always a possibility that a formal international agreement could address one or more of the problems likely to arise on board manned space stations. As early as 1979 Bourély called for a United Nations initiative leading to an agreement "laying down rules for manned international spaceflights applicable to all states."[25]

Before examining those situations where new formal agreements would provide rules and procedures governing space-station operations, it will be necessary to refer to the existing principles and rules which beneficially serve the mutual interests of States, international intergovernmental organizations, and private firms in this field of endeavor. It is not surprising in the light of the very rapid evolution of space law, both international and municipal, that there are a myriad of current and relevant legal prescriptions.

In urging the applicability of existing international space law to long-distance and long-duration space exploration, use, and exploitation, commentators have referred to both general and more specific principles and rules. For example, Marcoff has referred to the "general interests"

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22 For a text of the *Agreement on Cooperation in the Detailed Design, Development, Operation, and Utilization of the Permanently Manned Civil Space Station*, signed on September 29, 1988, *see* III UNITED STATES SPACE LAW - NATIONAL AND INTERNATIONAL REGULATION, sec. 22 (S. Gorove ed. 1989).

23 Bourély, *The Legal Hazards of Transatlantic Cooperation in Space*, 6 SPACE POL'Y 331'(1990); Compare, Barnes, *Treaties Are Not the Answer*, 7 SPACE POL'Y 167 (1991); Schwetje, *The Legal Regime of the U.S. Space Station*, 31 PROC. COLLOQ. L.OUTER SPACE 179 (1989).

24 Logsdon, *International Cooperation in the Space Station Programme*, 7 SPACE POL'Y 35 (1991).

25 Bourély, *Towards a Convention on the Legal Status of Manned International Space Flights*, 22 PROC. COLLOQ. L. OUTER SPACE 59 (1980).

provision in Article 1 of the 1967 treaty.[26] He recognized that this principle "keeps its full binding force under present international law. It applies integrally to the issues of the international legal status of all space objects, including all kinds of permanent space stations, interplanetary platforms and large space structures for industrial and commercial use."[27]

Other scholars have been more content to list those more specific and well-established principles and rules which they consider applicable to such activities. One of the more comprehensive listings has been compiled by Rudev. He refers to the areas where a space object may lawfully orbit, the relevance of the peaceful purposes principle, the *res communis* principle, disaster assistance and rescue operations, quarantine, manufacture, intellectual property, noninterference with communications, solar power, jurisdictional matters, including the right of one country to have access to a foreign space object or space station in either normal or emergency situations, and the utilization of transportation systems.[28]

Other experts have noted the applicability of existing principles and rules dealing with individuals in space, safety considerations applicable to them, the avoidance of collisions, debris and pollution, the use of nuclear power sources, the protection to be accorded to a space object while in the orbit of its choice, the applicability of the Common Heritage of Mankind principle to the natural resources of the Moon and other celestial bodies, and the contrast between the *res communis* principle and that of the Common Heritage of Mankind. Other areas regarded to be applicable include registration problems, low-altitude orbits over foreign countries, conflict resolution including the availability of officially sanctioned fact-finding processes, problems arising from living and working in space, on-board discipline, torts, criminal conduct, intellectual property, contracts, choice of law issues, including determining the applicable law relating to civil law situations, the problem of identifying which country is the launching country, tax problems relating to imports and transfers between modules of different nationalities, and other relevant matters. Even this long, and incomplete identification of subjects, deemed relevant by earlier commentators,[29] indicates the nonseverability of the international and municipal ramifications of both space station activity as well as long distance and long duration space ventures. It also demonstrates that such activities and ventures, together with the application of law to them, possess a global quality.

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26 Marcoff, *The International Legal Status of Large Space Structures and the 'General Inerests' Principle*, 27 PROC. COLLOQ. L. OUTER SPACE 264 (1985).

27 *Id.*

28 Rudev, *Manned Orbital Stations: Technico-Legal Aspects*, 28 PROC. COLLOQ. L. OUTER SPACE 281 (1986). He also refers to the possibility that, with the development of the capacity to acquire solar power, devices may become available to provide special illumination for agricultural crops being produced on Earth.

29 For a list of the relevant literature, see *supra* note 20.

The relevance of the foregoing is seen in the terms of the multipartite agreement entitled "Agreement on Cooperation in the Detailed Design, Development, Operation, and Utilization of the Permanently Manned Civil Space Station" signed on September 29, 1988.[30] Standard subjects dealt with in the agreement, especially Articles 5 through 27, were registration, jurisdiction and control, restraint on transfers of ownership of equipment on a space station, user elements and resources derived from the infrastructure, cross-waiver of liability, third party liability, customs and immigration, exchanges of data and goods, treatment of data and goods in transit, choice of law for intellectual property (State of registry), criminal jurisdiction including a code of conduct, and dispute resolution. The agreement also stipulated when it would enter into force, methods for amendment, and the right of withdrawal.

Two subjects which have been widely considered were not dealt with, namely, taxation and tortious conduct. In the important matter of jurisdiction the concept of territoriality was accepted, namely, each contracting party, referred to in the agreement as a "partner," was granted control over the elements which it provided. To shore up this determination each country was authorized to register, pursuant to the UN Registration Convention, the elements provided by it.[31]

While the terms of the 1988 and 1989 agreements cannot be referred to as general international law because of their contractual nature and the limited number of partners, they suggest relevant norms which will be considered by all States engaging in extended space activities. Further, while they do not address themselves to all of the issues listed above, they do nonetheless, deal with those problems having key importance to long-distance and long-duration space activities. Additionally, the terms of these agreements fall within the legal prescriptions contained in the five basic UN international space agreements.

A substantial amount of law, both international and municipal, is presently available for application to space stations and missions to the Moon and Mars. Undoubtedly it will be desirable to concentrate existing law on such efforts by unifying and formalizing the most relevant principles and rules so that a clearly identifiable legal regime will serve as an encouragement to such activities. In order to further this goal, it will be advisable for governmental space lawyers to place high on their several agendas an exchange of ideas between their respective governments. In light of differing perceptions as to priorities and urgencies, an early establishment of common goals is essential.

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30 *Supra* note 22. The parties are the United States, Canada, Japan, and the members of the European Space Agency. This agreement was accompanied by Memorandums of Understanding between NASA and ESA, Sept. 29, 1988 and NASA and Canada and Japan, March 14, 1989. *Id.* at secs. 22(a),(b),(c).

31 Schwetje, *supra* note 23, at 182-188; *Spradling, National Security Uses of the International Space Station*, 32 PROC. COLLOQ. L. OUTER SPACE 410 (1990). *See also*, Shin, *Multinational Space Stations and Choice of Law*, 78 CAL. L. REV. at 1375 (1990).

As this process goes forward the previously identified subjects will have to be considered. Additionally, it is suggested that attention be given to the following: (1) the acquisition of solar power, including safety considerations, for use on orbiting space stations, on fixed stations situated on a celestial body, and also its use for the illumination of the Earth; (2) the formation of rules making it clear that persons on space objects, including space stations, as well as on a celestial body, enjoy all of the rights and duties presently accorded to astronauts in international agreements and pursuant to national laws; (3) the identification of security zones around space objects; (4) the creation of rules designed to facilitate traffic control for space objects and for transportation systems going to and returning from such objects; (5) a further clarification of the circumstances under which nuclear power sources can be employed on space objects and on celestial bodies; (6) an understanding of the term "celestial body," and a determination of the legal regime or regimes applicable to such an entity; and (7) the creation of principles and rules establishing the rights and duties of launching States when they abandon inoperable space objects, including space stations in orbit or on celestial bodies.

Definitional problems may also arise in national statutes. For example, in the United States there has been some speculation as to whether the 1981 "Special Maritime and Territorial Jurisdiction"[32] statute which extends federal criminal law to events on space vehicles also applies to multinational space stations. In planning for such litigation, it will be necessary to determine if federal criminal laws of general applicability on Earth will be well-suited to events occurring on space stations inhabited by individuals of varying nationalities.

As an appropriate legal regime emerges for space stations and missions to the Moon and Mars, there will be a blending of existing laws with those designed particularly for new explorations, exploitations, and uses. This law must meet the critical test of protecting those humans who engage in long-distance and long-duration pursuits, although there will be unmanned elements. When this effort is coupled with multinational participation it becomes evident that it is a complex matter. The complexity is enhanced by the fact that such endeavors will call into play the presence of international intergovernmental organizations and private firms. Especially in the area of liability for damage, the involvement of such participants augments the need for acceptable and understandable legal precepts.

The need to address the content of the applicable legal regime at an early moment is demonstrated by the long time consumed in the negotiation of the 1967-1979 UN space agreements, the more recent Inter-Solar Polar Mission ("Ulysses") agreements, the problems which have arisen respecting the space station, and the Moon-Mars missions.[33]

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33 For texts of the U.N. space agreements, see *op. cit. supra* note 22.

It is the function of most international agreements to create and formulate commitments binding on the parties. However, few of these are self-executing. Frequently, a considerable time elapses between the initial agreement and its entry into force following ratification. Only following this event does it become incumbent on a party to enact implementing national legislation. Such statutes are the source for the rights and duties of those individuals who engage in space missions. These statutes are of critical importance to those engaged in manned space station activities.

Resulting from both the original hope that human benefits would result from space activities, and from highly pragmatic considerations, the exploration, exploitation, and use of space, the Moon, and celestial bodies and their natural resources has become a matter of global interest and concern. Globalization is a concept understood by both advanced and developing countries. These considerations led President Reagan in his speech of January 25, 1984, in calling for a "permanently manned space station" within a decade, to state that "We want our friends to help us meet these challenges and share in the benefits."[34]

Sharing in the benefits will require the use of a governing structure. The nature of the structure will measurably affect the manner and extent to which sharing will take place.

Two quite different approaches are possible. One, referred to as the corporate model, allows participants to invest with the expectation that the most favorably situated countries will invest larger sums than the developing countries. Benefits will be distributed on the basis of investment. INTELSAT represents this model.

The second, or administrative, model consists of all interested countries each having an equal vote and without the restrictions on sharing contemplated in the corporate approach. INMARSAT follows this design. According to Marcoff its program has demonstrated that "cooperation on a global level, management and sharing of profits in accordance with the 'general interest' [Article 1 of the 1967 Principles Treaty] principle is feasible and can be beneficial to all countries."[35]

In each situation the availability of benefits will depend on the management skills brought to the entire exploration, exploitation, and use process. Until recently, there has been a shortage of experienced managers able to relate effectively to the cooperative requirements of large scale space activities. If success is to come to space station and Moon and Mars activities, there will have to be much preparation of the needed multinational team.

Highly imaginative approaches will be essential in order to properly select from among existing legal principles and rules those to be applied to long-duration and long-distance human voyages into space and

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34 I PUBLIC PAPERS OF THE PRESIDENT OF THE UNITED STATES: RONALD REAGAN 90 (1986).

35 *Supra*, note 26, at 268.

onto celestial bodies. These will have to be shaped to the present situation. In any event, they will be supplemented by new ones as the occasion requires. An early need to identify the most relevant principles and rules relating to the critical issue of jurisdiction falls within this area of creativity.

Access to a foreign spacecraft is a case in point. A space object may be somewhat likened to a human being. It can be alive and engaged in many productive activities "during [its] orbital life."[36] On the other hand, its orbital life, in the sense of the constructive activities it was designed to accomplish, may have become terminated by choice or by an accident. In either event, it is not performing its intended function. In these two opposing situations the State of registry may hold different opinions respecting access by a foreign government. Security concerns may exist. Perhaps the space object has reached such a nonfunctional condition that it may be perceived to be debris, even though it retains the same form that it possessed following a successful launch. May a country fearing that the object poses a serious threat to it take, on its independent initiative, protective measures? Or, if unilateral protective action can be justified, would this, nonetheless, depend on a prior agreement and advance notice? Existing space law does not specifically address itself to the rights of the State which seeks to protect itself from such hazards.[37]

Security in a larger sense involves the various measures, including military activity, available to States to protect their territorial integrity and continued independence. In a smaller sense, it includes the protection of classified materials which compose elements of space stations. Clearances and procedures for obtaining access are essential elements for successful joint operations.

Conclusion

It is evident that there is an inextricable relationship between the use of the space shuttle, the aerospace plane, the space station, and an understanding of the Moon and Mars. These related matters present global issues. Success in dealing with them will require very serious and substantial commitments to international cooperation.

Even with a scaled-down approach to operational space stations, there will be ongoing involvements in science and technology, commercial undertakings, and the need for appropriate defense policies. Demilitarization of facilities and activities should be considered. It is expected that practical operations will enlist the combined efforts of

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36 Rudev, *supra*, note 28, at 283.

37 Christol, *Environmental Aspects of Activities in Outer Space - Suggestions for Legal Measures and Instruments for Dealing with Debris*, in : 9 STUDIES IN AIR AND SPACE LAW 257 (K.H. Bøockstiegel ed. 1990). This refers to but one aspect of security against space hazards.

governments, international governmental organizations, and private firms. The latter may be called upon to play a larger role than in the past.

From the legal point of view the most critical issue will be to establish the appropriate areas of jurisdiction for the several actors. It is to be expected that such determinations will be the product of international agreements. Every effort should be made to use standardized terminology. Defined terms should be employed where practical. Once they are formulated, there will be a need for cooperating governments to adopt national legislation implementing the international norms. Uniformity in such prescriptions will be desirable although different national interests and values may treat such issues separately and differently. For example, different countries may hold unique views on patents, taxation, and what constitutes tortious conduct.

Critical matters, including that of jurisdiction, have been disposed of to a large extent in existing international legal norms. Reliance should be placed on the principles and rules set out in the five UN based space agreements, the ITU conventions, WARC agreements, and on the provisions of the 1988 quadripartite space station agreement.[38] These offer assurance that there are no intractable legal problems which would impede long-distance and long-duration space ventures, manned or unmanned.

Admittedly, because of the nature of the projected efforts, there may be special problems. To the extent that these can be imagined before the practical operations begin, they should be addressed and resolved. As experience is gained after the practical efforts have been initiated, there will be a need for modifications. Especially if Earth-bound laws are overly relied upon, there may be a need for appropriate corrections. In any event, as previously suggested, a major function of the law is to afford a high measure of certainty and stability.

Since there will be many national concerns as to the content of an acceptable legal regime, it is highly desirable that governments give early attention to the law and laws for a new era of outer space and celestial body activity. This is particularly required since it is a notorious fact that much time is required to obtain the necessary accommodations to perceived wants and needs.

38 For texts of these agreements, see *op. cit. supra* note 22.

EVENTS OF INTEREST

A. PAST EVENTS

Reports

Tasks and Legal Aspects of the German Space Agency, DARA

Introduction

As a result of a cabinet decision in April 1989 to restructure the management of German space activities and to establish a German Space Agency as the central management organization, the Deutsche Agentur für Raumfahrtangelegenheiten (DARA), started its business activities in July 1989.[1] Following the assumption of duty by *Professor Dr. Wolfgang Wild,* former Bavarian State Minister for Science and the Arts, as Director General of DARA on June 22, 1989, the management board was successively completed by the appointment of three Managing Directors responsible for space infrastructure, space utilization and administration, and finance, respectively. By December 31, 1990, DARA's overall staffing, which was contemplated to reach approximately 300 persons, came to 230 employees. After two years of activities, this report purports to introduce DARA to an interested circle of readers.

Historical Background

The engagement of the Federal Republic of Germany (FRG) in space activities which started in the 1960s basically focused on the achievement of two objectives: acquisition of scientific knowledge and commercialization of space activities. Additionally, the carrying out of space activities also stengthened international cooperation. Therefore, German space policy always involved elements of foreign, economic and technological policy. Space activities have been and remain primarily a governmental task.[2]

Since 1962 the Federal Ministry for Research and Technology (BMFT) has been the main authority responsible for space activities in

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1 *See* Bischoff, *DARA; Raumfahrtpolitsches Management aus privater Hand,* in: DIE ÖFFENTLICHE VERWALTUNG 1990, at 677 *et seq.*; Spude/Staudt, *DARA die neue Deutsche Agentur für Raumfahrtangelegenheiten,* 39 ZEITSCHRIFT FÜR LUFT- UND WELTRAUMRECHT 188 *et seq.* (1990).

2 Finke, *Weltraumpolitik der Bundesrepublik Deutschland,* in: WELTRAUM UND INTERNATIONALE POLITIK 280 *et seq.* (K. Kaiser/S. Frh. von Welck ed. München 1987).

pursuance of a decision of the Federal Chancellor.[3] This main authority, however, does not exclude certain competences of other ministries. The Post Telephone and Telegraph (PTT) Minister, for example, is responsible for the utilization of operational telecommunication systems, thus representing Germany in international organizations, such as the European Telecommunications Satellite Organization (EUTELSAT), the International Telecommunications Satellite Organization (INTELSAT), and the International Maritime Satellite Organization (INMARSAT). Inasmuch as the Ministry for Transportation (BMV) has the prime authority for meteorology, remote sensing, and air traffic control, it represents the German side in the European Organization for the Exploitation of Meteorological Satellites (EUMETSAT). The coordinator for air and space activities in the Federal Ministry of Economics (BMWi) takes care of the interests of German space industry. The Minister of Defense (BMVg) is in charge of space-based verification as well as military communication and navigation systems. The Minister for Foreign Affairs (AA) is always involved whenever the matter concerns international cooperation.

Before the creation of DARA, the Federal Ministry for Research and Technology which served as the main authority was supported by the German Aerospace Research Establishment (DLR) located at Cologne. The DLR has capacities in the fields of research, operation and management.[4] As far as research and operation were concerned, there was only a general guidance by the BMFT. In the field of project management, however, there was a detailed direction by BMFT, and DLR acted on behalf and in the name of BMFT; this task was carried out by the department in charge of the project management of DLR.

Reasons for a New Structure

The need for a new organization of German space management and thus the creation of DARA arose essentially for two reasons. On the one hand, the immediate cause was the decision of the Federal Government in favor of participating in the European Long-Term Plan until the year 2000; this was agreed to at the ministerial level at the January 1985 and November 1987 Council meetings of the European Space Agency (ESA).[5] The Federal Republic's involvement in the ensuing large-scale space program necessitated a review of the previous approach in organizing German space activities. On the other hand, comparisons with space organizations in other countries, especially, with NASA and the French Centre Nationale d'Etudes Spatiales (CNES), were drawn and an analysis of the situation in Germany was made. Among the points of criticism were: lack of a central institution for space matters; lack of established

3 KOORDINIERUNGSTASCHENBUCH FÜR FORSCHUNGS- UND ENTWICKLUNGS-AKTIVITäTEN DER BUNDESREGIERUNG (BMFT, 3rd ed. Bonn, 1980).

4 DLR-ERGEBNISBERICHT 1988, at VIII *et seq.* (Köln Porz, 1989).

5 See Doc. ESA/C-M/LXXX. Res. 1 (final), Chapter I, No. 4 (1987).

procedure for effective coordination between the ministries concerned; splittered competences between BMFT and DLR; and insufficient involvement of industry, science community and space users.[6]

Reorganization of German Space Management in 1989

The above mentioned criticisms led to the Federal Government's decision in April 1989[7] to restructure German space management at the political and implementation levels. The key points of this restructuring were:

- The setting up of a cabinet committee for fundamental space strategy and planning chaired by the Federal Chancellor that includes the ministers for research and technology, foreign affairs, finance, economics, defense, transport, and post telegraph and telecommunications (PTT). The acting chairman on behalf of the Federal Chancellor is the Federal Minister for Research and Technology (BMFT);
- The establishment of a mirror-image undersecretaries' committee under the chairmanship of the BMFT that prepares the decision of the cabinet committee;
- The foundation of the German Agency (DARA) as the central management organization.

DARA's Legal Structure, its Tasks and their Legal Basis

DARA is a private law company with limited liability ("GmbH"). The Federal Government is its only shareholder. This legal construction was adopted to allow maximum flexibility, and especially to attract personnel from industry. DARA's supervisory board has thirteen members: eight representatives of the same federal ministries as in the cabinet committee, the chairman of DLR, and two representatives each from industry and academia. It is chaired by the BMFT representative. The board's objective is to ensure that DARA fulfills its obligations as set forth in the charter. An Advisory Board with a maximum of sixteen members from industry and academia ensures that DARA takes scientific, technical and economic requirements into account when drawing up and implementing the space programs.

The company's charter charges DARA with drafting German space policy and programs for approval by the Federal Government, implementing German space programs, particularly by awarding industrial contracts and financial assistance, and representing German space interests at the international level, especially in ESA. These tasks include the exercise of

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6 IABG-Expert Report for BMFT, Entscheidungsstrukturen und Entscheidungsprozesse im Raumfahrtbereich der Bundesrepublik Deutschland, (Ottobrunn, Dec. 1986); BMFT Press Release 6/87.

7 BMFT Press Release 16/89 of April 26, 1989: "Neuordnung des deutschen Raumfahrtmanagements."

certain sovereign rights. In order to be consistent with the constitution, *i.e.*, German Basic Law ("Grundgesetz"), a law governing the transfer of competence with regard to space activities[8] had to be passed so that governmental responsibilities could be delegated to the private law company, DARA. This law entered into force on June 21, 1990. This first domestic space legislation of the FRG stipulates in a general way an obligation for all authorities, *i.e.*, ministries involved in space activities, to transfer resonsibilities to DARA. Until now only BMFT has done so.[9] In a transitional process that started in October 1989 and was completed in September 1990, BMFT transferred its space responsibilities to DARA with the exception of political decisions.

Drafting of German Space Policy and Programs for Approval by the Federal Government of Germany

Up to now the Federal Government of Germany has promoted space activities in four programs. These programs served as a strategic framework and defined the focal points of German space activities. The fifth German space program currently under preparation by DARA will be introduced in the near future. In contrast to the former four space programs which generally covered a period of four or five years, the fifth program will cover the years from 1990 to 2000.

As a consequence of German unification, DARA is also responsible for space activities in the former German Democratic Republic (GDR), *i.e.*, in the new federal states. One of the major tasks of DARA in the near future will be the development of concrete measures to this end and the implementation of these measures after approval by the relevant political institutions.

Strategic planning comprises the following tasks: (a) detailed elaboration of German participation in international programs and projects; (b) detailed planning of national projects taking into account European, bilateral and multilateral programs; and (c) recommendations, analyses, proposals for projects taking into account technological, economic and financial aspects.

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8 *See* Gesetz zur Übertragung von Verwaltungsaufgaben auf dem Gebiet der Raumfahrt, briefly known as Raumfahrtaufgabenübertragungsgesetz (RAÜG), published in Bürgerliches Gesetzblatt (BGBL), 1990, I, p. 1014, and in: 39 ZEITSCHRIFT FÜR LUFT- UND WELTRAUMRECHT 305 *et seq.* (1990).

9 Bekanntmachung über die Beleihung der Deutschen Agentur für Raumfahrtangelegenheiten (DARA) GmbH mit der Wahrnehmung von Verwaltungsaufgaben, published in: Bundesanzeiger 1990, No. 155, p. 4262, and in: 39 ZEITSCHRIFT FÜR LUFT - UND WELTRAUMRECHT 395 (1990).

Implementation of German Space Programs, Especially by Awarding Industrial Contracts and Financial Assistance

The awarding of industrial contracts and financial assistance as well as the spending of government funds is governed by the rules and regulations of national public law. In concrete terms the implementation of the German space program covers: consultation and support for the federal ministries and public institutions concerned, coordination with industry and scientific bodies; promotion, control and supervision of projects, and evaluation of results; planning and coordinating operations; taking initiatives to encourage commercialization; allocation of funds from the space budget by virtue of legal authorization, and establishment of financial need.

After DARA had taken over responsibility for basic studies and technology in the fields of space research and technology in autumn 1989, responsibilities for the fields of new orbital systems (especially Colombus), space transport systems (especially Ariane, Hermes), micro-gravity research, extraterrestrial research, earth observation, telecommunication, product assurance and programmatic responsibility for the D2 mission (2nd German Spacelab mission) were successively transferred from the BMFT to DARA. Associated with this transfer of resonsibility is DARA's own competence for independent administration and management of the budgetary resources earmarked by the BMFT. This transfer of tasks to DARA in 1990 has meant that, except for a few primarily political matters and the hypersonic technology program, DARA is now in full charge of implementing the German space programs.

In 1990, DARA managed a space budget of 1.4 billion German marks. In 1991, DARA's space budget is 1.6 billion German marks, with 42 million German marks allocated as DARA's own running costs, *i.e.*, only 2.6 percent of the total space budget.

As mentioned above, DARA has been responsible for the management of the united Germany's space activities since October 3, 1990.[10] In order to continue the ongoing projects of the former GDR and especially those of the Institute for Cosmic Research (IFK), DARA has taken over the respective responsibility and has spent approximately 4.3 million German marks in 1990 as research expenditures including costs for materials and assets. Furthermore, DARA envisages to spend about 50 to 80 million German marks in 1991 for these running projects.

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10 See Hobe and Spude, *Unification of German Space Activities - Legal Implications,* 40 ZEITSCHRIFT FÜR LUFT - UND WELTRAUMRECHT 163 (1991).

Representing German Space Interests at the International Level, Especially in ESA

This includes the following tasks: (a) representation of German policies in delegate bodies of ESA and other international organizations (but not at the ministerial level), (b) joint management and supervision of ESA programs, and (c) representation of German policies in the implementation of multilateral and bilateral agreements.

Space activities inevitably lead to international cooperation. German space activities have been and are to a large extent carried out in a European framework, *i.e.*, within ESA, the European Space Agency, which was founded in 1975. On the legal basis of the Raumfahrt-aufgabenübertragungsgesetz (RAÜG), the law governing the transfer of competence with regard to space activities, DARA's Director General heads the German delegation in the ESA Council. Furthermore, responsibility for the supervisory function in the most important ESA delegate bodies, especially in the Program Boards, has moved to DARA during the course of 1990. The political decisions, however, *e.g.*, the decision to participate in an ESA program, remain with the BMFT. In autumn 1991, a ministerial level ESA Council, taking place in Germany, will decide on phase 2, *i.e.*, continuation, of the Columbus and Hermes programs.

In addition to its activities within ESA, DARA carries out projects in cooperation with one or more states such as the successful scientific satellite ROSAT, realized by means of American-British-German cooperation. In doing so, DARA has the power to conclude Memoranda of Understanding with the respective partners, *e. g.*, NASA, in its own name.

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International Bar Association Discusses Space Law in Hong Kong, Sept 20-Oct. 4, 1991.

The International Bar Association's Section on Business Law Committee which deals with outer space, held three half-day sessions during the 10th Biennial Conference that took place in Hong Kong, September 30-October 4, 1991. The first was devoted to the following topic: "Earth observation and the environment - initiatives in Asia and around the world. Opportunities in connection with the space and the earth segments. International and domestic regulation and concerns."

Professor Philippe Gaudrat of France focused on the problem of legal protection of remote sensing data. He argued that such protection was necessary for the commercial exploitation of remote sensing data, and that contractual protection was inadequate. Was remote sensing data protected by copyright? The problem under "Anglo-Saxon" laws was that copyright traditionally attaches not to information as such, but to a form of

expression of information. Can a flow of data from a satellite constitute a work? Is there any originality or creative act involved? No human intervention is involved, but there are preliminary choices to be made, such as the selection of wavelengths and of the satellite orbit. A reference was made to the US Copyright Act, which requires fixation before a work is deemed to be created. In the downlink phase, the data is not fixed and it seems that copyright should not attach to the primary data at this stage. On the other hand, the processed data should be regarded as a work. Although processing is an automatic activity, the creativity lies in the processing software. It was pointed out that, in French law, the requirement of originality is now satisfied by an "intellectual contribution" which need not necessarily be the "author's original stamp." *Professor Gaudrat* made several interesting comparisons with the copyright protection of software and also offered some possible solutions to the conflict of law issues. He concluded that there was no reason in the Anglo-Saxon or civil law systems to refuse protection to processed data.

Mr. Tony Ballard of England saw some prospect of a UK commercial remote sensing venture, and pointed out that the Outer Space Act of 1986 had created a suitable legal climate. However, it was not at present feasible to recover all costs, including satellite costs, from the sale of remote sensing data. *Mr. Ballard* also considered the copyright issues. Under English copyright law, protection is given to literary works, which include a table or compilation. Protection is also given to artistic works, which include a photographic work irrespective of its artistic quality, but photographs must be recorded "on a medium." It was doubtful whether the stream of raw data would benefit from copyright protection. One solution might be to record the signal on the satellite and transmit the recording on a continuous basis. There was also the possibility that the data stream could be regarded as computer-generated data. The 1988 Copyright Act also contained provisions dealing with fraudulent interception of radio transmission. A recent European Centre for Space Law study had revealed some support for the idea that no protection of remote sensing data was required or desirable. Among those holding the opposing view, there was no clear agreement that copyright protection was the desirable technique.

Mr. Leonhard Stärk of Germany delivered a paper in the absence of *Mr. Eckhart Wolff*. He concentrated on technical and commercial matters, giving a survey of remote sensing systems: Landsat, Spot and ERS 1. He referred to the "open skies" data marketing policy of the European Space Agency. ESA licenses the operators of ground stations, and requires them to market data to all customers. Those not participating in ESA programs do not have free access to primary data, but can buy available data on the same terms as others. The evaluation and analysis of data is carried out by a number of companies, which reduces the risk of excessive prices. ESA's policy is not to become involved in the enhancement and marketing of data. The Eurimage company markets ERS and other data, such as that from Landsat.

A lively discussion followed about the commercial viability of remote sensing activities. There was general agreement that it was not yet

possible to recover satellite or even ground station costs, but that the enhancement and marketing of data might in itself be commercially viable.

Gary Edwards of the United States spoke of the uncertainty about the future of Landsat. NASA's planned remote-sensing system will produce huge volumes of data. Where would be the niche for the private operator? *Mr. Edwards* made the robust presumption that data was legally protected. EOSAT had found in general that its claims to proprietary rights were respected. There was little doubt that copyright protection applied. This may not protect the data as such, but it restricts the copying and publication of data. Reference was made to the *BellSouth* (Yellow Pages) case. An advantage of copyright protection was that there was considerable uniformity in national laws by virtue of the Berne Convention. The international conventions do not regulate what are the permissible subjects of copyright protection. It was also possible to rely on the law of confidentiality and trade secrets, which protects the content but not the form of information. The requirements are that the information is of a confidential nature and is imparted in circumstances of confidentiality. An obligation of confidentiality arises if the recipient is aware of the confidential nature of the information.

Mr. Chiyoshi Kawamoto of Japan described NASDA's activities in remote sensing. Although NASDA had its own program of activities, it was also cooperating with CNES, NOAA, EOSAT and Spot. There was no direct law in Japan on remote sensing, although Japan recognized the UN Principles on Remote Sensing. NASDA's activities were conducted in accordance with these principles. NASDA agreements require all those acquiring data to make it available to third parties without discrimination. Broadly speaking, the direct reception of data in other countries is permitted. NASDA has established data as intellectual property by agreement or contract. It was difficult to apply copyright law where the platform provider and the sensor provider were not the same.

The next session was devoted to the following topic: "Commercial space activitiy in Asia - international collaboration and reciprocal benefits. Technology transfer and trading concerns. Role of government in promotion of space commercialisation." *Mr. Norbert Graeber* and *Mr. K. Ninke*, both of the German corporation MBB, gave a presentation on commercial space markets in Asia and MBB's activities in the People's Republic of China. *Mr. Ninke* described Japan as a potential competitor rather than a potential market. Intergovernmental relations provided the framework for commercial activities: for example, through bilateral agreements. From the customer's viewpoint, commercial space activities produced reciprocal benefits, including the possibility of technology transfer or barter. However, controls on the export of sensitive technology were an important constraint.

Guy David of Canada described the Canadian experience in establishing a mobile satellite system. The government approved the MSAT project in 1985 and Telesat Mobile Inc. (TMI) was incorporated to undertake the project. There was considerable government involvement through a series of feasibility and definitional studies, system promotion, financial

support of about $150,000,000, and a $120,000,000 contract signed for MSAT services on behalf of various government users. The government owns 51 per cent of TMI. There had been cooperation with the US in all stages of the project: system design, procurement, etc. The US was undertaking its own MSAT project which was closely linked with the Canadian project through a common system design and mutual redundancy. Bank financing for the Canadian project had only been possible after an initial commitment of $130,000,000 in equity and debenture capital.

John O'Brien of the United States, who has now returned to NASA, reflected on the commercialization of space activities. Telecommunications satellites no longer require government subsidy, but NASA retains its experimental advanced telecommunications program. The means of getting to space was a commercial activity, but it had to be asked whether what is done in space is commercially viable. Space activities involved technical, financial and market risks, but there was also the policy risk; there was need for stability in government space policy. The US government was attempting to create open markets and eliminate unfair competition. *Mr. O'Brien* turned to the need for imaginative foresight in space programs. We should aim to go to Mars: commercial activity always follows exploration. On the question of commercial viability of remote sensing and other space activities, it was necessary to keep in mind fundamental policy. If a result was desirable, it might not be appropriate to entrust a given activity to the private sector on a success or bankruptcy basis. *Mr. O'Brien* concluded with an intriguing speculation arising from the recent presidential statement on a reduction of nuclear weapons. What would happen to all the launch vehicles? Would they be dumped onto the commercial market?

The final session was a joint workshop with Committee Cm (communications law) on the following topic: "Problems and pitfalls of setting up a satellite delivered mobile communications network." *Mr. Henry Goldberg* of the United States chaired the workshop and, in opening, he referred to the potential growth of mobile communications. As regards fixed communications, satellite was gradually being replaced by fibre. There might be an inversion, with broadcasting moving to wire while voice telephony moved to radio.

David Manion of Hong Kong presented the business case for mobile satcoms. He described the activities of AMSC and INMARSAT, but focused on the Iridium system proposed by Motorola. The system would use non-geostationary satellite. It would be operational by 1995 and would produce revenues of 1 billion dollars by the end of the decade. Viability would depend on the resolution of regulatory issues. There were questions about the economic and political acceptability of the system in various countries. Governments want to obtain revenues from voice telephony and want to control it for security and other reasons. There were questions about the acceptance of international billing arrangements.

Mr. Peter Mahoney of Hong Kong described the activities of the Royal Hong Kong Jockey Club and its initiatives with electronic funds transfer. The Jockey Club had already experimented with the use of

satellite broadcasting, and *Mr. Mahoney* expressed the desire of users to have freedom to use satellite communciations in new applications.

Mr. Terry Seddon of Hong Kong drew attention to the bewildering succession of wireless technologies and gave a basic description of satellite communications. He referred to COMSAT and INMARSAT in describing the origins of mobile satellite communication.

Mr. Simon Bull of the United Kingdom expressed some nervousness in speaking as a non-lawyer to an audience of lawyers, but in fact his contribution was extremely well received. He referred to the enormous potential profits and risks of mobile satcoms. There were technology risks: there had not yet been an implementation of the intersatellite communications required by Iridium. Iridium would have an important and established competitor in INMARSAT. Qualcomm had not had to purchase a dedicated satellite but it was probably not making money yet.

Mr. Henry Wise of Hong Kong talked about the regulatory issues which would arise from the use of mobile satellite systems. He pointed out the slow progress which had been made in securing the freedom to use INMARSAT earth stations in the territorial sea and ports.

In a subsequent panel discussion, *Mr. Ian Harper* of Australia spoke of the creation of a competetive market for telecommunication services in Australia, but also referred to measures taken to ensure the viability of Aussat. The present writer emphasized the problems involved in the trans-border use of mobile satcom equipment. Radio licensing and type-approval requirements, together with customs restrictions, created barriers which States might wish to retain for economic or security reasons. *Mr. Guy David* of Canada gave further details of the Canadian MSAT project. Canada did not propose to permit other companies to compete with TMI. This regulatory stance had great significance in making the MSAT project financially viable. *Mr. David* concluded with a discussion of the legal problems involved in providing bank financing for a satellite venture.

One observation which was heard after all three sessions was that there had been insufficient time for comments and discussion from the floor. This slight note of frustration can, however, be taken as an indication of the high level of interest generated by the papers given in Hong Kong.

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International Colloquium on the Law of Outer Space, Montreal, Oct. 8-11, 1991

The 34th Colloquium on the Law of Outer Space took place in Montreal, Canada, during the IAF Congress, held on October 5-12, 1991. The Colloquium and its first session were opened on Tuesday, October 8 by *Dr. N.M. Matte* (Canada) as a representative of the host country of the IAF Congress and a Director of the IISL. He welcomed the participants in the

Colloquium, the first since 1976 to be held in North America and the first ever to be held in Canada. He also elaborated on the close interrelation of the IISL and the IISL Colloquia with the McGill Institute of Air and Space Law, of which many alumni could be found among the IISL members. Finally, *Dr. Matte* expressed his special thanks to long-time IISL President, now President Emeritus Prof. Dr. I.H.Ph. Diederiks-Verschoor, for her important role in the organization of the IISL Colloquia.

Then *Prof. Dr. I.H.Ph. Diederiks-Verschoor* took the floor and thanked *Dr. Matte* for his kind words. She also commemorated *Dr. Subrata Sarkar* who had passed away in the previous year. A moment of silence was taken.

Judge Manfred Lachs, as president of the IISL, introduced *Prof. S. Gorove* as the Chairman of the first session. *Mr. F.G. von der Dunk* acted as Rapporteur. In his opening speech, *Prof. Gorove* dwelt on the importance of the topic of the session, which was "Definitional Issues in Space Law." There are some fundamental terms in space law which are still unresolved as to their precise definition and interpretation. Some of these definitional issues had already arisen from the very beginning of space law. As examples thereof, he enumerated the notions of "space object," "launching" and "procurement." Later on, the notions of "space debris" and "passengers" on board spacecraft required definition.

The first paper was presented by *Prof. Dr. K.H. Böckstiegel,* on "The terms 'Appropriate State' and 'Launching State' in the Space Treaties - indicators of state responsibility and liability for State and private activities." The practical importance of defining those terms is obvious, as States, as much as private enterprise, need to know the principles according to which responsibility and liability are to be attributed. The two terms are often used inconsistently, although at least in space law a distinction was made by creating Article VI in the Outer Space Treaty on responsibility, and an Article VII in the Outer Space Treaty, plus a Liability Convention, to deal with liability. After analysis of Article VI and VII, their history and background, and such issues as national activity and procurement, *Prof. Böckstiegel* concluded that definitions of 'Appropriate State' and 'Launching State' can hardly be said to have been elaborated to a workable extent, and a lot of work remains to be done in this respect.

The second speaker on "Review of definitional issues in space law in the light of development of space activities" was *Dr. He Qizhi.* He started by stating that basically, law should follow scientific and technical development in stead of vice versa. Therefore, in developing law a balance must be found between doing it "too fast" and "too slow." *Dr. He Qizhi* then discussed three categories of definitional issues. The first consisted of definitions that are incomplete, such as those concerning "space object," "astronaut" and "common heritage of mankind." The second category dealt with definitions which are inadequate from a practical point of view, such as the one of "launching State," whereas the third comprised new terms to be defined. An example of the latter was "space debris."

Prof. Dr. V. Kopal, as the third speaker, spoke on "Issues involved in defining outer space, space object and space debris." As to the first one, the problem of defining "outer space" arose when the possibility of activities in outer space became a reality. As a consequence, the issue of delimitation arose, because it became important to provide for a special legal status of the area in order to allow for such activities, whereas it was not clear to what area such status would or should apply. *Prof. Kopal* proposed to solve the issue by taking the lowest possible perigee of orbiting satellites as the downward borderline of outer space, since that lowest possible perigee will not change in the foreseeable future, despite technological developments. In regard of the second problem concerning "space object," the speaker suggested to distinguish three types of space objects to begin with. He called them "space debris," "space stations" and other "space objects." This led him to the third problem of "space debris," and in this respect *Prof. Kopal* suggested to elaborate a definition distinguishing "real" space debris from non-functional space objects and component parts of a space object.

The fourth speaker was *Dr. W.B. Wirin,* who dealt with "Space object and space debris," and the relation between those two notions. He preferred a pragmatic approach to the definitional problem, and cited as an example how the "definition" of "space object," although incomplete and vague, had developed. The term, as used in especially the Outer Space Treaty and the Liability Convention, directly related to the fear of non-spacefaring States in those times of incurring damage caused by de-orbited or wrecked spacecraft. In other words: "space debris" was only important for them as far as there was a real danger of damage, i.e. if the space debris was large enough to pose such risks, and therefore only space objects and their component parts (or launch vehicles or their component parts) qualified as space debris. In another sense as well, "space debris" was considered to be too limited as a term, as it did not include all elements of contamination, such as biological, chemical or nuclear contamination. According to *Dr. Wirin,* these latter sorts of contamination pose a larger problem in the future than "traditional" debris. Thus, the need for a (more comprehensive) definition of "space debris" was made very clear.

Next, the paper of *Prof. Bin Cheng* was summarized by the Chairman. The paper dealt with "Space object and astronauts." The author provided a very comprehensive definition of "space object," covering all objects launched by humans into outer space. In this regard, he proposed to establish a clear borderline between air space and outer space, for example at 96, 110 or 130 kilometres above the Earth. In his opinion, "space object" covers functional and non-functional objects, as well as all things on board, including debris and refuse. As to "astronaut," *Prof. Cheng* suggested a definition covering all who travel to outer space; where "personnel" was already seen as encompassing all persons on board a spacecraft, that term had better be changed into "all persons on board" to avoid confusion.

Then, *Prof. Dr. V.S. Vereshchetin* summarized the paper by *Dr. G. Silvestrov* on "The definition of 'appropriate state'." The author explained that the most likely interpretation of "appropriate state," the

central element of Article VI of the Outer Space Treaty, would be that of "State of nationality," as the nationality of the entity undertaking activities in outer space is of paramount importance. However, he conceded that such an interpretation would not be complete and precise, and he pointed at the possibility of (additionally) covering activities as if "appropriate State" read "launching State." By way of conclusion, *Dr. Silvestrov* suggested a twofold approach. With regard to the launching phase, where launching is indeed the most fundamental link with one State or another, it seemed logical and consistent to interpret "appropriate State" as "launching State" for the purpose of apportioning international responsibility under Article VI of the Outer Space Treaty. With regard to the post-launching phase however, the jurisdiction of the registration State of the object involved in the activities or undertaking them should be exclusive, and that State should be the "appropriate State" under Article VI.

Since he had to leave the Colloquium early, *Hon. E.R. Finch* was allowed some time by the chairman to present his paper on "Future space commercialization and space debris". He stated that the problem of "space debris" was indeed a serious one; he even called it a "universal killer of outer space benefits for all". For this reason, he considered it necessary to conclude a new space debris treaty by 1994 or 1995, after conclusion of a UN working group study which should presently be undertaken. This study should shed more light on the definition of "space debris," if it would not indeed have to formulate such a definition. The speaker then entered into the relationship between the notions of "space debris" and "space object," dealt with the uselessness of freedom of use and exploration of outer space if the debris problem would not be solved and finally urged all nations to look forward when dealing with those issues.

Finally, *Judge Manfred Lachs* provided his thoughts on the general topic of "Definitional issues." As an example, he pointed at the importance of precise definitions of issues as "province of all mankind," "interests of all countries" and "common heritage of mankind," as in for instance Article I of the Outer Space Treaty and Article 11(1) of the Moon Agreement. These definitional issues have far-reaching consequences for deriving benefits from the outer space venture, since such definitions, as well as others, help to identify objects and subjects of the law, and help to juridically interpret the behaviour of persons and States. As the 25th anniversary of the conclusion of the Outer Space Treaty is very near, this provides for a moral obligation now to expand upon that very comprehensive Treaty, and to fill its loopholes in order to keep it operable and workable for many more years. All this, while taking due care of the context in which the space treaties and the definitions involved operate.

During the ensuing discussion, *Dr. H. Safavi* noted that a definition of "outer space" is indeed important, and referred to his proposal of thirty years earlier to establish a definite boundary of 110 km, irrespective of perigees or other technical criteria.

Prof. Dr. C.Q. Christol provided a historical, a philosophical and a practical remark. Historically speaking, he noted a growing trend towards

more specificity in legal terms, which was reflected in the discussions on "definitional issues". As a philosophical note, he remarked that making of definitions first and foremost amounted to making choices. From a practical point of view, definitions were necessary both in respect of more or less tangible "things" such as "debris", "space object", "responsibility" etc., and in respect of clearly intangible "things" such as "province of all mankind" and "common heritage of mankind". Finally, he suggested that apart from UNCOPUOS, there might be other institutions such as the ILC which could become involved in dealing with the definitional problems.

The last intervention was made by *Dr. L. Perek*. He noticed a certain evolution in the understanding of what constituted "space debris". Whereas it first seemed to point to "fragments" of whatever kind, it now seems to focus more on aspects of "uncontrolability". He argued strongly in favour of legal definition following these practical and scientific understandings, in this respect as well as elsewhere.

Finally, the Chairman closed the session after concluding that the time seemed very ripe to elaborate on the key notions discussed. He expressed the hope that the International Institute of Space Law would meet those challenges, or at least sincerely contribute to their solution.

The second session of the Colloquium dealt with "Legal aspects of settlements on the Moon and Mars". *Prof. Dr. N.M. Matte* was the Chairman, and *Mr. J.S. Thaker* was the session's rapporteur.

The Chairman, in opening the session, made mention of the Moon landing of 1969, and the subsequent excitement that followed. He also mentioned the American 'Space Exploration Initiative', and noted that the political will and technology exist. What remains to be done, he concluded, is to continue the idea of the Lunar Development Agency and to seriously consider the International Mars Mission Final Report produced by the 1991 session of the International Space University in Toulouse. He then turned the session over to that afternoon's speakers.

The first presentation was given by *Ms. M. Ulrich*, of a paper entitled "Transition of control and jurisdiction over space settlements", which was co-authored by *Prof. H. DeSaussure* and herself. *Ms. Ulrich* described the manner in which orderly transition of power and government from earth-based sources to planetary communities could be achieved. She warned that the "state of registry" notion which currently determines jurisdiction and control over persons and property in outer space, and which is rooted in state sovereignty and territorial acquisition, will lead to chaos if applied to future space settlements. It is natural, she said, that as space habitation becomes routine and permanent, bonds of inhabitants of these settlements will weaken and hence the extension of (diverse) national laws to outer space will be less justified. To begin with, mutual agreement between participating states ought to decide what law will apply and ultimately, a universal code governing space settlements established by an international agency will be required for orderly governance. During the age of transition - the period between the first Lunar or Martian outpost and the establishment of an independent space oriented society - an

international supervisory agency will be needed to ensure that earth's diverse legal regimes are not transported into outer space. A trusteeship, an international corporation, etc. could be formed in this regard.

Mr. M. Hintz spoke next on "Environmental aspects of settlements on the Moon and Mars: planetary protection". After briefly acquainting his audience with the history of planetary protection, he listed the possible risks that manned missions could cause to the lunar and martian atmospheres and to the ecosystem of, and possible life on, Mars. A detailed look at the current status of the law with respect to this matter, i.e. art. IX of the Space Treaty, was then made. The speaker concluded by making suggestions on planetary protection for the future.

Dr. C.C. Okolie then presented his paper on "International law principle of jurisdiction in regard to settlements of humankind on the Moon and Mars". The 1980's saw the rise of space commercialization and privatization of space activities, with legislation being passed in the US and various European countries to protect the activities of their domestic companies in outer space. *Dr. Okolie* did not doubt that intensive commercial activities will be linked to human settlements on the Moon and Mars. He argued that, from a commercialization and privatization viewpoint, claims to space resources, inventions made in outer space and other rights may be made on the ground of jurisdiction 'in personam' and jurisdiction 'in rem', and that although such claims in outer space have been forbidden by the Outer Space Treaty, it will be necessary for jurisdiction to be re-examined because of the problems posed by commercial activities, and also to lead jurists to a better understanding of other legal problems concerning space exploration. The speaker then entered into a detailed discussion on the interpretation of jurisdiction 'in personam' and 'in rem', and debated the concept of domicile and residence on space stations and/or settlements. In concluding, *Dr. Okolie* urged for the development of new rules to regulate space living, and he emphasized the fact that stations and settlements will give us the opportunity to develop one universal language, culture and civilization.

Mr. C. Rebellon Betancourt followed with his talk on "Legal aspects of settlements on the Moon and Mars". He began with a detailed look at the principles of the Outer Space Treaty, placing emphasis on the liability principles. He discussed within the context of the Treaty the concept of the common heritage of mankind and the important question of jurisdiction. He proposed that one single law ought to regulate human activities on the celestial bodies and on space stations, listing the constitutional principles of Lunar and Martian settlements.

Dr. H. Safavi's title was the same as that of the previous speaker. However, his paper was broader in nature, including a discussion on the purposes of settlement of the Moon and Mars, and the importance of the protection of the environments of these bodies. He examined the legal aspects of such settlements in detail, placing emphasis on matters like the freedom of exploration, the registration of space objects, Art. 11 of the Moon Treaty, and also touching upon the topic of jurisdiction. To conclude, he made note of the various benefits that these settlements could bring to

earth and he called for the conclusion of a new international convention concerning the settlement on celestial bodies, so as to guarantee the peace, security, the progress of science, education and better social and economic life for humans.

The final speaker in this session was *Dr. P. Sterns*, who presented the paper she had co-authored with *Dr. L. Tennen*, and which was entitled "Legal aspects of settlements on the Moon and Mars: international legal infrastructure and environmental considerations." The speaker, after a brief introduction of the subject-matter of her talk, laid out the basic concepts of the planetary environmental policy. She underlined the fact that in our exploitation of the Moon or Mars, we must understand the role of life, and take precautions against destroying extra-terrestrial life. Missions should be conducted having due regard for these pristine environments. In our environmental efforts, we must pool intellectual and financial resources. The speaker discussed principles of environmental protection in the "corpus juris spatialis" and, in closing, examined the needs of the inhabitants of space settlements for self-government and autonomy.

The discussion period that followed the presentations was largely taken up by the issue of "universal language, culture and civilization" on space stations and settlements that *Dr. Okolie* referred to in his speech. Also, time was spent on the discussion of the right to self-determination of space settlements, which was compared to terrestrial situations. Furthermore, the discussion focused on the interdisciplinary approach that was required to successfully determine the laws that should govern such settlements. Here, various non-lawyers took part in the debate, which was widely appreciated by the lawyers. *Prof. H. Almond Jr., Ms. J.I. Gabrynowicz, Mr. M. Duke, Mr. M. Ashkenazi, Mr. F. Smith and Lt. Col. F.K. Schwetje* participated in these deliberations.

The third session of Thursday 10 October was intended to deal with "Legal Implications of Nuclear Power for Satellites," but due to the large number of papers scheduled for the Friday session on "Other legal subjects" it was decided that some of these papers would be presented during the present session. The session was chaired by *Prof. Dr. K.H. Böckstiegel* and *Ms. P.M. Meredith* was the Rapporteur.

Four authors presented papers on the topic "Legal implications of nuclear power for satellites." In her paper entitled "The legal regime of nuclear power satellites: a problem at the cross-roads of nuclear law and space law." *Mme. S. Courteix* discussed nuclear-powered satellites in the context of nuclear law and space law. She considered the application of legal principles from both of these two bodies of law with respect to the prevention of accidents or incidents involving nuclear-powered satellites, emergency measures and crisis management, and compensation for damages.

The remarks of the three remaining authors focused on the United Nations draft principles on the use of nuclear power sources in space. This item had been on the agenda of the Legal Subcommittee of UNCOPUOS for over a decade under the heading "Elaboration of Draft Principles Relevant to the Use of Nuclear Power Sources in Outer Space."

In his paper "The use of nuclear power Sources in outer space: a set of United Nations principles," *Dr. V. Kopal* provided a historic perspective and discussed recent developments regarding these principles. *Dr. Kopal* noted that when the conclusion of the work on these Principles seemed imminent at the 28th session of the COPUOS Scientific and Technical Subcommittee in New York in 1991, the USA chose to re-open the discussions about Principle 3, which sets forth criteria for safe use of nuclear power sources in space.

Ms. Y. Lodico suggested that the proposed US changes would "strengthen the principles." In her paper "Developing legal principles for the safe use of nuclear power sources in outer space," *Ms. Lodico* noted that also the International Atomic Energy Agency (IAEA) had proposed that Principle 3 be reconsidered. IAEA recommended that the dose limitation specified in Principle 3 be changed to reflect the current exposure recommendations of the International Commission on Radiological Protection (ICRP).

Dr. A.D. Terekhov focused on Principle 8, which deals with international responsibility for activities involving nuclear power sources in space. In his paper, entitled "International responsibility for using nuclear power sources in outer space - reflections on the text adopted by COPUOS," he pointed out that the principles, when they are adopted, will not be legally binding. This presents a problem, he argued, since "international responsibility arises only in the case where an international legal norm is violated."

The papers of the session on "Other legal subjects" which were presented during this session had been divided into three general categories: space environmental issues, space commercialisation and satellite communications.

Dr. J.F. Galloway started the discussion on space environmental issues with a paper entitled "Protecting the Ozone layer: the 1990 London revisions to the Montreal Protocol". Referring to his previous papers presented before the IISL dealing with the Vienna Convention for the Protection of the Ozone Layer (1985) and the Montreal Protocol (1987), *Dr. Galloway* focused his attention this time on the 1990 London revisions to the Montreal Protocol. He offered an interdisciplinary analysis of these revisions, including perspectives from science, technology, politics, economics and ethics.

Mr. S. Hobe presented a paper on "Space debris: a proposal for its international legal regulation". He proposed an international agreement for the protection of the outer space environment to be elaborated within COPUOS. His proposal was prompted by the fact that the current legal regime does not adequately deal with the problem of space debris.

Dr. Popescu agreed that current international law does not provide sufficiently for the protection of the space environment and she also proposed a new convention. Her paper on "The draft convention on global environment protection and outer space conservation" elaborates on what the ingredients of such a convention might be.

Further, on the issue of the inadequacy of international law, *Dr. B.A. Hurwitz* dealt with "An international compensation fund for damage caused by space objects." He noted that the Liability Convention does not provide any mechanism to ensure the actual payment of claims pursuant to the Convention. Several of the major launching States do not have the funds to compensate the victims. Therefore, *Dr. Hurwitz* proposed the creation of an international compensation fund, to which launching states would contribute, and from which victims would receive compensation.

The discussion on the topic related to space commercialization began with the presentation by *Prof. T. Kosuge* of his paper "An international regime for effective use of space resources - radio frequency spectrum and Geostationary orbit". Prof. Kosuge proposed to establish an "international regime of tax on utilization of space resources, radio frequency spectrum and Geostationary orbit". He suggested that the tax revenues could be used for the development of telecommunications infrastructures in developing countries.

Prof. P.B. Larsen's presentation focused on the protection of security interests in satellites. His paper entitled "Creditors' security interests in satellites" noted that the protection of security interests in satellites is complicated by the fact that satellites are in contact with many legal systems. He recommended that COPUOS commence work on amendments to the Registration Convention, or, alternatively, that the UN Committee on International Trade Law or UNIDROIT prepare a new convention establishing a legal regime for the protection of security interests in satellites.

In her paper on "Risk allocation provisions in commercial launch contracts", *Ms. P.L. Meredith* discussed the results of a comparison she had made of risk allocation provisions of five commercial launch contracts. She concluded that a remarkable similarity exists among the risk-sharing arrangements adopted for the contracts compared.

On the topic of satellite communications, *Mr. P.H. Tuinder* discussed the European Space Agency's (ESA) Olympus direct broadcast satellite project in the context of the ESA Convention. In his paper "ESA and the development of space law - the Olympus programme," which he wrote in cooperation with *Dr. O. Ribbelink*, *Mr. Tuinder* suggested that an issue may be raised as to whether Olympus was in accordance with ESA's purpose, namely to research and develop space technology. He noted that the technology upon which Olympus was based was already mature, as evidenced by the fact that France and Germany launched their own direct broadcasting satellites.

Dr. M.L. Smith presented his paper on "Legal and policy developments in international satellite communications". The paper surveyed recent and upcoming developments within the International Telecommunication Union (ITU), including the World Administrative Radio Conference (WARC) scheduled for 1992. *Dr. Smith* also discussed Tongasat's attempt to lay claim to radio frequencies and orbital positions through the ITU registration process for 31 satellite networks. He referred to what he called "innovative action" by the International Radio Frequency

Board, which led Tonga to cancel all but six of the satellite networks that had been the subject of advance publication for Tongasat.

In the discussion, several comments were directed at *Prof. Kosuge* and his proposal for an international tax on the use of the Geostationary orbit and associated frequencies.

Dr. D. Popescu suggested that the tax might conflict with the "freedom of use of outer space" - a cardinal principle of international space law.

Dr. M.L. Smith noted that the economic impact on space operators might be severe.

Dr. A.D. Terekhov took issue with a statement by *Dr. Hurwitz* in his presentation that the Liability Convention provided the legal framework for settling the dispute concerning the "Cosmos 954" accident. *Dr. Terekhov* argued that the settlement between Canada and the USSR had been reached outside the Convention, since the Soviet Union denied that "damage" was caused within the meaning of the convention.

Prof. Dr. C.Q. Christol made an observation with respect to the nature of the orbit and spectrum resources. The notion that these resources are limited, he said, presupposes that science and technology are "closed universes", which they are not. In the sense that technological advances are possible and likely to occur, it may be more appropriate to characterize the orbit and spectrum as "unlimited resources".

Ms. J.I. Gabrynowicz disagreed with the statement by *Mr. Tuinder* that the Olympus project fell outside the ESA mission.

Dr. M. Bourély, the former ESA Legal Adviser, supported her and argued that Olympus fell within the purposes of ESA as stated in its Convention.

Mr. F.G. von der Dunk, in commenting on *Dr. Smith's* paper, suggested that Tongasat's attempt to lay claim on orbital positions in excess of its needs was nothing but "smart entrepreneurship." *Dr. Smith* disagreed. From a broader perspective, he contended, the Tongasat filings presented a "grave danger" to the integrity of the ITU regulatory system, which relies on the good faith of nations. After these interventions, the Chairman closed the session.

The last session of the Colloquium dealt, as usual, with topics falling under the general heading "Other legal subjects." The session was chaired by *Dr. V.S. Vereshchetin,* and *Dr. B. Schmidt-Tedd* was the Rapporteur.

Dr. R.S. Jakhu was the first speaker to present his paper, which was entitled "Space debris in the geostationary orbit: a matter of concern for the ITU." Dr. Jakhu emphasized the growing problem of space debris in the geostationary orbit and discussed possible procedures and policies to remove dead satellites. Up till now, only 30 to 35 satellites have been deliberately removed at the end of their useful life. At the 1985 ITU Space WARC some states advocated a compulsory removal. Later, the CCIR recommended the establishment of clear guidelines and information on how satellites may be safely removed. The author felt that the ITU is the most appropriate international organization for the settlement of debris

problems in the GSO and proposed extra efforts to pursue this issue in the CCIR. Non-binding resolutions and recommendations of the ITU might be a first step towards an international treaty.

Next, *Dr. W.B. Wirin* presented his paper on "US policy on launches by the People's Republic of China." He elaborated on the ideas exposed in his paper about the general US policy as established by the Reagan administration. This policy consisted of a prohibition for the People's Republic of China to provide launch services for Western satellites. The Bush administration had made an exception to his rule by allowing the export of the AUSSAT-satellite in 1990.

Dr. L. Haeck explained that research and ballistic missile defense and related systems are areas of vital interest to Canada, and that the Canadian military must be capable of monitoring events closely and of advising the government. His paper "Space law in military academies in North America" set out that recent operations in Iraq had demonstrated the unprecedented degree to which space systems have become integrated in day-to-day battlefield operations. Strategic analysts should not only be familiar with the potential use of most space technology, but also with the space treaties. Space law is already part of the curriculum of several military academies in North America, and *Dr. Haeck* gave an overview of the Canadian activities in this respect.

Prof. G. Catalano Sgrosso, in her paper on "Non-discriminatory access of sensed states to data and information obtained by remote sensing," reflected upon the relation between on the one hand the principle of exploration and use on a non-discriminatory basis as laid down in the Space Treaty, and on the other the principles of sovereignty and non-interference in the internal affairs of other states with regard to remote sensing. She explained the main operating systems such as LANDSAT, SPOT, ERS-I and the Soviet initiatives in this field, and indicated that a special problem in view of the distribution of information is the fact that many states have, either in part or totally, entrusted private entities with remote sensing activities (cf. the privatization of LANDSAT in 1979). Of special interest are Principles X and XI of UN Res. 41/65 on remote sensing, which deal respectively with the protection of the earth's natural environment and the protection of mankind from natural disasters. Both principles establish the obligation to transmit relevant data to the states concerned. Despite the vagueness of the term "information," Prof. Catalano Sgrosso interpreted it so as to refer to both processed and analyzed data. These principles confirmed, in her view, the theory on the creation of an "aerospatial functional environmental system," which denies the necessity of a distinction between air space and outer space, affirming the singleness of aerospace.

In his paper entitled "Air and space transit: international law and space law: clarification of law and policy," *Prof. C.Q. Christol* outlined the need to establish separate legal principles applicable to aerospace planes next to the mature legal systems which govern the activities of aircraft and space objects. He observed that the considerations regarding such a regime either favour a unique legal regime or distinguish between sovereign air

space and free outer space. These considerations are based on two different theories, viz. the functional theory and the spatial theory. The author argues that although the functional theory with the formulation of one single legal regime may be acceptable for traditional space objects and the space shuttle, they are not for a hybrid spacecraft such as the aerospace plane; the "unitary perspective" cannot meet the needs of a vehicle with dual capabilities. *Prof. Christol* distinguished between two allocative criteria to determine whether to apply air law of space law: (1) the intended purpose of the hybrid vehicle, and (2) the effects of hybrid vehicular activity. Since purpose or effect will be the critical determinates in identifying the specific legal status, it will not be necessary to rely on functional or spatial considerations, and furthermore this approach would allow for full reference to existing international space law.

Ms. J.I. Gabrynowicz talked about "Space law and feminist jurisprudence" and explained that she used the term "feminist jurisprudence" in a large sense, addressing issues of interrelatedness of humans among themselves and with the planetary ecosystem. She felt that the information age has too little consideration for human aspects, the ethic of care and the ethic rights. Nevertheless, she demonstrated that the space treaties incorporate care ethic values. As an example, she mentioned Intelsat, which provided various countries with affordable access to satellite communications decades before they would have been able to develop their own capability. At present, the Mission to Planet Earth is the largest "care ethic space activity."

Next, the rapporteur of this session, *Dr. B. Schmidt-Tedd,* presented his paper "Data Sharing Agreement for the German Spacelab D-2 Mission - a new approach for protection of intellectual property rights in scientific cooperation." He presented this agreement as a practical example of how to protect publication rights by self-selected procedures during an open cooperation and data sharing. The practical background is the cooperation on human physiology experiments during the D-2 Mission. The Agreement comprises three different relations: the inter-Agency relation, Standard terms between Agency and Investigators and a joint declaration of the investigators. The basic concept has as key-elements a Data Sharing Plan and a Data Publication Plan. During a period of projected publication, each investigator of the group has the exclusive right to publish the results of his experiment. Finally, the author discussed the similarities and differences between the period of protected publication and the principle of prior access according to the new ESA Rules concerning information and data.

Prof. F. Lyall reflected on the question "Space law: what law or which law?" and pointed out that space law is an area classification and not a traditional category of law. It involves matters of public, private and commercial law, e.g. insurance, copyright, safety control, launch contracts etc. Private international space law hardly exists but there is a well developed set of laws and regulation of space activities in the United States that serves as a model for many international activities. *Prof. Lyall* compared this situation with the development of the law of the sea, which

was largely dominated by English law. Nevertheless he saw the need for a truly international forum for the discussion and standardization of space law practice, at least for the very practical commercial space activities. This matter should in his view be forwarded to UNCITRAL, before too many different approaches are adopted by various jurisdictions.

The next paper was presented by *Prof. P.M. Martin*, on "Legal consequences of the lack of French space legislation." His starting point was the liability situation for launches from the Guyana Space Center. Originally, according to an agreement of 1976 between ESA and France, ESA has priority in the use of the launch pads and therefore ESA guaranteed France against liability claims. In 1980 several European governments subscribed the Declaration on Ariane, which arranges for Arianespace to carry out the launches and for the French government to bear the cost of any liability notwithstanding Artl. 13 of the Guyana Space Center Agreement. Claims for compensation either fall under the Liability Convention or under French municipal law. Special procedural questions arise when French law is applicable. Whether an administrative tribunal or a civil court is competent may make a big difference for the settlement of space business cases; a decision of the "Tribunal des Conflits" may take several years. Therefore, Prof. Martin urged for national space legislation in France which would make civil courts competent for space law disputes.

Mrs. T. Masson-Zwaan presented the paper she had written with *Mr. W.W.C. de Vries*, entitled "The establishment of a legal regime for the exploitation of the natural resources of the Moon and other celestial bodies: when and how?" In order to determine how the natural resources of the moon should be regulated, the speaker compared two other areas, the deep seabed and Antarctica, where natural resources also exist. Regarding the seabed, as an alternative to the unsuccessful Law of the Sea Convention, eight developed nations signed the Provisional Understanding Regarding Deep Seabed Matters. This agreement does not have a system of control over nations not party to the agreement, and access and non-interference are assured only among eight states. Concerning Antarctica, a Minerals Treaty was adopted in 1988, but subsequent environmental disasters led to a political climate of agreement that Antarctica should be preserved for future generations. The treaty has been replaced by a new instrument which forbids all exploitation activities for a period of fifty years. On the basis of the lessons learned from these analogies, the authors proposed two approaches for the establishment of an exploitation regime. On the one hand, a universal solution does not seem impossible and the speaker provided some details on how to achieve it. On the other, a small-scale agreement among like-minded parties similar to the agreement for the deep seabed could work well, of course avoiding the problems encountered there. The authors conclude that the universal approach fulfills the main purposes of the regime as laid down in Article 11 par. 7. The small-scale approach, although it does not directly violate international space law, fails to comply with some of its underlying principles.

Mr. M. Rothblatt talked about "Low earth orbit satellite communications systems" and outlined the institutional and regulatory

issues arising from the use of new low earth orbit (LEO) systems since Geostar Corp. inaugurated the first commercial LEO satellite communications early 1987. In contrast to geostationary satellites which operate for a single region, LEO systems have global activities; therefore an internationally coordinated legal regime is necessary. *Mr. Rothblatt* provided a practical example of the effectiveness of Geostar system 1, recovering two stolen trucks by means of its tracking capabilities. A series of proposals for new LEO systems followed. In the USA these systems have to be transmitted to the Federal Communications Commission. The third wave of proposals were designed to operate near the microwave frequency, to provide normal cellular-phone type telecom service anywhere in the world. Those proposals raise unique institutional and regulatory issues because of their interference with traditional telecom services. Nevertheless, the author felt that there would be no way to enforce any kind of restriction for long.

In his paper "Gun launch to space: international policy and legal considerations", *Mr. M. Potter* presented the technology and application of "Gun launch to space" (GLTS) against the recent background of the destruction of the supergun in Iraq. Space guns are typical "dual use" technology that can be used either for military of for civilian/commercial applications. One military application for GLTS would be the rapid launch of reconnaissance and communications satellites for use by tactical battlefield commanders. A civil application could be the supply of expendables such as air, fuel and water to the space station. A controversial commercial proposal has recently been put forward, calling for a UN structure of nuclear waste disposal. The proposed applications raise a number of space law issues, such as liability concerns, potential pollution, or the well-known question about where outer space begins and air space ends. An essential question for Mr. Potter was whether or not developing countries should be supported by the development of such space gun technology. Despite the bad experience of military abuse by Iraq, the author supported the free access of developing countries to such inexpensive space projects; the contrary could be a discrimination in the sense of art. 1 of the Space Treaty.

Lt. Col. F.K. Schwetje gave an overview of the US legislation to implement the Missile Technology Control Regime (MTCR) agreed upon by a number of space-faring nations. His paper "US legislation to implement the Missile Technology Control Regime" explains that the purpose of the guidelines is to limit the proliferation of nuclear weapons and missile technology by controlling transfers of technology. MTCR established two categories of equipment and technology: category I items are those systems capable of delivering at least a 500 kg payload to a range of 300 km or more. The transfer of those items will be authorized only when enumerated government to government assurances are given, and the recipient government assumes responsibility that the item is put only to its stated end-use. Violations of MTCR as implemented by the US Export Administration Act of 1979 and the Arms Export Control Act, are punished by Presidential sanctions such as denial of licenses. Similar

sanctions exist for foreign persons importing such technology. Therefore, the author concluded that both domestic and foreign corporations should be aware of the high risks for their business in case of violation of MTCR rules.

The next paper dealt with "United Nations peacekeeping in the age of ballistic missile defense." Its author, *Mr. G.P. Sloup*, described different initiatives against the proliferation of ballistic missile technology and weapons of mass destruction and especially the peacekeeping role of the UN and its instruments. The Gulf war has demonstrated the increasing risk of proliferation of longer-range ballistic missiles to third world states or sub-state political entities. At the same time, *Mr. Sloup* observed a renewed hope that the UN could maintain international peace and security through effective collective measures. Export control laws can always be violated; therefore, *Mr. Sloup* believed that direct UN peacekeeping activities would be more effective. After an overview of the past and present UN peacekeeping missions, he analyzed the differences between Chapter VI and VII of the UN Charter. Chapter VII has never yet been invoked in its entirety. This led to peacekeeping operations as "holding actions," forming a bridge between the voluntary dispute resolution techniques of Chapter VI and the enforcement techniques of Chapter VII. The author concluded that the concept and legal basis of UN peacekeeping is not incompatible with ballistic missile defence operations.

Prof. Sybesma-Knol presented a paper on "Delimitation and outer space: a conceptual approach". She explained that the word "and" in the title refers to questions about effective control and management of the areas concerned. There are several definitions about the recognition of authority over areas which belong to nobody. *Prof. Sybesma-Knol* mentioned the Las Palmas and the Eastern Greenland case. However, fundamental changes have taken place, since some 25 years ago the international community started to formally designate certain areas (the deep seabed, outer space) as "res communis" in the sense of the common heritage of mankind. The important consequence is that the international community assumes the exercize of effective control and continuous authority. With regard to outer space, the fundamental question is whether current space law meets this condition of effective control and continuous display of authority necessary for the international community to retain its legal title over the area of outer space. The author said that such is not the case until now. She recommended that the international community soon begins to fill this legal void in order to safeguard the concept of "common heritage" for outer space.

The last speaker in the session was *Mr. F.G. von der Dunk*, who presented his paper on "Liability versus responsibility in space law: misconception or misconstruction?". Art. 6 of the Space Treaty refers to responsibility, whereas art. 7 deals with liability. The author indicated that it is surprising to see that two of the authentic treaty languages - French and Spanish - have only one term for these two notions. His analysis leads the author to the conclusion that the traditional construction of the

two concepts in general international law is a misconstruction. A further point in *Mr. von der Dunk's* presentation was the proposal of the ILC according to which the term "liability" should be used exclusively for acts not prohibited as such under international law. This would draw a clear borderline between cases where responsibility is involved and those involving liability. *Mr. von der Dunk* however concluded that the proposed matrix remained semantics and created a misconcept. In space law, the liability concept as a whole does not conform to the above matrix, but rather to the traditional concept of international liability. The author proposed a simplifying option. Liability should become part of the principle of state responsibility. By making liability a sub-principle of responsibility it would become applicable only once responsibility has already been found to be involved.

Before the discussion, the floor was given to *Mr. P.H. Tuinder,* Secretary of the European Centre for Space Law, who gave an overview of this Centre's past and future activities. He mentioned that a publication about national space agencies is in preparation and that the current research project deals with intellectual property rights.

In the discussion which followed the numerous presentations of this fourth session, *Prof. Dr. K.H. Böckstiegel* pointed out that in his view the session on "Other legal subjects" was most stimulating and interesting. It provided an occasion to present a number of different subjects related to practical space business. He therefore suggested to maintain such an open subject in the sequence of the sessions. With regard to the presentation of *Prof. Lyall,* he agreed with the proposal to make use of the UNCITRAL mechanisms to develop model contracts for at least the commercial and practical Law of Space. UNCITRAL has been quite successful in some areas of international commercial law. Nevertheless, he would recommend to combine the know-how of both UNCITRAL and UNCOPUOS.

Dr. C.C. Okolie referred to the presentation of *Prof. Christol* about air and space transit. He felt that the theory about the two "allocative criteria" was timely and logical. In his view it was equally contributory for the development of air and space law to recognize the concept of practicality of the claim of jurisdiction advanced by *C.W. Jenks,* who argued that "any projection of territorial sovereignty into space beyond the atmosphere would be inconsistent with the basic astronomical facts." On the question of "functional jurisdiction," *Dr. Csabafi,* in his book on "The concept of State jurisdiction in international space law" argued that "functional jurisdiction" is premised on the right of a State in international law to regulate rights of persons, or property of things, events and occurrences in designated zones. Thus, Dr. Okolie observed that these theories and concepts are generally carried out by legislative, executive and judicial measures to the extent and for the period of time that is necessary to safeguard and secure the rights of states to explore and exploit the benefits of air and outer space.

Referring to the presentation of *Dr. Sloup, Dr. Okolie* added that the UN Security Council did invoke Chapter VII of the UN Charter in regard to the Desert Storm war against Iraq. *Dr. Sloup* replied that - regardless of the

factual support of the UN Security Council - the Iraqi war had not been a UN intervention in the sense of Chapter VII of the Charter.

Hereafter the Chairman closed the session and the 34th Colloquium on the Law of Outer Space. The 35th Colloquium will be held during the International Astronautical Congress in Washington DC, US, from 28 August to 5 September 1992. *

*Tanja L. Masson-Zwaan***
IISL Secretary

The Thirty-Fourth Session of COPUOS: An Appeal for Strengthening Space Law

The thirty-fourth session of the Committee on Peaceful Uses of Outer Space (COPUOS) convened in Graz, Austria from the 26 May to 6 June 1991. At this session, a new chairman was elected, *Mr. Peter Hohenfellner* of Austria. *Mr. Hohenfellner* replaced *Mr. Peter Jankowitsch*, who had presided over the Committee for twenty years.

In *Mr. Jankowitsch's* final opening statement, he remarked on the paradox in developing international space law. He pointed out that although amazing advancements have taken place in national space development and exploration, the international legal instruments created to provide the framework for these national space activities were relatively weak. In over the last thirty-five years, organized space activity has fundamentally changed the knowledge and potential of humanity, the legal instruments, however, have remained virtually the same. Therefore, he appealed to Member States of COPUOS to consider strengthening the institutional frameworks that will respond to the requirements of space cooperation and exploration.

During the two week session, the Committee made recommendations and decisions on agenda items concerning the ways and means of maintaining outer space for peaceful purposes. It also reviewed the work of the Scientific and Technical Subcommittee and the Legal Subcommittee.

Ways and Means of Maintaining Space for Peaceful Purposes

The Committee agreed that it had to improve, whenever necessary, the methods and forms of its work to strengthen international cooperation in the peaceful exploration and use of outer space. The delegates agreed that through international and regional space programmes, such as those programmes undertaken as part of International Space Year (ISY), it was

* Information about the Colloquium, the session topics and the procedure for the submission of papers can be obtained from the IISL Secretariat, 3-5 rue Mario Nikis, 75015 Paris, France, tel. 33-1-4567 4260, fax 33-1-4273 2120.

** The author wishes to express her special thanks to *Frans von der Dunk, Jitendra Thaker, Pamela Meredith* and *Bernhard Schmidt-Tedd*, without whose able rapporteurship this report could not have been prepared.

possible to enhance international cooperation in outer space. To strengthen its work in ensuring the peaceful use of outer space, some delegations expressed that COPUOS should seek to keep itself informed of progress in this area and find ways to complement its work with other bilateral and multilateral forms such as the Disarmament Commission that deals with related items like the prevention of militarization and confidence-building measures. These delegations expressed that some type of working liaison should be arranged between the chairman of COPUOS and the chairman of the Conference's *ad hoc* Committee on the Prevention of an Arms Race in Outer Space. As expected, other delegations pointed out that the issue of the prevention of the arms race was an issue that was within the exclusive competence of the conference on Disarmament and questioned the need for two separate United Nations bodies to develop any linkage. To ensure that outer space remains for peaceful uses, other delegations proposed that broad international programmes, including the proposal for the establishment of the World Space Organization, which have been suggested over the past years offer alternative mechanisms for maintaining space for peaceful uses. Other delegations expressed that the best way to ensure that outer space is used for peaceful purposes is to strengthen and revitalize the work of COPUOS and its subcommittees.

The Scientific and Technical Subcommittee

The Committee reviewed the work of the twenty-eighth session of the Scientific and Technical Subcommittee. It noted the Subcommittee's consideration of following the progress in implementing the Second United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE 82) recommendations. Although the Committee expressed satisfaction with the number of projects and studies developed and the proposals for forthcoming reports, the Committee concluded that a number of recommendations were not fully implemented. Therefore, it endorsed a proposal that the Secretariat prepare a background paper for the Working Group on UNISPACE so it could then prepare a comprehensive report on assessing the implementations of UNISPACE since 1982. Under the item of UNISPACE, the Committee reviewed the work of the United Nations Programme on Space Applications and the progress it has made in developing countries. It also noted progress in terms of developing an international space information service, including the publication of selected papers from seminars of the United Nations Programme on Space Applications, the Directory of Education, Training, Research and Fellowship Opportunities, and the Directory of Information Systems on Space Science and Technology.

In celebration of International Space Year (ISY), the Committee paid special attention to the United Nations programme of activities. It noted in particular its collaboration with International Astronautical Federation (IAF), the Committee on Space Research (COSPAR) and the International Society for Photogrammetry and Remote Sensing (ISPRS) to hold a seminar for developing countries at the World Space Congress. The Committee

endorsed the Subcommittee's recommendation for the 1992 twenty-ninth session theme: "Space technology and the protection of the Earth's environment: development of endogenous capabilities, in particular the developing countries and in the context of the International Space Year."

The Legal Subcommittee

The Committee reviewed the work of the Legal Subcommittee's thirtieth session. As a result of informal negotiations that took place between the Subcommittee's session and the COPUOS meeting, the Committee reached a consensus on Principles 8 and 9 of the Draft Principles Relevant to the Use of Nuclear Power Sources (NPS) in Outer Space. Principle 8, Responsibility, which invokes Article VI of the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (Outer Space Treaty), informs States that they shall bear international responsibility for national space activities involving NPS, governmental and non-governmental. Also, it informs international organizations that this responsibility shall extend to a NPS activity in which they participate. Principle 9, Liability and Compensation, invokes Article VII of the Outer Space Treay and relevant provisions of the Convention on International Liability for Damage Caused by Space Objects (Liability Convention). According to Principle 9, a State which launches or procures the launching of a space object is internationally liable for damage caused by space objects carrying a NPS. Also, in accordance with Article V of the Liability Convention, States jointly launching a space object with a NPS will be jointly and severally liable for any damage caused. To compensate States, Principle 9, invokes the Liability Convention and instructs States that they shall restore a damaged State, including its persons, natural or juridical, or an international organization, to the condition existing before the damage had occurred. Compensation shall include reimbursement for substantiated expenses for assistance received from third parties. Both Principles 8 and 9 use the terms "shall" rather than the terms "should." The Committee agreed that when it addresses the entire draft of principles, it will consider whether it will make any adjustments in applying these terms.

For the remaining principles, Principles 2 and 4, Notification and Safety Assessment, respectively, the delegates could not reach a consensus on combining these two principles. According to some delegates, the two principles should be combined into a single principle providing for a publication of the mission's safety assessment prior to each launch. Other delegates, however, expressed that the principles should remain separate because they call for distinct actions. The Committee instructed the Subcommittee to draft a text that delineates all the elements required for safety assessment and notification before it decides whether the two should be combined.

On the issue of a possible revisit to Principle 3, Criteria for Safe Use of Nuclear Power Sources, delegates expressed their disappointment

about proposals for "reopening" that principle which would slow the finalization process. As requested at the Scientific and Technical Subcommittee, the International Atomic Energy Agency (IAEA) representative presented a statement to clarify the IAEA's position. Although the IAEA representative stated that the IAEA did not desire to disrupt the Committee's efforts, he nonetheless expressed that the current text is not in accordance with the most current international radiation regulatory practice. Basically, the IAEA representative pointed out that the text which calls for a limitation of radiation exposure does not incorporate the International Commission for Radiological Commission (IRCP) recommendations developed in 1990. According to the IAEA, the dosage limit in para. 1.3 of Principle 3 does not take into consideration all potential radiation exposures and prevention activities. However, if the Committee finalizes the text of the principles, as currently written, the IAEA representative suggested that the Committee could call for an early revision of the principles in four or five years.

As part of its review of the work of the Legal Subcommittee, COPUOS considered the agenda items dealing with the *Definition and Delimitation of Air Space and Outer Space and Equitable Use of the Geostationary Orbit*. Under this item, the Committee considered a proposal that several developing countries made on establishing a legal regime for the use of geostationary orbit based on preferential treatment for developing countries that had not yet access to the orbit. The sponsors of this proposal recommended that this would lead to the equitable use of the finite resources. For the relatively new item *Consideration of the Legal Aspects Related to the Principle that the Exploration and Use of Space Should Benefit all Humankind*, the Committee urged the Legal Subcommittee to move forward with its work so that a legal framework could be developed on this important issue.

Also, the Committee considered the *spin-off benefits* of space technology. It reviewed a thorough report that the Secretariat prepared on the topic and it expressed its appreciation. Delegates expressed that a mechanism should be found so that all States have access to the benefits from the spin-off technologies of space exploration.

COPUOS concluded the work of its thirty-fourth session on 6 June 1991. It expressed its gratitude to the Government of Austria, including the Mayor of Graz for hosting the session in Austria. The delegates paid tribute to *Mr. Peter Jankowitsch*, who was appointed to the post of Minister of State for European Integration and Cooperation of the Austrian Government, and lauded his twenty years of dedicated service to COPUOS.

The Special Political Committee at the 46th General Assembly

During its forty-sixth session, from 4 to 8 November 1991, the United Nations General Assembly considered the role of COPUOS in elaborating norms and principles governing space activities in its Special Political Committee (SPC). *Mr. Peter Hohenfellner* of Austria, the Chairman of COPUOS, introduced the annual report of the Committee to the delegates.

The General Assembly, in Resolution 46/72 endorsed the report of COPUOS. The discussion of the SPC focused on activities in preparation for International Space Year (ISY), nuclear power sources in outer space and the problem of space debris.

On the topic of ISY, the General Assembly endorsed the United Nations programme of activities, which will be carried out on the basis of voluntary contributions, focusing primarily on the use of space technology for studying and monitoring the global environment. It also endorsed the Scientific and Technical Subcommitee's programme for a special session on the use of space technology for the environment.

In consideration of nuclear power sources, the General Assembly urged that the Legal Subcommittee make every effort to complete the elaboration of the draft principles at its next session.

In consideration of the space environment, the General Assembly invited Member States to provide information on national research on space debris to the Scientific and Technical Subcommittee so that it could follow this area more closely. Also, the General Assembly considered that space debris could be an appropriate subject for in-depth discussion for COPUOS in the future.

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Comments

Current Status and Prospects For Space Insurance[+]

Space Insurance Coverages

Space insurance coverages are discussed in four general categories in which the insured has insurable interest namely:

1) damage to property owned by the insured;
2) damage to property not owned by the insured, but upon which the insured's business depends;
3) potential legal liability of the insured for third party claims; and
4) potential financial loss from occurrences which do not necessarily involve physical loss or damage to property or injury to persons.

The first two categories represent risks typically insurable for spacecraft and launch vehicle related incidents which are a consequence of identifiable physical loss or damage. Coverage usually is all risk, with

[+] A review of the current status and prospects for space insurance was presented to the Legal Subcommittee of the U.N. Committee on the Peaceful Uses of Outer Space on April 5, 1991. This comment is based on that presentation and addresses a number of areas important to the insurance of space launches and space systems.

named exclusions, and can apply to occurrences during launch, in space or on the ground. Launch and in-orbit physical damage coverage has been the most critical form of space insurance from the business perspective of cost and the amount of insurance capacity available from the world-wide markets. The terms and conditions of coverage and the cost of insurance depends upon the particular systems and operations as well as the conditions in the space insurance markets.

Liability insurance covers bodily injury and property damage claims from third parties against the insured resulting from an accident or occurrence. The insured's legal liability for damage could arise from a number of different causes including negligence in conducting operations, a defect in a product, or from failure of a service which results in personal injury or property damage to a third party. Separate liability insurance is usually obtained covering space launch and in-orbit operations since general liability policies and manufacturers' products liability policies have exclusions which could affect space coverage.

Financial loss insurance, as referred to here, is based essentially on *force majeure* risks, in particular acts of government, which do not necessarily involve any physical loss or damage. Small entrepreneurial companies that rely on governmental services for their business have an increasing need to demonstrate an acceptable degree of protection as a condition of financing. In the case of a commercial space facility which requires launch on the Space Shuttle, for example, coverage could include a specified level of protection from launch preemption, adverse change in the government's commercial launch policy, or non-appropriations of funds necessary for NASA to provide launch services to the insured. These risks are difficult to quantify, are subject to moral hazards, and accordingly the coverage is narrowly drawn and expensive.

U.S. Government Requirements

The government imposes certain conditions and obligations on private space launch participants. The requirements are different depending upon whether a launch is performed by NASA or is conducted under the licensing authority of the Department of Transportation (DOT). The major areas of government interest affecting insurance are third party liability, government launch property, government indemnification, and the allocation of risks between the parties involved in the launch.

NASA Launch and Operations

In the case of Space Shuttle launch, the commercial customer or user is required to purchase third party liability insurance in an amount not to exceed $500 Million to cover claims arising out of the launch. NASA agrees to indemnify losses in excess of the insurance if the claim arises during a period of time associated with the launch phase, defined as the "Risk Period". This period in most cases is from attachment of the user's payload to the Shuttle Orbiter prior to launch, until after the payload is

deployed and the Orbiter returns from orbit and lands. The risk period is different in the event of unsuccessful deployments and in cases of launch vehicles other than the Space Shuttle. Insurance is also required after the launch during in-orbit operations, although indemnification is not provided after the defined risk period.

All participants in a launch are required by NASA to enter into inter-party waivers of liability and indemnity, during the period of "Protected Operations". This is generally a much longer time period before and after the launch than the Risk Period. The waivers in effect require each participant to be responsible for any damage to its own property and injury to its employees. NASA assumes the risk of loss in the event of damage to government property. In case of property owned by private participants, risk of loss can be retained or transferred through contract arrangements between the parties. Alternatively, insurance can be purchased to cover the particular risk of loss whether during launch, in space, or on the ground.

Commercial Launch Services

The DOT has the responsibility for issuing Orders to a commercial launch provider delineating the insurance requirements for obtaining a license for launch. The provisions of the Commercial Space Launch Act Amendments of 1988, P.L.100-657, establish maximum liability insurance of $500 million during the period identified as "activities carried out under the license". Within the maximum, the DOT specifies the amount of insurance required depending upon the particular launch vehicle and the launch site. The DOT also specifies different periods for insurance coverage depending upon whether the launch provider's service is for delivery to low earth orbit, geostationary transfer orbit, or some other orbit or suborbital trajectory. The final orbit of the payload is not the determining factor.

The U.S. Government provides indemnification of commercial launch services up to a maximum of $1.5 billion for successful claims that exceed the amount of insurance specified by DOT. Since, in practice, DOT specifies liability insurance to cover a period which can be shorter than the period involving activities carried out pursuant to the license, under certain conditions government indemnification may apply to the first dollar of claims.

Participants involved in commercial launch services are also required to enter into agreements providing for reciprocal waivers of claims against the other parties. Each party is responsible for damage to its own property, except that the DOT licensee must provide insurance or assume financial responsibility for the first layer of damage to government property. The DOT specifies the amount of coverage for property damage depending upon the launch vehicle and launch site, and the government assumes the risk of loss above that amount. The Space Launch Act Amendments set a maximum amount of coverage required at $100 million.

Space Insurance Markets

The availability and cost of insurance necessary to cover the physical loss or damage to satellites during launch and in-orbit has been a major concern for commercial space enterprises. Essentially, all commercial satellites launched into earth orbit have sought insurance to cover the risks of launch. Many have also purchased in-orbit life insurance. The insurance markets providing space insurance coverages are world-wide, with the major underwriting capacity coming from the United States and Europe.

As of the end of 1990, the maximum amount of space insurance capacity available for underwriting a space risk was about $300 million. The approximate percentage of the total from the various markets by country was as follows: U.S.A., 31%; France, 17%; U.K., 15%; Germany, 13%; Italy, 12%; others, including Japan, Sweden, Norway and Australia, 12%.

Space Insurance Capacity

The amount of space insurance capacity available on the world markets has changed substantially since the early 1970's. Capacity had increased in response to demand for higher insurance limits during the periods when space-related losses were in reasonable balance with the premiums collected. This was the case during the time period prior to 1984, when world capacity reached a maximum of about $260 million. Following the large number of launch and in-orbit failures from 1984 through 1986, capacity declined substantially to below $100 million, in spite of the continuing demand for launch insurance. After 1986, capacity has again continued to increase year by year to the recent levels, since the higher premiums charged to space insurance buyers have kept up reasonably well with the losses, and have attracted more underwriting capacity.

Space Insurance Rates

The cost of space insurance for launch and in-orbit coverage has also responded to market conditions. Prior to 1984, the premium rates for insuring satellite launches on expendable launch vehicles (ELVs) and the Space Shuttle (STS) were generally decreasing. Losses were not too far out of balance with premiums collected, as previously indicated, and there were great expectations that substantial new business would be coming from space. While the insurance rates were different depending on the risk rating for a particular launch vehicle and satellite, in 1983 the launch

rates for communications satellites (geostationary orbit) could be characterized at about 5% for STS launches and 7%-11% for launches of ELVs. In-orbit rates were about 1% per year.

During the period 1984 to 1986 geostationary orbit launch rates increased substantially to 25%, and greater in some cases. In-orbit rates were up to about 5% per year. Following this period of higher insurance costs which significantly increased the amount of premiums injected into the insurance markets, new capacity as previously indicated was attracted to space insurance, and the premium rates were again brought down. By the end of 1990 geostationary orbit launch rates were in the 16% - 18% range for ELVs, and in-orbit rates were about 1% - 2% per year. The Space Shuttle was no longer launching commercial satellites so that essentially no insurance was being placed.

The availability of insurance for future space systems will continue to depend upon market forces. The higher premium rates charged in the past few years has tended to stabilize the geostationary orbit launch rates around the 16%-18% range with capacity in excess of $300 million. Capacity at this level seems to be reasonably sufficient to meet foreseeable needs. The launch rates are always a negotiable item which will continue to receive the full attention of the marketplace.

Factors Affecting Space Risk Rating

There are a number of factors which affect the insurance rating of space risks. The historical loss records are a major consideration since they reflect a burning rate for different types of launch vehicles and spacecraft systems as well as the overall contribution of space losses to the insurance markets.

In addition to system and subsystem heritage and performance histories, the particular design philosophy such as single point failures, redundancies, and complexities must be considered. In other systems related considerations are contractor experience in manufacture, quality assurance and testing, as well as the customer or insured's experience in overseeing space systems purchases.

The scope of insurance can include coverage for named perils or for all risk and stated exclusions. The underwriting risk also depends on the amount of risk retained by the insured such as loss deductibles and co-insurance, and the risk allocations and transfers to others through contract. Other factors affecting coverage and cost, particularly in the case of space systems, is whether insurance pays for total loss only or if partial loss claims can be made.

As a final consideration, the state of the space insurance as well as the general property and casualty markets must be considered. The market capacity for space risks may limit the amount of insurance available for any given satellite launch and restrict the accumulation of risk as a consequence of multiple spacecraft on a single launch or multiple space systems on a space station. Market conditions, and specifically space insurance underwriting results can have a major effect on the cost of

insurance for risks which would otherwise receive a more favorable risk rating.

*Daniel E. Cassidy**

*Space Insurance: European Perspectives***

The European Space Agency (ESA) has the longest practice in Europe insofar as space insurance issues are concerned, having insured nine satellites up to now against launch failure and, occasionally, other risks.

The main criterion applied was the kind of service the satellite would provide. If destined for a customer such as INMARSAT or EUTELSAT that had requirements of a more or less commercial type (and so paid fees for the satellite's use), insurance would generally be bought as a means of protecting against loss of expected revenues, so long as this was justified by the state of the market and the relative cost and availability of spares. For other missions (*i.e.* mainly science ones), ESA's approach has, like its predecessor ESRO's, generally been not to take out insurance. By way of comparison, it is interesting to note that, in Europe, EUTELSAT has taken out insurance for the launch and initial in-orbit testing phases, while EUMETSAT has decided against the insurance option and Société Européenne des Satellites S.A. has opted to insure its private system, ASTRA.

ESA has received $124 million back from its insurers for three satellites which suffered launch failures (OTS-1, Marecs B and ECS-3). The premiums paid for OTS-1 and Marecs B were quite low, meaning that, in cumulative terms, ESA has gained financially. Only in the last couple of years have the total amounts paid for insurance started to overtake the dollar value of ESA's claims.

The other side of this coin is that claims such as these in a low-volume market have contributed to a shrinkage in the capacity the market can attract with the result that premiums at one point (1983-1986) attained as much as 25% of the insured value. In recent years, a more mature, specialist market has evolved which is better able to engage in competition. (A leading share of this market is, incidentally, occupied by European companies). Rates have in fact dropped to around 15-18%. Also, there are grounds for optimism, that new capacity can be attracted to the

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** These comments are based on the author's presentation in the course of an IISL Space Insurance Seminar, held on April 4, 1991 at the United Nations headquarters in New York City, in connection with the 1991 session of the Legal Subcommittee of the U.N. Committee on the Peaceful Uses of Outer Space.

market -- especially in light of Ariane 4's good performance -- and that these rates will move further downwards.

A last point of interest is that the component of third-party risk, which is of great importance to the space lawyer, comprises only a modest fraction of the cost of insurance. The bulk of any premium is mainly attributed to coverage for the spacecraft's investment value. The relatively low cost of third-party insurance will be of relevance when considering any possible changes to the existing regime for unlimited financial liability established by the 1967 Outer Space Treaty and the 1972 Liability Convention.

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European Space Agency

The Omnibus Space Commercialization Act

On July 31, Rep. Walker (R-PA) introduced H.R. 3153, the Omnibus Space Commercialization Act. At the time of this writing, a similar Democratic bill was being drafted. The Omnibus Act contains the following major provisions:

Tax incentives: The bill provides several tax incentives for commercial space enterprises. *First*, in a proposal somewhat similar to the "Urban Enterprise Zone" concept, activity taking place in designated "Commercial Space Centers" would be tax exempt, and stock in such centers would be deductible, subject to certain maxima and recapture provisions. *Second*, gain on stock in "space corporations" (roughly defined as those obtaining at least 75% of gross income from space activity) would be excludable from gross income, subject to a $100,00 per tax-payer limitation and the requirement that the gain be long-term capital gain. *Third*, states would be empowered to issue tax-exempt "exempt facility bonds" in support of space launch and launch support facilities. *Fourth*, income from space manufacturing would be excludable from gross income, and products of space manufacturing would be exempt from all federal excises, etc. *Fifth*, states would be encouraged to offer their own tax abatements and other incentives in support of commercial space activities.

Procurement: The Act would amend language contained in Title II of last year's NASA Authorization Act[1] to eliminate loopholes and limitations in its requirements that NASA and other government agencies purchase launch services from commercial providers wherever possible, rather than conducting launches themselves. It would also establish a system of government launch grants, in the form of vouchers, to support microgravity research.

1 Pub. L. 101-611, 104 Stat. 3188; codified at 42 U.S.C. 2465b *et seq.*; legislative history at 1990 U.S. CODE CONG. ADM. NEWS 4540.

Antitrust: The Act contains language designed to exempt joint ventures in space fields from certain antitrust limitations. In particular, it limits the ability of private parties to bring actions and to recover treble damages.

Liability: The Act limits the liability of commercial launch providers where government payloads are involved, and provides that noncompliance with government or military specifications shall not, in itself, be proof of negligence except in limited cases.

Report on Laws: The Act directs the National Space Council, together with the Office of Space Commerce at the Department of Commerce, to report on laws and treaties affecting space commercialization, and on what actions might be taken to improve the situation.

At the time of this writing, Congressional staff expect a concerted effort to pass either this bill or a Democratic version that is substantially similar. Even if such legislation fails to pass in this Congress, the strong interest shown by industry and government officials, and the obvious need for legal reform in the field, indicate that some sort of legislation is likely to be passed in the reasonably near future. This is a process in which input from space lawyers with interest in commercial industry issues is vital.

Prof. Glenn H. Reynolds
University of Tennessee Law School

Case Note

Martin Marietta Corporation v. International Telecommunications Satellite Organization (INTELSAT)

Due to the inherent risks present in the commercial space launch industry, satellite companies and the providers of space launch services will continue to find themselves confronted with the issue of how losses should be allocated whenever failed satellite missions occur. Such was the setting for a recent federal district court decision which involved certain tort claims made by International Telecommunications Satellite Organization (INTELSAT) against Martin Marietta Corporation, a provider of space launch services, for the unsuccessful placement of a commercial satellite in the correct orbit.[1] The United States District Court for the District of Maryland examined the tort theories proposed by INTELSAT in the light of the contractual obligations between the parties and also discussed the issue of liability waivers as covered by the Commercial Space Launch Act, as amended in 1988.[2]

In August of 1987, Martin Marietta contracted with INTELSAT for the launch of two satellites on Titan III launch rockets. Martin Marietta's

1 763 F. Supp. 1327 (D.Md. 1991).

2 49 U.S.C. app. §§ 2601-2623 (1988).

launch of the first satellite was unsuccessful, failing to properly place the satellite in the correct orbit.[3] As a result, INTELSAT sustained substantial losses. Martin Marietta brought a declaratory judgement action seeking to absolve itself of any liability for the incident. INTELSAT counterclaimed, asserting breach of contract, and alleged negligence, gross negligence and negligent misrepresentation by Martin Marietta. Martin Marietta sought dismissal of the counterclaim, and the instant decision dealt only with the tort claims made by INTELSAT as the court stated that further proceedings would be necessary to resolve the breach of contract issues.[4]

Martin Marietta contended that the 1984 Commercial Space Launch Act, as amended in 1988, which requires all private commercial launch contracts to contain cross-waivers of liability, prohibited INTELSAT from bringing tort claims against Martin Marietta. According to the statute, "all license holders who contract to provide private commercial space launch services must enter into reciprocal waivers of claims, under which all parties agree to assume their own risk of loss."[5] Additionally, the statute requires all launch providers to obtain a license to conduct a private launch with all licensees subject to the reciprocal waiver provision. Martin Marietta contended that the reciprocal waiver provisions should have been read into the contracts, even if the contract itself contained no express waiver provision, simply by virtue of Congress' preemptive authority over state contract law.[6]

The court reasoned that since Congress' main purpose of the Act and its amendments was to encourage the development of the private commercial space launch industry, the resulting comprehensive regulatory scheme of allocating tort liability was a proper response to the dilemna faced by commercial launchers to procure insurance at any price.[7] The court then rejected Martin Marietta's argument that the 1988 Amendments created liability waivers for contracts in which no waivers had been expressly agreed upon by the parties. The court went on to state that the statute "requires only that the licensee include waivers in its contract;" a failure of which would possibly result in the Department of Transportation revoking the launch provider's license. Moreover, the court noted that the language of Martin Marietta's license allowed for Martin Marietta to be held liable if cross-waivers were not included in the contract. Thus, the court, in examining the statute and license itself, rejected Martin Marietta's claim that the Act operated to impute cross waiver provisions into the contract when the contract itself did not contain them.[8]

Turning to the tort claims in general, maintained by INTELSAT, the court found that Martin Marietta did not owe any duties in tort distinct

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3 *Martin Marietta v. INTELSAT*, , 763 F. Supp. at 1329..

4 *Id.*

5 *Id.*

6 *Id.*

7 *Id.* at 1330.

8 *Id.*

from the duties created by the contract itself.[9] Thus, the court recognized the principle that "where the relationship between parties is purely contractual, and the heart of plantiff's claim is the defendant's failure to perform the contract, contract damages will suffice to compensate the plantiff - no extra protection for the parties is necessary."[10] The court proceeded to say that equally sophisticated parties, such as those involved in the case *sub judice*, who have "the opportunity to allocate risks to third party insurance or among one another should be held to only those duties specified by the agreed upon contractual terms and not to general tort duties imposed by state law."[11]

As to a determination of whether the contract defined the scope of Martin Marietta's duties with respect to the subject matter of INTELSAT's tort claims, the court found that the contract itself imposed no duty on Martin Marietta to have exercised due care to avoid negligence and so found the resulting tort action improper. INTELSAT had maintained that Martin Marietta, notwithstanding its warranty disclaimer provisions found in the contract, had made negligent misrepresentations after the signing of the contract. The court found that INTELSAT's interpretation that the disclaimer applied only to representations made prior to and concurrent with the signing of the contract was reasonable in view of the language of the disclaimer provisions. However, the court stated "that INTELSAT could not recover since under Maryland tort law a claim for negligent misrepresentation is improper when, as here, the only relationship between the parties is contractual and the contract does not impose an express duty of care in making representations."[12]

Regarding the further contention by INTELSAT that public policy invalidated such aforementioned contractual waivers as they applied to claims of gross negligence, the court found that "in the particular context of the case at hand, public policy in fact strongly favored the enforcement of such waivers for all tort claims, including those based upon gross negligence."[13] The court looked to the legislative history of the Act and its amendments and indicated that it was Congress' intention to bar claims of gross negligence in order to avoid increased litigation costs and the burdensome requirement of launch providers having to obtain expensive insurance policies to protect themselves from failed launches.[14] The court concluded by stating that the public policy of the country, as announced by Congress, requires that those using the services of a licensed space launch provider do so at their own risk.[15] Thus, since the waivers in the contract were interpreted to preclude liability for gross as well as ordinary

9 *Id.* at 1331.
10 *Id.*
11 *Id.* at 1332.
12 *Id.* at 1333.
13 *Id.*
14 *Id.*
15 *Id.* at 1334.

negligence, the court held that INTELSAT could not recover on its tort claims.

A. Kelly Sessoms

Short Accounts

The First Asian Conference on Air Transport and Space Activities, Taipei, Taiwan, May 25-30, 1991

The Graduate Institute of European Studies of Tamkang University, Taipei, Taiwan, Republic of China (ROC) and the International Institute of Air and Space Law (IIASL) of Leiden University, The Netherlands, organized this conference on the theme of "The Highways of Air and Outer Space over Asia." During the four days of the conference, some seventy selected high ranking participants from universities, institutes, governments, air and space industries, mainly from the Eastern Asian regions, engaged in a thorough discussion of a wide array of topics on this theme with the expert speakers. The combination of air and space law topics was found to be very interesting and was the reason why a high number of participants chose to attend the sessions on both topics.

After the welcoming and opening addresses in the morning of May 27, the afternoon was reserved for session I on "Regulatory Reform in International Air Transport." Chairman of the session was *Prof. Dr. Henri A. Wassenbergh* (The Netherlands), and presentations were given by *Mrs. Neelie Smit-Kroes* (The Netherlands), *Ms. Rachel B. Trinder* (United States) and *Prof. Dr. Chia Jui Cheng* (Taiwan, ROC). The stage was set for a "global" approach towards the future of international air transport and commercial space activities.

On May 28, session II was held on "The Legal Aspects of Commercial Space Activities," under the Chairmanship of *Prof. Dr. Isabella H. Ph. Diederiks-Verschoor* (The Netherlands). The first speaker was *Prof. Dr. Bin Cheng* (United Kingdom), who spoke on "Legal and Commercial Aspects of Data-Gathering by Remote Sensing." He posed the problem by reference to the sovereignty of every state to control everything happening on its territory and to its population, and then pointed out the useful effects of remote sensing. Essentially, a distinction should be made between what *Prof. Cheng* called "penetrative reconnaissance" and "peripheral reconnaissance," the first taking place from within the airspace subject to national sovereignty and the second from outer space. Extensive analysis led *Prof. Cheng* to conclude that the second form of remote sensing, even if commercialized, could not be considered as infringing either general international law or space law, including the UN Principles on Remote Sensing. Following *Prof. Cheng, Prof. Dr. Carl Q. Christol* (United States) spoke on the "Legal Aspects of Aerospace Planes." He discussed the legal problems arising from the hybrid character of the aerospace plane by mentioning four factors and contrasted the spatialist and the functionalist approaches to the scope of space law, when applied to the spaceplane. *Prof.*

Christol proposed a new approach for the international regulation of such hybrid vehicles with an "allocative function" as a central characteristic: whether air or space law applied should be decided on the basis of the purpose, intent and effect of the activity deployed by the spaceplane. The next speaker, *Prof. Dr. Toshio Kosuge* (Japan), held a lecture on "Legal Problems of Direct Broadcasting by Satellite: Programme, Advertising and Copyright Issues." *Prof. Kosuge* discussed the basic problem of DBS concerning 'overspill' with a special view to the use of DBS in Asian areas with wide spread populations. The main question according to *Prof. Kosuge,* however, was whether countries in the Asian region indeed wanted DBS, considering that the social benefit, with adequate supervision, would outweigh the possible risks; the answer to the question determines the need for international cooperation and regulation. *Mr. Frans G. von der Dunk* (The Netherlands) then spoke on "Legal Aspects of the International Space Station." Inasmuch as one week earlier, developments in the United States had culminated in a real threat to the financing of the project, he highlighted the most topical aspects of the International Space Station, which related to the legal status of the agreements concerning the Space Station and the rights and duties of the partners with respect to each other as contained therein. He concluded that the concept of "genuine partnership" provided no legal solution to the problems discussed, not even if the Intergovernmental Agreement would have been in force. Consequently, this concept should be left out in future agreements of this kind. Finally, the chairman gave a short summary of the paper of *Mrs. Tanja Masson-Zwaan* (The Netherlands), who had not been able to present her paper on "International Telecommunications and ITU Developments."

Two more sessions dealt with air law: one was on "Aviation Safety and Security," under the chairmanship of *General Chia-Jui Chen* (Taiwan, ROC), with the participation of *Mr. Rodney Wallis* (United Kingdom), *Prof. Dr. Andreas F. Lowenfeld* (United States), and *Mr. Chatrachai Bunya-Ananta* (Thailand), and the other one on "Liability in International Civil Aviation," chaired by *Prof. Dr. Bin Cheng* (United Kingdom) and *Prof. Dr. Hans Nieuwenhuis* (The Netherlands) with the participation of *Prof. Dr. Doo-Hwan Kim* (South Korea), *Mr. Mitsunari Kawano* (Japan), *Mr. Dirk Slijper* (The Netherlands) and *Dr. Rod D. Margo* (United States).

The fifth session chaired by *Prof. Dr. H. Toshio Kosuge* (Japan) again concerned space law and dealt with the "Euro-Asian-Relationship of the Future: Space Activities." The first speaker was *Dr. Michel Bourély* (France), who spoke on "The Experience of Regional Cooperation: the Example of ESA." He set out the history of ESA, arising out of the experience in Western Europe with ELDO and ESRO: one single comprehensive organization was considered to be a much better way for combining the space effort of the states concerned. Then he described the main features of the ESA Convention and the Agency itself: the legal status and structure, the rules governing its activities and programs and the related financial organization. Especially, the flexibility and dynamics of the so-called optional activities were highlighted. Afterwards, *Prof. Dr. Sompong Sucharitkul* (Thailand) presented a lengthy paper on "The Benefit

of Space Activities for Asian Countries." He started with definitional questions concerning such terms as "outer space" and "air space", and concentrated on outer space and the legal framework of space activities arising out of the space treaties. The freedom of space exploration and use, the central principle of space law, was then applied to commercial space activities of various types. The final part of his paper dealt with the potential benefits of space activities for Asian countries, both through the application of the "common heritage of mankind" principle and through the active participation of the countries themselves. *Prof. Sucharitkul* concluded that through both means, Asian countries were able to derive a large potential benefit indeed. The last speaker of the session was *Mr. H. Peter van Fenema* (The Netherlands), on the subject of "Cooperation and Competition in Space Transportation." He provided an overview of the situation in the international launching market as it is today, and elaborated on several bilateral relations in the field of launching between competing states. Thus, the relations between the USA-Soviet Union, USA-People's Republic of China, Europe-People's Republic of China and Europe-USA were respectively analyzed. *Mr. Van Fenema* concluded that while the issue of fair trade, when applied to launch activities, had to take account of some very specific characteristics, nevertheless it should be applied as much as possible to launch activities as well.

The conference was concluded with session VI, on the "Euro-Asian Relationship of the Future: Aviation," chaired by *Mr. Rob Schreurs* (The Netherlands). Speakers were *Prof. Dr. Chong-Ko Tzou* (Taiwan, ROC), *Mr. Bernard Wood* (United Kingdom), *Mr. M. Soeparno* (Indonesia) and *Prof. Dr. Henri A. Wassenbergh* (The Netherlands). Afterwards, the sessions' chairmen presented their concluding remarks which were followed by a press conference. For aviation, cross-border concentration of airline activities on a regional level looked promising, while for space activities international cooperation became imperative.

All in all, the Conference was a very valuable platform for the exchange of ideas on a high level between representatives from Europe, North America and, especially, the Eastern Asian region. The very active and lively participation of the attendees greatly contributed to the success of the Conference, the papers of which are currently being prepared for publication by the IIASL of Leiden University.

Preliminary plans were drawn up for a Second Asian Conference to be held in Tokyo in 1992 or 1993, and a Third Asian Conference to be held in Seoul two years later, both to be organized in cooperation with the International Institute of Air and Space Law at Leiden. In yet another way the Conference proved very fruitful: at the conclusion of the Conference an announcement was made of the establishment of the Asian Institute of International Air and Space Law, a regional international organization with its Permanent Secretariat being located in Taipei, Taiwan, ROC. *Prof. Chia Jui Cheng* of Soochow University, Taiwan, ROC has taken the initiatve and already assembled a Board of Directors which includes thirteen inter-

national experts in the field of air transportation and space activities.

Frans G. von der Dunk
Co-Director, International Institute of Air and Space Law
Leiden University, The Netherlands

Air and Space Law and the Challenges of the XXIst Century

On the occasion of the fortieth anniversary of the Institute of Air and Space Law, a colloquium "Air and Space Law and the Challenges of the XXIst Century" was held in Montreal on October 3-5, 1991 to mark this historic event.

The Institute was established by McGill University within its Faculty of Law in 1951, and since that time, some 620 students from 103 countries have followed its programmes and obtained a Diploma in Air and Space Law, a degree of Master of Laws (LL.M.) or a degree of Doctror of Civil Law (D.C.L.). A large number of the Institute's graduates have achieved high positions of responsibility in their respective countries - in government service, airlines, international organizations, judiciary, or as practising lawyers, and many have achieved an international reputation as leading scholars in the field of air and space law.

Over the past forty years the Institute has been led by a succession of eminent jurists and scholars who have served as its Directors and were assisted by scores of eminent faculty members and staff including *John Cobb Cooper* (1951-55), *Dr. Eugene Pépin* (1955-59), *Prof. Max Cohen* (1962-65) and *Dr. Nicholas M. Matte* (1975-89).

The colloquium was opened by *Dr. Donald H. Bunker* - President of the Institute of Air and Space Law Association, and *Professor Yves-Marie Morissette* - Dean, Faculty of Law, McGill University.

The keynote speakers were *Mr. Arnold Kean* - CBE, Past Chairman of the ICAO Legal Committee who addressed the topic "Air Law, Past and Future: The Challenges of the XXIst Century," and *Professor Dr. Karl-Heinz Böckstiegel* - Director, Institut für Luft- und Weltraumrecht, Cologne, who addressed the same subject with respect to space law.

Seventeen other papers were delivered at the colloquium (eight on aviation law and nine on space law) involving such topics as air liability, regulatory matters in air law, aviation security, development of space law, issues in space development, arms control and space activities. The rapporteur was *Professor Milde* who gave his report at the close of the sessions and the final address was given by *Professor David Johnston*, Principal and Vice-Chancellor of McGill University who spoke on "The Place of the Institute of Air and Space Law at McGill University and in the World."

Dr. Donald H. Bunker
Adjunct Professor of Law, McGill University
and Partner of Ogilvy Renault, Montreal

Space Activities and Society

The Third Symposium on Space Activities and Society, sponsored by the International Academy of Astronautics, took place on October 7, 1991 in Montreal, Canada. The topic on "Institutional Models for International Cooperation" produced a number of interesting papers, some of which brought about lively debate. With *N. Jesentuliyana* (UN) and *I. Pikus* (USA) as chairs, and Professors *J. Galloway* (USA) and *F. Lyall* (UK), as commentators, the session went smoothly. *T.E. Cremins* 's paper on "New World Order, Environment, and Space: Opportunities for Institution Building and Security" pointed out how global change is not just an environmental issue but needed a broader approach with greater attention to the economic and sociological problems which might have engineering solutions. While, in response to a question from *Dr. J. Galloway*, he agreed that there was no plan regarding management for these problems, he thought that a large management system probably would not be needed for the programs.

Dr. Bland presented *B. Forman's* paper on "Prospects for Organizing International Cooperation in Space in the Pacific Basin" and reviewed various innovative ideas for the future. The European Space Agency was taken as an example of a system that might work for the Pacific region where members could include Japan, which has no orbit rocket, China which has the Long March rocket, Australia, and India, which is presently increasing its space budget by 30%. The US/USSR/Canada could have observer status. Several questions were raised regarding the inclusion of other countries into the "Pacific Basin" concept, but it was pointed out that less complex arrangements were needed at first to ascertain whether they worked. Another paper, presented by a representative of CNES on "20 Years of Soviet-French Cooperation," stressed an aspect essential for all international cooperative efforts, the need for technical translation and interpretation, including terminology specifications to ensure automatic translation systems.

A most stimulating paper was put forth by *M. Rothblatt* (USA) who suggested an "ITU Stock Market in Orbital Slots Practice Run in the ISY." He advocated looking for institutional models for international cooperation in the stock market, and pointed out that everybody seems to like the International Telecommunications Union (ITU) since it makes profits and is the only institution that allows members to get involved in shared ventures. One could buy and sell slots or simply be an honest broker for a clearinghouse. Computer runs could simulate an ITU stock market and be operational during the International Space year. Market mechanisms might be useful regarding other resources as well. For example, one could divide the orbit spectrum (that is, a combined use of orbits and spectra or frequency bands) into 600 slot rights divided into fractional units. The number would change over time, but presently about two-thirds of the 600 slot rights are already in use. There would need to be a "use it or lose it" rule, requiring that the resources would have to be used, and used effectively. This would create a more equitable system than at present,

particularly if the ITU would take the usual transfer fees (1-5%) and provide a portion of them to assist with the development of resources in third world countries. After much discussion, *Mr. Rothblatt* agreed that other problems would be encountered, including the assignment of responsibility regarding debris (purchaser or seller) and the need for an international police authority to protect property.

Professor Margaret J. Gorove
University of Mississippi

Symposium on the Changing Law of Outer Space

The Student International Law Society of the University of Akron School of Law held a Symposium on the Changing Law of Outer Space on October 15, 1991 in Akron, Ohio. The Faculty Advisor, *Prof. Hamilton DeSaussure*, assisted the Society President, *Scott Macom*, and the Vice President, *Sam Bluedorn*, in planning the program which attracted a wide audience, not only from the law school but also from the community at large. The purpose of this Symposium was to explore the evolving laws of outer space. The Dean of the Law School, *Isaac Hunt*, welcomed the participants, and the moderator, *Hon. John F. Seiberling*, spoke from his special background as a former member of the U.S. House of Representatives with service on the Science, Space and Technology Committee.

The first speaker, *Dr. Eilene Galloway*, Honorary Director of the International Institute of Space Law (IISL), gave an account of the legislative reaction to the launching of the first satellite on October 4, 1957, a process which resulted in passage of the National Aeronautics and Space Act of 1958. Having served as staff consultant to the Senate Preparedness Investigating Subcommittee of the Armed Services Committee, the House and Senate special and select committees set up to meet the challenges created by opening the new environmental frontier of outer space, she was able to explain the reasons for the separation of military and space activities and the coordinating mechanisms established by the National Aeronautics and Space Act.

Prof. Vladlen S. Vereshchetin, Deputy Director of the Institute of State and Law of the U.S.S.R. Academy of Sciences, who is also Vice President of the International Institute of Space Law, spoke of the Soviet national experience and also that of the United Nations Committee on the Peaceful Uses of Outer Space. For many years he has been a delegate to the Committee and its Legal Subcommittee, and is now, for a semester, serving in the Brennan Chair of Law of the Akron School of Law. He described the problems created by space debris and explained the role of the International Telecommunication Union and use of the geostationary orbit.

George Paul Sloup spoke in his personal capacity rather than his official position as Attorney Advisor at NASA's Ames Center. He discussed the missile and satellite situation and analyzed problems of arms control and the peaceful uses of outer space.

There was a lively discussion following the speeches, centering on questions concerning the nature of space law and its relevance to practical problems on earth. *Dr. Galloway* defined space law as responding to "legal problems arising from the uses and exploration of outer space."

Dr. Eilene M. Galloway
Honorary Director, IISL

Other Events

The European Centre Space Law Workshop on **"Legal Aspects Protection of Satellite Data"** took place May 16-17, 1991 in Frascati, Italy.

The **10th Annual Classified Military Space Symposium,** was organized by the American Astronautical Society on May 22-23, 1991 in Washington, D.C.

The Ninth **IAA Man in Space Symposium** was held on June 17-21, 1971 in Cologne, Germany.

The 6th International Conference on **Commercial and Industrial Activities in Space in the 1990's: Insurance Implications** was organized by Assicurazione Generali in Rome on Sept. 16-17, 1991.

A course of study on **Artifical Space Debris: Technical and Policy Issues** was arranged by the AIAA on July 30-August 1, 1991 in Washington, D.C.

The Third Annual Symposium on the **Law and Outer Space** took place on Sept. 5-6, 1991 at the Georgetown University Law Center in Washington, D.C.

The **UN/IAF/CSA Workshop on Space Technology for Developing Nations** was held in Montreal, Canada on October 2-12, 1991. The fifty participants included twenty-three invited delegates from seventeen different countries. The Workshop brought together representatives from spacefaring and developing nations in order to help developing countries become more aware of space technologies, and to learn how applications of these technologies can enhance their development and solve present day problems such as communications to remote areas. The Workshop recommended the setting up of Regional Training Centers in developing countries. A similar workshop is planned in conjunction with the World Space Congress in 1992.

Telecom 91, held under the general theme "An interconnected world: improving the quality of life for all," brought together leaders of the world telecommunications industry, together with decision makers, system providers, operating agencies, regulatory bodies and user groups. Divided into five symposia, the discussions centered around the new developments and main problems of telecommunications of today, as they related to political, technical, regulatory and economic aspects, or to the special requirements of the disabled.

A conference, sponsored by NASA, NOAA and the Environmental Research Institute of Michigan on **"Earth's Observations and Global Change Decision Making: A National Partnership,"** was held in Ann Arbor, Michigan, October 22-23, 1991.

A **Space Education Conference** was sponsored by the Florida Space Grant Consortium on October 23-25, 1991 in Cocoa Beach, Florida.

An international Colloquium on **"Commercialization of Space Activities: A Positive and Prospective Legal Analysis"** was organized on October 24-26, 1991 in Dijon, France by the Centre de Recherche sur le droit des Marchés et des Investissements Internationaux.

The program of **Space Exploration 91,** the 2nd Annual Conference and Exposition organized by NASA Alumni League, on October 29-31, 1991 included the U.S., European and Japanese perspectives of space station utilization as well as a review of international space activities.

The **European Regional Telecommunications Development Conference** took place in Prague, Nov. 19-23, 1991 with the aim of promoting a coordinated, harmonious and accelerated development of telecommunications in countries of Central and Eastern Europe in transition.

Brief News

On October 28, 1991 **President Bush** signed legislation authorizing his administration to proceed with building the Space Station Freedom. . . **Astronauts** aboard the space station are to conduct onboard experiments and operate observation equipment in addition to operating and maintaining the space station. Initially, there will be four astronauts and their number will increase to eight. Astronauts from the participating countries will live together for a maximum of 180 days, working two shifts a day in a team of four. Assembly of the space station on orbit is to start around 1995 and is to enter its operational phase around the year 2000.

For the first time in six years the Space Shuttle **Atlantis** landed at the Kennedy Space Center. On their most recent November mission Atlantis astronauts were to determine how much detail can be seen on the ground from a distance of 224 miles up. . . Because of malfunction in Orbital Sciences' **Pegasus** booster, seven communications satellites were placed into a lower orbit that will shorten their useful lives. . . A shuttle servicing mission is planned for 1993 to replace the **Hubble** telescope's three gyroscopes that failed.

Lack of uniform policies for testing of spacecraft before launching was criticized in a **GAO** study. . . Recent scientific evidence suggests that the reflective substance shown at **Mercury**'s polar caps may be ice. . . Astronomers believe that a newly discovered distant **quasar** is emitting million times the energy of the entire Milky Way galaxy. . . The first closeup picture of an asteroid, called Gaspra, revealed a big crater-dotted rock which probably resulted from the collision of larger objects.

NASA's 1992 budget was reduced by $1.4 billion over the $15.7 billion requested by the administration, but left the space station program unchanged . . . **Congress** authorized the development for deployment of a new anti-missile defense system . . . A special engineering panel, reviewing NASA's planned Earth's Observation System's Data and Information System (**EOSDIS**) designed to acquire, process and distribute scientific data on the complex environmental processes that affect our planet, recommended that EOSDIS undergo a thorough review by an outside panel of experts. It also stressed that the environmental offshoot of SDI's controversial **Brilliant Pebbles,** the **Brilliant Eyes,** perhaps could do the job for $750 million instead of NASA's estimated $30 billion for EOS, though it would be premature to rely on it entirely. . . **EOSAT** operates **LANDSAT** 4 and 5 and is building LANDSAT 6 under contract with the Commerce Department. **EOSAT** urges funding by the government for **LANDSAT** 7 to gather data on global change. . . Hughes is suing NASA for the Agency's 1986 decision to ban commercial satellites from the Space Shuttle.

The first major space research project between the **U.S. and the Soviet Union** since the Apollo-Soyuz mission in 1975 took place recently when a Soviet rocket carried the first U.S. instrument ever placed aboard a Soviet satellite. The instrument, a Total Ozone Mapping Spectrometer, is to measure the Earth's ozone layer and monitor holes in it.

Kazakhstan declared that the **Baikonur** Cosmodrome which is located on its territory belongs to Kazakhstan. It is reported that the space center would be turned into an international spaceport to offer its launch services commercially in competition with the Ariane consortium, the U.S. and China. This would be done in the form of a joint stock company with Kazakhstan, Russia and the Ukraine holding 80% of the shares, while the rest would be sold to private interests . . . The Soviet Union joined **INTELSAT.**

NASA's upper atmosphere research satellite launched on September 12, 1991 carried **Canada's** Wind Imaging Interferometer (**WINDII**). WINDII is a joint project sponsored by the Canadian Space Agency and the French Centre National d'Etudes Spatiales. The instrument is designed to measure winds and temperatures at high altitudes in the atmosphere. . . Canada has contracted with Arianespace to launch the first Canadian mobile communications satellite, MSAT 1, in 1994 . . .The **Canadian Space Agency** became the 126th member of IAF.

The Council of telecommunications ministers of the **European Coummunity** agreed to break government monopolies and deregulate the satellite communications industry.

The **French** civilian space budget for 1992 shows an increase of 7.9 percent over the 1991 expenditures, thereby permitting development of a new launch vehicle, a piloted spaceplane and a contribution to the space station activities.

Germany increased its 1992 space budget by 12%, but officials believe this increase is still too low to meet German commitment to the European space effort.

In preparation for a meeting of experts on the transborder use of mobile satellite earth stations, **INMARSAT** carried out a survey of regulations and policies in countries around the world relating to mobile satellite terminals.

Discovery by **British** astronomers of a planet beyond our solar system suggests that planets may be common throughout the universe. . . **India's** second remote sensing satellite was succesfully launched from the Baikonur Cosmodrome in Kazakhstan on August 29, 1991.

The National Space Development Agency of **Japan (NASDA)** is to begin recruiting and selecting Japanese astronauts for the space station in fiscal 1991 and the assembly of the Japanese Experiment Module is to start around 1998.

India's second remote sensing satellite was successfully launched from the Baikonur Cosmodrome in Kazakhstan on August 29, 1991.

Arabsat awarded a contract to **Telespazio** of Rome for the preperation, launch, and in-orbit testing of its Arabsat 1C communication satellite. Telespazio's work is to be carried out at the Aerospatiale center in Cannes, the French Guaiana Center and the Mission Control Centers in Toulouse and Riyadh. . . **Italspazio** designed two small communications satellites, Ministar and Leostar, for geostationary and low earth orbits for the European Space Agency.

B. FORTHCOMING EVENTS

The Eighteenth **International Symposium on Space Technology and Science** is to take place in **Kagoshima, Japan, May 17-23, 1992.** One of the sessions will be devoted to Space Law and International Cooperation.

An international interdisciplinary Colloquium on **Manned Space Flight - Legal Aspects in the Light of Scientific and Technical Development** is organized by the Institute of Air and Space Law of Cologne University on **May 20-22, 1992.**

Huntsville, Alabama will be the site of the **International Aerospace Convention** which is to discuss issues of international cooperation and competition on **July 16-20, 1992**

The 35th **Colloquium on the Law of Outer Space** will be held **Aug. 28-Sep. 5, 1992** in **Washington, D.C.** (USA) during the IAF Congress. Topics to be discussed include: (1) Emerging and Future Supplements to Space Law, Specifically in the Context of the International Space Year (Papers are invited describing newly emerging national laws, bilateral agreements, international agreements and regional arrangements relating to activities in space, or addressing the needs for supplements to the existing space law, or supplements not covered by these instruments). (2) Managing Environmental Issues, Including Space Debris. (Papers are invited dealing with legal aspects of environmental impacts of space activities, including but not limited to aspects of managing space debris. Authors may, for instance, focus their attention on the use of nuclear and solar energy in outer space, or on the legal questions concerning the

protection of the ozone layer (earth and space environment). (3) Legal Regulation of Economic Uses of Outer Space. (Papers are invited to address subjects which arise in the economic activities of states and private enterprises. The discussion of specific issues in detail, such as the law governing commercial transactions concerning activities in or of outer space (international or municipal law) or the delegation by States of actions to private institutions, is recommended). (4) Other Legal Subjects. [Authors may suggest their topics, but in particular papers are invited to deal with the role of the UN in implementing the law of outer space (*e.g.* the role of the Secretary General), the legal status of aeorospace vehicles, the regulation of mobile satellite stations and the matter of overcrowding of the geostationary orbit].

An **International Symposium on Benefits from Space Activities,** cosponsored by the Chinese Society of Astronautics and the International Academy of Astronautics, is planned for **October 11-14, 1992** in Beijing, China.

Book Reviews

Developments in Space Law - Issues and Policies by *Stephen Gorove*, Dordrecht, Martinus Nijhoff, 1991, pp. 416, hardbound.

There are authors who contend that the development of space law can be distinctly divided into two phases. The first phase, lasting from 1957 to circa 1980, was the era of international public law. The second phase begins around 1980 and allegedly "can be categorized by the atrophy and obsolescence of most space treaties and the shift toward a domestic law of outer space. Under this domestic law, private enterprise and other actors have begun to enter space, answering chiefly to the laws of their own nation states."[1] On the other hand, there are people who still think that space law is a part of science fiction.

The new fundamental treatise Developments in Space Law, Issues and Policies, which is published by Martinus Nijhoff Publishers, is solid evidence that both of the assumptions are incorrect. The author of the new treatise, *Professor Stephen Gorove*, is a world-renowned expert on space law. He is the Director of Space Law and Policy Studies at the University of Mississippi Law Center and the Chairman of the Editorial Board of the Journal of Space Law, which is the only periodical in the world totally devoted to the issues of space law.

Building on the space law developments which occurred after the appearance in 1977 of his previous book, Space Law: Its Challenges and Prospects, *Professor Gorove* presents in thirty-three chapters of his new book basic topics associated with the recent developments in international and American space law and the projected expectations. It is neither a systematic exposition of the current international and domestic space law nor a textbook for beginners; rather, it is a collection of essays, some of which are based on the previous writings and presentations of the author on the most acute issues of space law.

The book consists of nine parts organized around the following subjects: Background, Resources, Environment, Transportation, Liability, Arms Control, Remote Sensing, Space Stations and the Future. Major international space instruments are reproduced in the Annex.

In the first part of his book, *Professor Gorove* gives a brief overview of domestic regulations of space activity in the United States. He highlights U.S. legislative, regulatory and judicial developments pertaining to space activities and shows that U.S. national space laws "may well serve for other space-faring nations as useful tools for study and analysis when they consider drafting their own national regulations" (p. 12).

In the second part, the author attracts the attention of the reader to the major legal issue of international law arising from the use of the

1 NATHAN C. GOLDMAN, AMERICAN SPACE LAW, INTERNATIONAL AND DOMESTIC, Iowa State University Press, Ames, Iowa, 1988, p. vii.

Geostationary Orbit, Direct Television Broadcasting by Satellites and Solar Power Satellites. Some of the key considerations in this part of the book are also devoted to the concept of "common heritage of mankind" as it relates to the exploitation of space resources and to the principle of "equitable access," advocated by developing countries with regard to the geostationary orbit and the services utilizing it.

The third part of the treatise deals with the role space law in the protection of the human environment and focuses on the issue of space debris. Although the author takes a cautious approach to this problem and avoids any concrete legal recommendations before sufficient scientific and technological data are available, he definitely expresses the opinion that under the Liability Convention of 1972 "the liability would also extend to what we regard as space debris, such as the broken-up pieces of a space object" (p. 165).

While treating the space transportation problems (PART IV), *Professor Gorove* concentrates on the legal implications of the space shuttle program and the legal aspects of international space flights. The logical continuation of these subjects is the legal and policy issues of the U.S./International Space Station "Freedom" and the future aerospace planes considered respectively in PARTS VIII and IX of the book.

Among other topics studied by the author, the essays devoted to liability issues connected with the Cosmos 954 accident and the Challenger disaster (PART V), limitations on the use of arms in outer space (PART V), possible controversial issues associated with the U.N. Principles on Remote Sensing (PART VII), and the teaching of space law (PART IX) are noteworthy.

Not all of the recent developments in space law have received equal attention from the author and, hence, not all have been given equal in-depth analysis. Thus, there exists a voluminous literature on the problem of the so-called liberal or restrictive interpretation of the ABM Treaty. Unfortunately, the reader will not find an adequate coverage of this acute subject in the book. One could also expect a more detailed analysis of the modern developments in national American space law and of the interrelationship between international space law and domestic law from the perspective of American legal theory and practice.

Some of the propositions of the author seem debatable. For instance, while discussing the "eternal" issue of international space law about the meaning of "peaceful" and "military" in international legal instruments, the author expounds the view that "the objects of the research (in outer space),* whether the advancement of science, military defense, or perhaps even outright aggression, would have no bearing on the lawfulness of any research activity" (p. 257). It is hard to agree, though, that the clearcut provision of international space law demanding the use of the moon and other celestial bodies "exclusively for peaceful purposes" permits such a broad interpretation.

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* Phrase in parenthesis has been added by the reviewer.

A wide range of challenging problems of international public space law discussed in the new book by *Professor Gorove* is vivid evidence to the fact that public international law will continue to play a major role in the regulations of space activities. Certainly, another movement in space law 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. I absolutely agree with the remark by the author "that lawyers and policy makers must continually bear in mind the close interrelationship between national and international space laws so that the two areas of law will develop in harmony and will not become a source of potential conflict" (p. 13).

Every new book written or edited by *Professor Gorove* is received with great interest by the international community of space lawyers and by all those who follow the developments in space law. I am firmly convinced that his latest book will not be an exception to this rule.

Professor V.S. Vereshchetin
Deputy Director, Institute of State and Law,
Soviet Academy of Sciences

Handbuch des Weltraumrechts, edited by *Karl-Heinz Böckstiegel* (Cologne *et al.*, 1991), 893 pp., hardbound, 480 DM.

The recently published Handbuch des Weltraumrechts (Manual on Space Law) is the first of its kind in German. Edited by *Böckstiegel*, it contains the contributions of twenty-one authors, mostly from Germany but also from Switzerland, Austria, and the United States.

The manual gives an encompassing overview of all legal problems of current space law. It is divided into ten parts entitled: A. Basics of Space Law *(Böckstiegel);* B. Basic Notions and Principles of Space Law (*Vitt, Bückling, Rehm, Bittlinger, Schwenk);* C. Space Objects *(Hintz);* D. Humans in Outer Space *(Bittlinger);* E. Space Research *(von Kries);* F. Utilization of Outer Space *(Böckstiegel, von Kries, Wolfrum, Malanczuk, Benkö, Schmidt-Tedd, Reifarth, Pritzsche, Vitt, Frantzen);* G. International Cooperation in Outer Space *(Focke, Spude);* H. Liability *(Malanczuk);* I. Settlement of Disputes *(Böckstiegel);* J. National Space Law *(Reifarth, Müller, Fasan, Guldimann, Gorove)* and includes a bibliography *(Focke)* at the end.

Due to the comprehensiveness of the manual, a detailed review of each contribution is almost impossible. Nonetheless, it can be said that the aim of the editor, to pool the knowledge of experts in the different fields of space law and provide compact and useful information has fully been achieved.

After *Böckstiegel's* comprehensive introduction in Part A into the basics of space law, namely its notion, its development and its sources, *Vitt* opens Part B offering a definition of outer space and celestial bodies along the line of the current delimitation debate. Then *Bückling* discusses the principle of freedom of outer space which, in his opinion, is not decisively

limited by the "benefit-clause" of article I, para. 1 of the Outer Space Treaty. Next, *Rehm* discusses another limitation of the freedom principle, the prohibition of national appropriation in article II of the Outer Space Treaty. After *Bittlinger's* discussion of the rights and obligations to be derived from the mutual respect clause of article IX of the Outer Space Treaty, Schwenk helps in clarifying the importance of air law for outer space activities by explicitly discussing the problem of so-called innocent passage rights of spaceplanes during the starting and landing process. Part C is devoted to "space objects" presented by *Hintz* and not defined in international space law. In particular, the doctrinal discussion of the space object quality of the Spacelab and of the International Space Station as well as of the different aerospace vehicles (Space Shuttle, Hermes, Saenger) elucidate the eminent relevance of having a precise understanding of the notion of space object.

In the following Part D, *Bittlinger* gives an overview of the legal problems associated with humans in outer space, before *von Kries*, in Part E, investigates the legal framework for space research. *Böckstiegel* opens Part F on utilization of outer space with a discussion of the general legal framework by stressing the importance of the "freedom of use" principle and its limitations. Based on this framework, the same author discusses the legal problems of commercial use of outer space which he sees developing more and more as a branch of international economic law. Afterwards, different forms of use of outer space are discussed. *Von Kries* starts with an investigation of military uses of outer space and demonstrates impressingly the still limited range of legal rules prohibiting such use. Then *Wolfrum* discusses the legal regime for using the geostationary satellite orbit. He states a significant change during the past thirty years toward a limitation of the freedom of states to use this orbit. Starting from almost unlimited freedom, the present legal regime exhibits a growing tendency toward a planning approach, thus establishing at least, in part, a regime of international administration by the ITU. The aim of this administration is the establishment of equal chances for the use of this orbit, in other words a guarantee of an equality of opportunity in its use, mostly for the benefit of the developing countries. Moreover, this tendency demonstrates the emerging shift of public international law from a law of coexistence toward a law of cooperation. The same author also presents the legal regime for the use of satellites for direct broadcasting, navigation and weather forecasting, whereas *Malanczuk* discusses the legal regime of remote sensing of the earth by satellite. *Benkö* then explains the growing legal framework for the use of nuclear power sources in outer space focusing on a diligent description and evaluation of the current discussion in UNCOPUOS. Next, *Schmidt-Tedd* gives an overview of the political, economical, and technical aspects of the development of launching systems and thoroughly discusses the legal regime. Besides more general questions like the legal regime for activities of private launchers, the author discusses the legal nature of launch service contracts. In his contribution, *Reifarth* explains the legal regime for the international space station "Freedom." *Pritzsche* discusses the legal

regime for the utilization of natural resources, thereby indicating a progressive development from the "benefit-clause" of article I, para. 1 of the Outer Space Treaty to the principle of the common heritage of mankind, as contained in article 11 of the Moon Treaty. This section continues with a contribution by *Vitt* who demonstrates the legal regime for colonies in outer space, and correctly states the still anthropocentric feature of the law regulating outer space activities. Finally, *Frantzen* discusses the environmental law of outer space which he considers inadequate with regard to the problem of space debris. He, therefore, proposes some changes, mainly in the Liability Convention and, additionally, traffic rules for outer space overseen by an international organization.

The next Part G on international cooperation is subdivided into two sections. First, *Focke* investigates general questions of international cooperation, then *Spude* explains the legal regime of ESA. He stresses that ESA is an important and impressive example of European cooperation and thus greatly contributes to the process of European integration. In part H, *Malanczuk* examines the liability system for space activities. He correctly states that, except in the case of article II of the Liability Convention, there is still no general regime of strict liability for damage on earth caused by space objects and that, therefore, all states should adhere to the Liability Convention. *Böckstiegel* then explains in Part I the main rules for a convention on the settlement of space law disputes.

Finally, in the last Part J, different authors describe the national space laws which in many states are still in *statu nascendi*. *Reifarth* explains the law of the Federal Republic of Germany and briefly illustrates the new structure of German space management, as well as the laws of Sweden and the United Kingdom. *Mueller* discusses the law of the former German Democratic Republic, *Fasan* the law of Austria, *Guldimann* the Swiss law and *Gorove* the still most important law, that of the United States.

In sum, the Handbuch des Weltraumrechts can be regarded as an important contribution to the doctrinal discussion of space law and a useful tool for any practitioner. Its high quality would also justify an edition in English if care could be taken that, unlike in the German edition, the price would make the volume a bit more accessible to the average customer.

Stephan Hobe,
Deutsche Agentur für
Raumfahrtangelegenheiten (DARA)
Bonn, Germany

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Danilenko, *Space Activities and Customary Law of Environmental Protection, Id.* at 169.

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Corrigendum

Page 66, last para., line 10 of Vol. 19, No. 1 (1991) should read: ". . . which was in fact sold . . .", instead of " . . . which in fact sold out . . ."

CURRENT DOCUMENT

Exploring the Moon and Mars: Choices for the Nation*

Since July 1989, President Bush has urged that the United States develop a permanent presence on the Moon early in the next century, and land a human crew on Mars by 2019, 50 years after the first Apollo Moon landing. The Administration has termed this challenge the Space Exploration Initiative (SEI). The Advisory Committee on the Future of the U.S. Space Program recently suggested that SEI be thought of as part of a Mission from Planet Earth, which would focus on the long-term exploration of space, using advanced robotic systems and human crews.

During this decade, Congress will be faced with a series of decisions concerning whether or not to invest public dollars to meet these objectives, and if so, how. This assessment, which was requested by the House Subcommittee on VA, HUD, and Independent Agencies and the Senate Committee on Appropriations, explores the role of automation and robotics technologies in pursuing them. It also examines the broader issues of how a Mission from Planet Earth relates to U.S. national goals.

Both humans and machines can contribute as partners in a Mission from Planet Earth. This partnership raises the following question: What is the appropriate mix of humans and robotic machines on the surface of the Moon and Mars? The answer to this question will shape the program and necessary funding over decades.

At one extreme, the United States could mount Apollo-like expeditions to the Moon and Mars, in which the United States would place maximum emphasis on science and technology to support humans in transit and on the surface, but put relatively little emphasis on automation and robotics (A&R). In the Apollo era, because the available A&R technologies were quite primitive, the United States sent men to the Moon with very little robotic support. Most of the control remained on Earth where thousands of support personnel followed every detail of the crew's progress and controlled most of their actions.

At the other extreme, the United States could focus on the development of advanced A&R technologies for exploration and indefinitely defer sending humans to the Moon and Mars.

In the most effective exploration program, people and machines would function as interactive partners, with people on Earth or perhaps on the surface of the Moon or Mars, as need and funding allow. A&R experts believe that it will soon be possible to develop machines, guided by controllers on Earth where appropriate, but acting autonomously most of the time, to carry out many exploration duties. On the Moon, robots controlled from Earth could be used to explore for lunar resources, to conduct scientific observations, and to carry out a variety of simple construction tasks. On Mars, robots could be employed to survey the planet's composition and structure, monitor its weather, and return samples for analysis on Earth.

However, experts in field research methods believe that, even with advances in A&R, human explorers would be needed to carry out geological field studies on the Moon or Mars, or search for signs of indigenous life on Mars—tasks that require a broad experiential database and the ability to link disparate, unexpected observations in the field. Nevertheless, robotic devices would be needed to assist human explorers in a wide variety of tasks as they work on either planetary body.

In the past, A&R technologies have received relatively little emphasis, in part because they have lacked capability. In the future, giving A&R technologies a more central role in exploration activities could greatly enhance scientific understanding and contribute to increased human productivity in other parts of the economy. Congress can play an important part in assuring that the partnership between humans and machines evolves as productively as possible. It could, for example, encourage NASA to:

- devote greater and more consistent effort to A&R research and development; and
- include far more A&R technologies in future projects involving space exploration and humans in space than is the practice today.

EXPLORATION TIMETABLE

Congress also faces a decision regarding the timetable of a Mission from Planet Earth. Given the

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* Taken from OTA Report Brief, July 1991

existing Federal budget crisis and chronic shortages of public capital, acceptance of the President's timetable (2019) for landing humans on Mars might require a major emphasis on the development of technologies to support human crews and thus greatly constrain the options for developing A&R technologies.

Some argue that the United States should demonstrate its leadership in advanced technology to the rest of the world by embarking on the human exploration of Mars as soon as possible. However, it is far from clear what the United States would gain from demonstrating leadership in human exploration. For the next decade or even two, the United States has no effective competitors in sending human missions to the Moon or Mars. If the United States emphasized human exploration and failed to fund the development of A&R technologies directly related to the U.S. economy, it might slip in economic competition with other nations. A U.S.-led Mission from Planet Earth could assist in boosting international leadership in space activities, but only if it were part of a balanced space program that rested on a solid foundation of space science and technology development.

In the near term, Congress could:

1. *defer decisions on a Mission from Planet Earth indefinitely and fund the scientific exploration of the Moon and Mars within the existing planetary exploration program;* or
2. *agree in principle with the goals of a Mission from Planet Earth, but emphasize the development and use of A&R technologies to accomplish them;* or
3. *agree in principle with the long-term goals of a Mission from Planet Earth, but wish to focus on measured efforts to develop technologies supporting human exploration;* or
4. *accept the President's timetable of people reaching Mars by 2019.*

Options 1 through 3 would tend to extend the timetable for humans to reach Mars beyond 2019.

MANAGEMENT OF A MISSION FROM PLANET EARTH

U.S. experience with large science and technology projects having long-range goals suggest that program planners need to maintain considerable planning flexibility and a broad set of intermediate objectives within the general program plan. Operational success in each successive phase should be favored over forcing a fit to a detailed long-term plan.

The scientific success of missions to the Moon and Mars will depend directly on the quality of the scientific advice NASA receives and the relative influence of engineers in designing robotic missions to the Moon and Mars. If the Nation wishes to maximize the quality of its scientific returns, planetary scientists should have a major role in the decision process for the exploration program.

EXPLORING AND EXPLOITING THE MOON

Despite U.S. and Soviet successes during the 1960s and early 1970s in studying the Moon, scientists still have a relatively rudimentary understanding of its structure and evolution. A detailed scientific study of the Moon would assist in understanding the geological and climatological history of the Earth. Most of this work could be carried out robotically with a variety of instruments.

The United States may in time wish to establish a permanent lunar base in order to study the Moon more intensively and to exploit its unique properties for scientific observations and experiments. For example, the Moon would provide an excellent site for astronomical observatories operating at all wavelengths. However, the costs of lunar observatories would have to be balanced against the costs of placing observatories in competing locations, e.g., geostationary orbit, or on the Earth.

Exploitation of the Moon's material resources might eventually prove cost-effective, for example, in constructing surface or orbital infrastructure, or in providing additional sources of energy. Robotic devices would provide human explorers with support for field studies, emergencies, surveys, and construction.

EXPLORING MARS

It is too early to plan a detailed, integrated program of robotics and human exploration of Mars. However, it is not too early to begin a series of projects to continue the scientific investigation of Mars, and to study human physiology in space in order to reduce the uncertainties facing human exploration of the planet.

Robotic exploratory missions will first be needed to explore Mars, whether or not the United States decides to land humans on Mars by 2019. These missions could provide important geological and atmospheric data about Mars, help refine planning for human missions, and assist in choosing potential landing sites.

If the United States ultimately decides that it is important to send human crews to Mars, A&R technologies could provide crucial assistance to these crews while on the Martian surface. A&R could provide support for field studies; assistance in surveying prior to human exploration, especially over dangerous terrain; and emergency support.

A trip to and from Mars would experience much higher risk than a return to the Moon, but would also provide greater challenge and adventure. If the United States decides to send human crews to Mars, it must accept the potential for loss of life, either from human error or mechanical failure.

A&R RESEARCH AND DEVELOPMENT

Robotics exploration will be needed as a prerequisite to human exploration. The United States has many promising A&R technologies, but to date it has not spent sufficient time or funds to incorporate

them into devices for exploring the Moon and Mars. Yet, aggressive pursuit of robotic devices would assist exploration efforts and make humans much more capable on the Moon and Mars than they could otherwise be. However, at present NASA lacks the A&R capability to carry out a vigorous exploration program using advanced robotics. Since the development of robotic technologies does not receive high priority within NASA, there is little evidence to suggest this will change.

A number of reports, including the recent report of the Advisory Committee on the Future of the U.S. Space Program, have urged increased attention to, and funding for, developing the requisite U.S. technology base. Congress could assist the development of A&R technologies by funding a set of A&R projects that culminated in a variety of scientific capabilities for missions to the Moon and Mars.

The potential applications for A&R technologies extend far beyond the space program and include manufacturing and service industries, as well as the defense community. Yet because the A&R discipline derives from a widely splintered set of subfields, only in weak contact with one another, NASA has a relatively thin technology base upon which to draw for its own needs. An integrated A&R program to serve government needs and assist industry will require the collaborative efforts of the universities, government laboratories, and industry.

COSTS

Sending humans back to the Moon and/or on to Mars would be extremely expensive. According to experts OTA consulted, because of the need to support human life in extremely harsh environments, exploration by human crews could cost more than ten times the costs of robotics exploration. Yet, because cost estimates depend critically on the range of planned activities, schedule, and new information developed in the course of the program, it is too early to judge the total costs of a Mission from Planet Earth. As more information is gained from robotic missions, e.g., Mars Observer, and from technology research and development, it will eventually be possible to develop more credible cost estimates.

A comprehensive search for cost-reducing methods and techniques and for alternative approaches will be of high priority. Congress should ask NASA how it plans to control costs. NASA's plans should also include plans for controlling operational costs. As experience with the space shuttle has demonstrated, operational costs for crew-carrying systems can constitute an extremely high percentage of total system costs.

A return to the Moon and the exploration of Mars would have a major impact on NASA's yearly budget, and, in times of constrained budgets, pursuit of these goals would almost certainly adversely affect the funding of NASA's other activities, e.g., space science, and the Mission *to* Planet Earth (NASA's program to address environmental and other Earth-bound problems). Hence, it will be important for Congress and the administration to test continually whether the President's aspirations for human activity in space can be accommodated within NASA's likely budget, and adjust its projects accordingly.

INTERNATIONAL COOPERATION AND COMPETITION

Issues of international competition and cooperation will continue to play important roles in the development of U.S. space policy. The United States is part of a rapidly changing world in which the political and military challenge from the Soviet Union has substantially decreased but the technological and marketing capabilities of Europe and Japan have markedly increased. How the United States invests in its space program could deeply affect other segments of the economy. The experience gained in applying A&R technologies to tasks in space could assist their development in other parts of U.S. industry and help the United States to compete in this important arena of the world economy. It is less clear how investments to support human exploration of space would benefit U.S. industry.

Politically and technologically, the United States could gain from leading an international cooperative program to advance in space exploration. But for such a space program we will have to learn how to pursue *shared* goals, which would give the United States less latitude in setting the program objectives. Cooperative activities with other countries also could reduce U.S. costs and increase the return on investment for exploration by bringing foreign expertise and capital to bear on the challenge. The Soviet Union has far more experience with supporting humans in space than any other country. More extensive cooperation with the Soviet Union could markedly reduce U.S. expenditures for life sciences research, and lead to much better understanding of the risks of extended spaceflight and how to reduce them.

Japan, Europe, and the Soviet Union have made significant progress in applying A&R to space activities. Cooperative scientific programs that would incorporate robotic devices contributed by several countries might significantly advance U.S. experience in this important area. For example, nations might cooperate in sending small rovers to the Moon or to Mars to do reconnaissance and simple chemical analysis, and to return samples to Earth.

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VOLUME 19, NUMBERS 1 & 2
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