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Legal Implementation of Orbital Debris Mitigation Measures: A Survey of Options and Approaches

Pamela L. Meredith

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LEGAL IMPLEMENTATION OF ORBITAL DEBRIS MITIGATION MEASURES: A SURVEY OF OPTIONS AND APPROACHES

Pamela L. Meredith*

ABSTRACT

A survey is provided of options for legal implementation of space debris mitigation measures. United States Federal regulatory agencies have the authority to impose mitigation requirements on commercial satellite and launch vehicle operators, subject to proper rulemaking proceedings. Existing international organizations, while possessing the appropriate authority, do not provide fora to resolve the debris problem in an effective and timely fashion. A conference of spacefaring nations is offered as an alternative. Only space debris from civil and commercial missions is addressed.

INTRODUCTION

The failure of current law to address adequately the problem of space debris is evidenced by the ever-increasing amount of Earth-orbital debris.[1] This fact has prompted legal scholars and practitioners around the

* President of Space Consultation and Information, Inc. of Washington, D.C. and Adjunct Professor of Space and Satellite Communications Law, Washington College of Law, The American University; Candidatus Juris, University of Oslo, Oslo, Norway, 1981; LL.M., McGill University Air & Space Law Institute, 1983. The author is co-chairman of the American Institute of Aeronautics and Astronautics, Legal Subcommittee on Space Debris.

1. More than seven thousand space objects are currently being tracked by the North American Aerospace Defense Command (NORAD). These objects are being catalogued. Only 5% of the catalogued objects are operational spacecraft. The rest is

world to work with space engineers, project directors, and policymakers, to help find ways to remedy the situation. One such effort is underway at the American Institute of Aeronautics and Astronautics (AIAA). On May 4, 1989, the AIAA's Legal Aspects Committee, formed a Subcommittee on Orbital Debris.[2] Although this article is based in part on the discussions and findings of the Subcommittee, the conclusions are the author's alone, because the Subcommittee has not yet completed its work.

The purpose of this article is to provide an overview of options for, and approaches to, future legal participation in the resolution of the orbital debris problem. Effective resolutions, or solutions, lie in the standardization and legal implementation of technically feasible and economically sound orbital debris mitigation practices at an appropriate time in the future. Debris mitigation practices refer to spacecraft design and operating procedures intended to limit the debris generation, such as shifting to a higher, so-called "graveyard," orbit of inoperational geostationary satellites, and deorbiting low-Earth orbit satellites and launch vehicle upper stages. To some extent, such measures already are being taken by industry and governments and could be mandated in the United States as a matter of United States domestic law, and universally, as a matter of international law.

The scope of this article is limited. Its focus is Earth-orbital debris, rather than space debris in general, simply because a solution is more

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space debris in one form or another. Operational space debris, that is, objects intentionally discarded during space missions, such as satellite launch and deployment, including, for example, payload shrouds, comprises 12%. Spent intact rocket bodies account for 14%; inactive payloads, (typically, inoperational satellites) 20%; and fragmentation debris, 45%. INTERAGENCY GROUP (SPACE) OF THE NATIONAL SECURITY COUNCIL REPORT ON ORBITAL DEBRIS 3, 6-8 (Feb. 1989) [hereinafter NATIONAL SECURITY COUNCIL REPORT]. *See also* OFFICE OF TECHNOLOGY ASSESSMENT, ORBITAL DEBRIS: A SPACE ENVIRONMENTAL PROBLEM, [and] SPACE DEBRIS WORKING GROUP, EUROPEAN SPACE AGENCY (ESA) (Sept. 1988) (providing more information on the orbital debris environment).

Fragmentation debris stems from spacecraft explosions and collisions. To date, all collisions between operational spacecraft have been deliberate. Typically, collisions take place in the context of anti-satellite-satellite (ASAT) or ballistic missile defense testing. On the other hand, several unintended explosions have occurred, e.g., in spent rocket bodies (rocket upper stages) that failed to reenter the atmosphere and that contained residual fuel. Residual fuel often remains in rocket bodies after successful launching and leaves them prone to explosions. For example, on October 4, 1990, a Chinese rocket body from a CZ-4 launch fragmented while in a circular (850-900 km) sun-synchronous orbit. The CZ-4 launch vehicle had successfully completed the launching of a satellite and two "balloons" on September 3, 1990. *Late Breaking News*, ORBITAL DEBRIS MONITOR, Oct. 1990, at 3.

2. The Subcommittee's mandate is: (1) to provide a survey of existing law relevant to space debris, and (2) to identify mechanisms for legal implementation of debris mitigation practices.

urgently needed for the Earth-orbital environment. Furthermore, debris resulting from military space activities is not addressed. The failure to deal with such debris reflects no attempt to diminish the significance of the problem of military space debris, but simply the fact that setting standards for the military raises an entirely new and complex set of national security and political issues, particularly at the international level. Consequently, this paper concentrates on legal solutions to the problems of civil—primarily commercial—space debris.

I. SPACE DEBRIS AND EXISTING LAW

General agreement exists in the United States, as well as in the international, legal community that current law does not adequately address the issue of orbital debris. United States domestic regulatory regimes governing private commercial space activities[3] do not mandate debris mitigation measures.[4] Moreover, the National Aeronautics and Space Administration (NASA) appears to have adopted an *ad hoc* approach to space debris and, in fact, is opposed to comprehensive standards of conduct aimed at debris mitigation. Ironically, NASA also recognizes that debris poses one of the greatest threats to the survivability of the planned international Space Station.

Public international law is simply insufficient to resolve the debris problem. A handful of provisions, scattered largely throughout a body of space treaties,[5] provides little more than general discouragement and vague admonitions to would-be space polluters. For example, the Treaty on Principles Governing the Activities of States in the Explora-

3. *See* The Commercial Space Launch Act of 1984, 49 U.S.C. App. §§ 2601-23 (1990) (providing information on launch vehicles); The Land Remote-Sensing Commercialization Act of 1984, 15 U.S.C. §§ 4201-92 (1990) (providing information on remote-sensing satellites); [and] The Communications Act of 1934, 47 U.S.C. §§ 151-55 (1990) and the Communications Satellite Act of 1962, 47 U.S.C. §§ 701-44 (1990) (setting forth licensing regimes for communications satellites).

4. *See generally* Baker, *Space Debris: Law and Policy in the United States*, 60 U. COLO. L. REV. 55 (1989) (describing United States law and policy on space debris).

5. 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 [hereinafter Outer Space Treaty]; Agreement on the Rescue of Astronauts, the Return of the Astronauts, and the Return of Objects Launched into Outer Space, Apr. 22, 1968, 19 U.S.T. 7570, T.I.A.S. No. 6599, 672 U.N.T.S. 119 [hereinafter Rescue Agreement]; Convention on International Liability for Damage Caused by Space Objects, Mar. 29, 1972, 24 U.S.T. 2389, T.I.A.S. No. 7762 [hereinafter Liability Convention]; Convention on Registration of Objects Launched into Outer Space, Jan. 14, 1975, 28 U.S.T. 695, T.I.A.S. 8480 [hereinafter Registration Convention]; and Agreement Governing the Activities of States on the Moon and Other Celestial Bodies of 1979, G.A. Res. 34/68 (Dec. 5, 1979) *reprinted in* 18 I.L.M. 1434 (1979) [hereinafter Moon Treaty].

tion and Use of Outer Space, Including the Moon and Other Celestial Bodies (Outer Space Treaty),[6] which addresses environmental issues in more detail than any of the other space treaties, is silent on space debris. Article IX of the Outer Space Treaty speaks of "harmful contamination" of the celestial bodies and of "adverse changes in the environment of the Earth resulting from the introduction of extraterrestrial matter." The preparatory works of the Outer Space Treaty suggest, however, that "harmful contamination" refers to biological contamination, and not to space debris.

To attempt to apply to space debris other provisions of the Outer Space Treaty—such as requirements for "cooperation and mutual assistance"[7] in the conduct of space activities or for consultation where one state's space activities "would cause potentially harmful interference" with those of another state—is even more far-fetched. First, these provisions were not intended to control space debris; and second, the provisions do not contain strong legal obligations that could be relied on to protect the space environment beyond the twentieth century.[8]

Moreover, the Convention on Liability for Damage Caused by Space Objects (Liability Convention),[9] which is designed *inter alia*, to compensate those whose space objects are damaged in space, probably does not even apply to most kinds of space debris.[10] The Liability Convention applies when damage is caused by a "space object."[11] It is very unlikely that this term, as defined in the Convention,[12] would encompass, for example, operational or fragmentation debris, which together

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6. Outer Space Treaty, *supra* note 5.

7. *Id.* at 2416-17.

8. *See, e.g.*, Ospina, *Outer Space: 'Common Heritage' or 'Common Junkyard' of Mankind*, XXX PROCEEDINGS OF THE THIRTIETH COLLOQUIUM OF THE INT'L INST. OF SPACE L. 228; McCloud, *Space Pollution*, XXX PROCEEDINGS OF THE THIRTIETH COLLOQUIUM OF THE INT'L INST. OF SPACE L. 142; Reibel, *Prevention of Orbital Debris*, XXX PROCEEDINGS OF THE THIRTIETH COLLOQUIUM OF THE INT'L INST. OF SPACE L. 147; Gorove, *Space Debris in International Legal Perspective*, XXXII PROCEEDINGS OF THE THIRTY-SECOND COLLOQUIUM OF THE INT'L INST. SPACE L. 97; and Okolie, *International Law for the Protection of Outer Space*, XXXII PROCEEDINGS OF THE THIRTY-SECOND COLLOQUIUM OF THE INT'L INST. SPACE L. 123 (providing basic discussions of the space treaties in the context of space debris).

9. Liability Convention, *supra* note 5.

10. *See* Baker, *Liability for Damage Caused in Outer Space by Space Refuse*, XIII ANNALS OF AIR & SPACE L. 183 (1988).

11. *See* Liability Convention, *supra* note 5, art. III (applying fault-based liability). This section applies in the event "damage is caused elsewhere than on the surface of the Earth to a space object of one launching State. . . [or] by a space object of another launching State . . . ." *Id.*

12. *See id.* art. I(d) (defining space object). The definition of "space object" includes "component parts of a space object as well as its launch vehicle and parts thereof." *Id.*

make up about sixty percent of the orbital environment.[13] It is even unclear whether it would encompass spent rocket bodies and inactive payloads. The preparatory works of the Liability Convention indicate that the drafters contemplated operational spacecraft as damage-causing objects. Moreover, due to problems of identification of space debris, recovery may elude the victim even if the Liability Convention does apply.

Domestic and international commercial contracts generally do not address the issue of space debris. For example, transactions, such as spacecraft procurement contracts and launch services agreements are not concerned with the debris mitigation techniques, because no such design standards or operating procedures are mandated by law. Furthermore, satellite launch contracts and insurance policies, so far, have not included damage by space debris as a reason to disclaim liability.

II. ORBITAL DEBRIS MITIGATION MEASURES: LEGAL IMPLEMENTATION

A. Debris Mitigation Measures

Debris mitigation measures refer to spacecraft design and operating procedures aimed at reducing space debris from geostationary and low-Earth orbit satellites, as well as launch vehicle operations. Geostationary and low-Earth orbit satellites become potential debris hazards when they are no longer operational, and telemetry, tracking, and command from the ground ceases. Left to drift in relatively congested or heavily-trafficked orbital paths, these objects pose a risk of collision. To minimize or eliminate this risk, geostationary satellites may be shifted to higher orbits and low-Earth orbit satellites can be deorbited by controlled reentry into the Earth's atmosphere where friction with the atmosphere causes them to disintegrate and "burn-up."[14]

Launch vehicle upper stages are potentially a great source of debris because excess propellants and pressurants leave them prone to explosions. To minimize this risk, upper stages can be designed to reenter or, alternatively, to expel excess propellants and pressurants. To reduce further the debris generated by launchings, it is possible to minimize the number of independent parts allowed to reach orbit, secure parts to upper stages, and employ payload shrouds to contain the satellite or other payload.[15]

13. *See supra* note 1 and accompanying text (describing the orbital environment).
14. *See* National Security Council Report, *supra* note 1, at 33 (describing debris mitigation measures).
15. *Id.*

B. UNITED STATES DOMESTIC LAW

It appears that both the Federal Communication Commission and the Department of Transportation's Office of Commercial Space Transportation (OCST), federal agencies charged with regulating commercial telecommunications satellites and launch vehicle operations, respectively, have authority pursuant to their charters to impose debris mitigation requirements. The National Oceanic and Atmospheric Administration (NOAA), which licenses remote-sensing satellites, may impose such requirements, as well, subject to approval by the President of the United States.[16] None of these agencies, however, has yet taken formal initiatives with respect to debris mitigation.

1. The Federal Communications Commission: Telecommunication Satellites

The Federal Communications Commission (FCC or Commission)[17] licenses and regulates commercial telecommunications satellites under the Communications Act of 1934, as amended.[18] The FCC assumed jurisdiction over satellites in the early 1970s, when it first granted applications by private companies to launch and operate satellites.[19] Satellites fall within the scope of the FCC's licensing authority because they are considered *radio stations*, which is what the Commission was established to regulate.[20]

To date, the FCC has not attempted to regulate the debris aspects of telecommunications satellite operations. That is, it has not formally imposed requirements on satellite licensees for disposal of satellites at the end of useful life (a stage normally reached by commercial geostationary satellites after about ten years of operation) for two reasons: first, the Commission has felt that it lacks adequate technical basis for adopting a standard; and second, the Commission has not considered a standard to be urgent because, as a practical matter, several major satellite operators routinely boost their geostationary satellites to higher

16. *See infra* notes 35-38 and accompanying text (discussing the requirements NOAA imposes on parties who need to dispose of satellites).

17. The FCC is an independent regulatory agency created by the Communications Act of 1934. 47 U.S.C. § 151 (1990).

18. 47 U.S.C. §§ 151-52 (1990).

19. *See* Domestic Communications Satellite Facilities, 22 F.C.C.2d 86 (1970) (DOMSAT I), 35 F.C.C.2d 844 (1972) (DOMSAT II), *recon. in part*, 38 F.C.C.2d 665 (1972) (DOMSAT III) (providing for the authorization of private communications satellite operations).

20. 47 U.S.C. § 151-52 (1990).

orbits at the end of life. Satellite operators typically inform the Commission by letter when the orbital shift has taken place.

In any event, it appears that the Commission does have the authority to prescribe rules for disposal of telecommunications satellites at the end of life, should it decide to do so. This authority is based on the premise that a drifting satellite could collide with an operational satellite and impede "communications by. . .radio,"[21] which the Commission is charged to secure and regulate.[22] Because the main thrust of the Commission is to promote foreign and interstate communications by wire and radio, it would seem not to be inappropriate for the Commission to regulate inoperational communications hardware to the extent it might interfere with, or interrupt, communications. A collision between an operational satellite and one that is inoperational or, indeed, with debris from a previous collision between satellites, would cause precisely such a disruption of radio communications.

The Commission has general authority to make rules and establish conditions of license.[23] Section 303(r) of the Communications Act provides that the Commission may: "[m]ake such rules and regulations and prescribe such restrictions and conditions, not inconsistent with law, as may be necessary to carry out provisions of this Act . . . ."[24]

The Commission has used its general authority to regulate telecommunications satellites, as well as the more specific authority to "[d]etermine the location of . . . [radio] stations,"[25] and to prescribe specific locations for each satellite in the geostationary orbit.[26] Accordingly, the Commission assigns each satellite licensee a specific orbital location based on orbital deployment plans. For example, the Commission has determined that domestic-fixed satellites operating in the 4/6GHz and 12/14GHz frequency band, respectively, shall be spaced two-degrees apart, within a segment of the orbital arc from 64 to 143 degrees West Longitude.[27] Furthermore, as a general matter, the Commission always reserves the right, as a condition of each satellite operating license issued by it, to order the licensee to relocate the satellite on thirty days notice.[28]

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21. *Id.*
22. *Id.*
23. 47 U.S.C. § 303(r) (1990).
24. *Id.*
25. 47 U.S.C. § 303(d) (1990).
26. *Id.*
27. Assignment of Orbital Locations to Space Stations in the Domestic-Fixed Satellite Service, 84 F.C.C.2d 129 (1983).
28. *See* 47 C.F.R. § 25.202(d) (1990) (stating that the FCC may issue a summary order requiring space stations to change orbital locations on thirty days notice).

To be accurate, it must be emphasized that the Commission's regulation of satellites and the orbit is based on considerations that do not encompass debris, namely, the avoidance of harmful electrical interference between radio transmissions. Nevertheless, in light of the discussion above, it appears reasonable to conclude that the FCC could require licensees: (1) to shift geostationary satellites to higher (to be determined) orbits, and (2) to deorbit low-Earth orbit satellites by controlled reentry. Such requirements could become part of the Commission's rules, for example Parts 25 and 100 of Title 47 of the Code of Federal Regulations, which apply to domestic-fixed, radio-determination, and direct broadcasting satellites.

2. *The Office of Commercial Space Transportation: Launch Vehicles*

The Office of Commercial Space Transportation[29] licenses commercial launch operations pursuant to the Commercial Space Launch Act of 1984, as amended.[30] No provision in the Act or in the implementing regulations[31] refers specifically to space debris, although the OCST, to some extent, does consider the debris aspect of the launch operation as part of its overall launch safety assessment during the licensing process.

It appears that the OCST has sufficient authority to impose vehicle design and operating requirements. Under Section 7 of the Commercial Space Launch Act, the OCST, aimed at reducing orbital debris, is authorized to license launch operations "consistent with the public health and safety, [and the] safety of property . . . ."[32] On the premise that space debris resulting from launch operations poses a potential risk to the safety of property, (i.e., other space objects) mandating measures to reduce debris generation seems to be well within the scope of the OCST's authority. As a general matter, the OCST is authorized to "issue such regulations . . . as may be necessary to carry out this Act."[33]

Consequently, the OCST could amend its rules (subject to proper rulemaking procedures) to require licensees, as a condition of license, for example: (1) to employ upper stages that are guaranteed to reenter

29. The OCST is an office within the Department of Transportation, which was established to license launch vehicles under delegated authority. The Department of Transportation was designated by the Commercial Space Launch Act of 1984 as the lead agency for the regulating and licensing of launch vehicles. 49 U.S.C. § 2602(3) (1990).

30. 49 U.S.C. § 2601 (1990).

31. Office of Commercial Space Transportation, Department of Transportation, 14 C.F.R. §§ 400-15 (1990).

32. 49 U.S.C. § 2606 (1990). *See also id.* § 2601(7) (discussing, specifically, the safety of property).

33. Commercial Space Launch Act, § 13, 49 U.S.C. App. § 2612 (1990).

or, alternatively, expel excess propellants and pressurants from spent upper stages; (2) to take all possible measures to minimize the number of launch vehicle independent parts allowed to reach orbit and secure parts to upper stages; and (3) to employ payload shrouds, which would contain the payload. Prior to mandating such requirements, however, the OCST will have to consider the consequential economic burdens and performance penalties which States launch vehicle operators may suffer.

The authority to impose debris reduction requirements probably extends also to payloads that are *not* subject to the jurisdiction of the FCC or NOAA because the mission review, as part of the launch vehicle consideration, encompasses such payloads.[34] Payloads that are not subject to FCC or NOAA jurisdiction include, for example, microgravity and foreign payloads. Imposing stringent requirements on foreign payloads, however, may place the United States launch industry at a competitive disadvantage in the world market. For example, if the OCST were to require that all geostationary satellites launched on United States vehicles be boosted to higher orbits at the end of life, foreign governments or companies not prepared to detract from the operational life of the satellite to save fuel for the orbital shift, might simply select non-United States launch providers.

3. The National Oceanic and Atmospheric Administration: Remote-Sensing Space Systems

NOAA[35] licenses commercial remote-sensing systems, e.g. satellites, pursuant to the Land Remote-Sensing Commercialization Act of 1984 (Landsat Act).[36] No provision of the Act or the implementing regulations[37] refers specifically to space debris. Furthermore, because NOAA has not yet granted a single application for a remote-sensing satellite license, no precedent exists for how NOAA would deal with the debris issue. Nevertheless, it appears that NOAA does have jurisdiction with respect to the disposal of satellites at the end of life. Any rules NOAA proposes, however, will be subject to approval by the President of the United States. Pursuant to Section 402(b), any license issued by

34. Commercial Space Launch Act, § 6(b)(2), 49 U.S.C. § 2605(b)(2) (1990). *See also* 14 C.F.R. § 416.21 (1990) (providing implementing regulations for the Office of Commercial Space Transportation).

35. NOAA is part of the Department of Commerce (DOC). The DOC was designated as the lead agency for the licensing of remote-sensing satellites under the Landsat Act. 15 U.S.C. § 4241 (1990).

36. 15 U.S.C. §§ 4201-92 (1990).

37. Licensing of Private Remote-Sensing Space Systems, 15 C.F.R. § 960 (1990).

NOAA "shall specify . . . that the license shall . . . (3) upon termination of operations under the license, make disposition of any satellites in space in a manner satisfactory to the President."[38]

The written legislative history of the Landsat Act does not elucidate why a reference was made to the President. One individual involved with drafting the legislation, however, provided the following account of a closed session discussion. Three items were considered in the context of the provision cited above on disposal of satellites at the end of life: nuclear power sources, transfer of technology, and debris. It was felt that the two former items were of such importance that they should be dealt with at the highest level, thus, the reference to the President. Consequently, it would seem that NOAA could decide in individual cases, as well as make rules, subject to Presidential approval, how a licensee will dispose of a satellite at the end of life. For example, NOAA could, as a condition of license, require a licensee to deorbit the satellite, by controlled reentry, at the end of the license term.

C. PUBLIC INTERNATIONAL LAW

The United Nations Committee on the Peaceful Uses of Outer Space (COPUOS) and the International Telecommunications Union (ITU) are international organizations well equipped to develop spacecraft design and operating standards aimed at reducing debris. A conference or meeting of spacefaring nations is offerred as an alternative to COPUOS and ITU.

1. The Committee on Peaceful Uses of Outer Space

COPUOS has promulgated five treaties[39] and two resolutions[40] governing space activities, and is about to complete a set of principles on nuclear power sources in space. This international body has the authority to deal comprehensively with all aspects of the debris issue. The reason COPUOS has not already taken action with regard to space debris is that certain important COPUOS member states, among them the United States, have opposed it.

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38. 15 U.S.C § 4242(b)(3). NOAA's implementing regulations provide that the licensee has agreed to dispose of [the satellite] in a satisfactory manner. 15 C.F.R. § 960.11(d) (1990).

39. *See supra* note 5 (providing citations to the five major space treaties).

40. *Principles Governing the Use by States of Artificial Earth Satellites for International Direct Television Broadcasting*, G.A. Res. 37/92, 37 U.N. GAOR Supp. (No. 51) at 98-99, U.N. Doc. A/37/646 (1982); *Principles on Remote Sensing of Earth from Outer Space*, G.A. Res. 41/65, 41 U.N. GAOR Supp. (No. 53) at 115-16, U.N. Doc. A/41/751 (1986).

Although, so far, the opponents have prevailed, increasingly countries are calling for space debris to be placed on the COPUOS agenda. Notably, at a COPUOS annual meeting held June 4 to June 14, 1990, the Chairman, Dr. Peter Jankowitsch, stated: "I think it is only fair to bring [the space debris] problem in all its dimensions before a committee that sooner or later will have to face the legal and technical changes on an issue extricably linked to the further development on space research and space application."[41]

If COPUOS does decide to take up the debris problem, it may concern itself with all aspects of the issue, including design standards and operating procedures, as well as liability for damage. For example, COPUOS may establish requirements for: (1) end-of-life maneuvers with respect to all types of satellites; (2) launch vehicle operating procedures to guarantee reentry of upper stages or to ensure expulsion of excess propellants and pressurants from spent upper stages that do not reenter; (3) the use of payload shrouds; and (4) limiting the number of spacecraft independent parts allowed to reach orbit. COPUOS can amend existing space treaties or adopt a new treaty or principles of conduct. In either case, it would be necessary to ensure that damage *caused by the space debris* is actionable. As mentioned earlier, it is unclear to what extent the Liability Convention covers damage caused by debris.[42]

2. *The International Telecommunication Union: Telecommunications Satellites*

Pursuant to the International Telecommunications Convention,[43] the ITU serves three primary functions also with respect to satellites: (1) it allocates radio frequencies for use by satellites;[44] (2) it provides a regulatory framework for technical coordination to prevent harmful interference between satellite transmissions;[45] and (3) it affords international protection from radio interference between satellite transmissions through a system of registration.[46] Incident to its frequency allocation,

41. Extract from Prepared Statement by Dr. Peter Jankowitsch, COPOUS 33rd Session, New York, New York (June 4, 1990).

42. *See supra* notes 9-13 and accompanying text (explaining the limited applicability of the Liability Convention to space debris).

43. International Telecommunication Convention, *done at* Nairobi (1982), *entered into force* Jan. 1, 1984 [hereinafter ITU Convention]. The Convention was not ratified by the United States until December 1985. S. EXEC. REP. No. 4, 99th Cong., 1st Sess. (1986).

44. *Id.* art. 4.2(a).

45. *Id.* art. 4.2(b), (g).

46. *Id.* art. 4.2(a).

coordination, and registration responsibilities, the ITU exercises jurisdiction over the geostationary orbit.[47] Although the ITU normally does not determine the locations of satellites in the orbit (the individual member state does), it has the authority to do so, and has exercised such authority on at least two occasions.[48]

The ITU has not formally considered procedures for disposal of satellites at the end of life. While several countries have called for an ITU policy of removal of non-operational geostationary satellites, states that consider such a move premature, including the United States, have prevailed so far.

Arguably, the ITU has authority to deal with the space debris issue, at least with respect to geostationary satellites at the end of life. A similar rationale to that used to justify the FCC's authority over non-operational satellites applies also to the ITU, namely, that such satellites may collide with operational ones and impede radio communications, which the ITU is charged to safeguard and promote.

Pursuant to the International Telecommunications Convention, the purposes of the ITU are to: "[m]aintain and extend international cooperation among all Members of the union for the improvement and rational use of telecommunications of all kinds . . ."[49] [and] "to harmonize the actions of Member nations in the attainment of these ends;"[50] [and] "coordinate efforts with a view to harmonizing the development of telecommunications facilities, notably those using space techniques, with a view to full advantage being taken of their possibilities."[51]

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47. The ITU exercises jurisdiction over the geostationary orbit, although it has no actual authority to do so. *See* Christol, *The Modern International Law of Outer Space*, 435-50 (1984) (describing the lack of actual authority which the ITU possesses over the geostationary orbit). *See also* Jakhu, *The Legal Status of the Geostationary Orbit* 7 ANN. OF AIR & SPACE L. 333 (1982) (detailing the legal issues surrounding the use of the geostationary orbit and the lack of clear, accepted jurisdiction over the orbit).

48. Orbit and frequency allotment plans assigning frequencies and orbital positions to individual member states were adopted at the World Administrative Radio Conference for the Planning of the Broadcasting Satellite Service, Geneva (1977) and at the Regional Administrative Radio Conference for the Planning of the Broadcasting Satellite Service in Region 2. The plans were incorporated into the *Final Acts*, WORLD ADMINISTRATIVE RADIO CONFERENCE (WARC), Geneva (1979) and the *Final Acts*, WORLD ADMINISTRATIVE RADIO CONFERENCE ON THE GEOSTATIONARY-SATELLITE ORBIT AND THE PLANNING OF SPACE SERVICES UTILIZING IT, Geneva (1985).

49. ITU Convention, *supra* note 42, art. 4.1(a).

50. *Id.* art. 4.1(c).

51. *Id.*

3. *Conference of Spacefaring Nations*

A meeting or conference of spacefaring nations could be convened for the purpose of negotiating and concluding a multilateral agreement, series of bilateral agreements, or simply a set of guidelines, on spacecraft design and operating procedures aimed at reducing space debris. The participants could include all countries and international organizations which actually operate or whose citizens operate spacecraft, or a more limited group. The mandate for such a conference could be broad (i.e., to consider all aspects of space debris, including liability) or could be focused more narrowly. Moreover, the participants would have to decide on the degree of commitment they are willing to assume, ranging from voluntary cooperative procedures to generally-agreed, but non-binding, recommended practices, to binding international design standards and operating procedures.

D. Private International and Domestic Law

Private transactions are not appropriate instruments for implementation of debris mitigation standards in the first instance, although, such standards will find their way into transactional agreements after they become mandated by law. For example, if the FCC were to impose a requirement on satellite licensees to shift the satellite to a higher orbit at end of life, the requirement would be reflected in the spacecraft performance specifications contained in the procurement contract between the licensee and the satellite manufacturer.

III. CONCLUDING REMARKS

While there is general agreement among legal experts and government officials that current law is doing little to help control or reduce orbital debris, there is no consensus on how to remedy the situation. Contending that knowledge and understanding of the debris problem, as well as mitigation techniques, are incomplete, some experts maintain that it would be premature to establish standards for spacecraft design and operation at this point; others warn that inaction may now have catastrophic consequences later.

Even among those who propose action, there is disagreement on how to proceed. For example, within the United States, legal experts are not altogether in agreement on whether to: (1) adopt unilateral measures first (e.g., through the regulatory mechanisms of the FCC, OCST, NOAA, and NASA) and subsequently seek acceptance for such measures at the international level; or (2) seek an international understand-

ing first and then implement the standards domestically. The disadvantage of the former approach is that it may place an unfair burden on United States commercial spacecraft operators in the world market competition.

There is also disagreement with respect to the approach to international implementation. Some experts maintain that a conference of spacefaring nations would be preferable to dealing with the matter in an ITU or COPUOS context since negotiations among countries with common interests are more likely to have a successful outcome. Moreover, the effort to reach agreement will not be impeded or delayed by non-spacefaring nations attempting to impose unreasonably strict standards.