# LEGAL STANDARDS FOR ORBITAL DEBRIS MITIGATION: A WAY FORWARD

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## Introduction

At the IISL Colloquium held last year in Rio de Janeiro, Edward Frankle, NASA s General Counsel, presented a paper that addressed the emerging international standards for mitigating orbital debris generation.[1] Mr. Frankle s paper: 1/ described from a technical perspective the current scope of the issue as presently understood; 2/ reviewed NASA and other U.S. Government agencies evolving experience with orbital debris mitigation guidelines; 3/ considered some of the limitations of existing space law conventions in the context of damage caused by orbital debris (in particular, the problem of proof); and 4/ summarized the international guidelines under consideration by the Inter-Agency Space Debris Coordination Committee (IADC) intended to forge consensus on standard international mitigation guidelines. The paper also discussed the work of the Scientific and Technical Subcommittee (STSC) of the United Nations Committee on the Peaceful Uses of Outer Space (UN/COPUOUS) to assess the current state of knowledge concerning measurements and modeling of the debris environment, as well as proposed mitigation measures.

The discussion in this paper builds upon this information and analysis by providing an update on recent developments and assessing current efforts to achieve international endorsement, adoption and implementation of these emerging international debris mitigation guidelines. To support this discussion, therefore, I want to recall some important aspects of the orbital debris issue that were highlighted in the earlier paper.

First, it should be noted that concerns about orbital debris are sometimes greater than the actual magnitude of the problem. In the half-century that human beings have been launching objects into outer space, there have been few

instances of damage resulting from orbital debris — either in space or on the Earth s surface.[2] This does not mean that the issue is neither an important one nor deserving of international attention. It does suggest that, at the present time, solutions may be found more in the technical arena than in legislative fora. The focus of most serious attention has been on developing technical and programmatic means to minimize the creation of orbital debris, to mitigate its potential consequences, as opposed to creating new legal norms to govern spacecraft design and operations or to allocate liability for any damage it may cause.

NASA has long been concerned to protect the orbital environment of Earth. Its research efforts in the field date from 1970; operational standards for agency programs have been in place since the early 80s.[3] As the agency s standards evolved, they ultimately became the basis for debris mitigation standards for all U.S. Government missions. They have also provided the foundation for the IADC s work in establishing recommended international guidelines. The following four standard practices are applied in U.S. Government missions and may be implemented relatively soon in space programs worldwide:

1. Programs and projects must assess and limit the amount of debris that they plan to release during normal operations. Any planned release of debris larger than 5 mm. in any dimension which will remain on orbit for more than 25 years has to be evaluated and justified.

2. Programs and projects must assess and limit the probability of an accidental explosion both during and after the completion of mission operations. Each program must demonstrate that there is no credible failure mode for accidental explosion.

3. Programs and projects also need to assess and limit the probability of operating space systems later becoming a source of debris by collisions with man-made objects or meteoroids. Spacecraft design should limit the probability that collisions with debris smaller than 1 cm. in diameter will cause loss of control to prevent subsequent disposal after completion of the mission.

4. Programs and projects will plan for cost effective disposal procedures, considering one of three methods: reentry, maneuvering to a storage orbit, or retrieval.[4]

Mr. Frankle also reviewed the limitations of the existing U.N. space law conventions as applied to orbital debris issues, concluding that numerous, fundamental questions about liability for damage caused by orbital debris remain unanswered.[5] He suggested, however, that the course of the technical, programmatic and legal discussions surrounding orbital debris issues might be taking a new direction:

> Academics and other space law commentators have tended to view orbital debris primarily as an environmental law issue: protection of the Earth s environment from space contamination and protection of the space environment from Earth-generated contamination.

> It seems, however, that the focus of debate on orbital debris issues is beginning to shift in a more realistic direction. Rather than broad pronouncements of liability and responsibility from an environmental perspective, spacefaring nations are beginning to examine actual space operations as a means of remedying past problems caused by orbital debris. Instead of developing a complex regime of punitive measures to address problems *ex post facto,* the international community appears to be moving to mitigate orbital debris problems at the outset by encouraging compliance with accepted standards of behavior .
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> Every recent analysis of orbital debris has concluded that preventative measures could alleviate future problems. These preventative measures include reliance on emerging technology and establishment of and adherence to standards in spacecraft operational profiles, configurations, design, and post mission conduct.[6]

The paper concluded that a system of widespread, voluntary compliance with technical orbital debris mitigation practices could greatly minimize debris generation. Technical solutions could emanate from the IADC or other groups with a view toward encouraging their adoption and implementation on an ongoing basis in space programs worldwide. As consensus develops on particular solutions, technical standards-setting bodies like the IADC could recommend newly emerging technical practices for adoption as international guidelines. The STSC could play an important role in reviewing recommended standards and encouraging their adoption. However, only after experience with technical standards is gained over time, through widespread adoption, can the Legal Subcommittee (LSC) of COPUOS realistically consider formulating these standards as international principles.[7]

The paper concluded with the observation that, without such knowledge, it will be difficult if not risky for the international community to make decisions that could have dramatic implications for national — and commercial — space activities worldwide.

> Although some of the steps that space programs need to take to mitigate the creation of debris are clear, the longer term solution to the problem is not. As of now, I am skeptical that a lengthy international debate over legal standards would significantly advance the goal of encouraging spacefaring countries to implement debris mitigation standards expeditiously. Rather, spacefaring nations should start to take controlled, well-considered steps to mitigate debris creation individually, and collectively be prepared to take advantage of advances in technology that will improve those practices.[8]

## Recent Developments

### Evolution of U.S. Policy

The strategy Mr. Frankle proposed for addressing concerns over potential increases in orbital debris generation was based upon experience suggesting that challenging problems of international space law can sometimes be alleviated by technical and programmatic means that can be implemented relatively quickly. In the past year, the U.S. Government has sought to work closely with other governments with active space programs to accelerate international efforts to develop debris mitigation guidelines. The policy is consistent with the approach Mr. Frankle s paper suggested. The key components of the policy may be summarized as follows:

- The overarching goal of achieving widespread adoption and implementation of voluntary debris mitigation guidelines.

- Emphasis of the fact that U.S. Governmental Orbital Debris Mitigation Standard Practices are voluntary practices used by agencies to carry out relevant responsibilities, based on mission requirements and cost effectiveness. The Government has and will continue to consult with industry and make the practices publicly available.

- Ongoing sharing with the IADC of U.S. standard practices.

- Near-term consensus within the IADC on international debris mitigation guidelines, with the goal of combining the best of standards currently proposed and ensuring the guidelines are compatible with national standards.

- Presentation of IADC-developed guidelines to COPUOS/STSC.

- Endorsement of the IADC guidelines by the STSC.

- Annual reports by the IADC to the STSC on the application of the guidelines by the international community.

- Appropriate governmental-level agreement among spacefaring nations to apply the IADC guidelines in their national space activities (government and private), consistent with mission objectives and cost effectiveness. Options might include placing provisions in bilateral space cooperation agreements and/or an adherence regime, similar to the approach taken in the missile technology control regime.[9]

- Appropriate action by COPUOS endorsing use of the IADC guidelines, consistent with mission requirements and cost.

With regard to the last component, the U.S. has expressed preference for a sequential process that first establishes a solid technical understanding of debris mitigation practices. Accordingly, the U.S. considers the STSC to be the proper forum within COPUOS for this activity as consensus on the guidelines develops. While the U.S. Government has indicated support for eventual action by COPUOS to endorse these guidelines, it has not yet identified the mechanism it

considers most appropriate for this purpose.

Moreover, the U.S. Government has also expressed a view that preparatory research and discussions of certain legal aspects of space debris (e.g., definition of the term) in non-governmental for a, such as the European Center for Space Law, are highly desirable. Informal preliminary work in this area will be essential in structuring any eventual work by the Legal Subcommittee to resolve orbital debris questions referred to it by COPUOS.

## COPUOS/STSC Activities

In February of this year, the U.S., together with Canada, China, France, Germany, India, the Russian Federation and the United Kingdom, proposed that the STSC adopt an accelerated, multi-year workplan of activities that is largely consistent with the approach outlined above.[10] The STSC

> strongly endorsed the action undertaken by IADC to reach consensus on debris mitigation measures and encouraged IADC to treat the topic with due priority, with a view to completing the task during 2002 so that the results could be reported to the Subcommittee at its fortieth session, in 2003.[11]

The multi-year work plan that the STSC adopted establishes the goal of expediting international adoption of voluntary debris mitigation measures. [12] The workplan is as follows:

> 2002: The Subcommittee invites IADC to present its proposals on debris mitigation at the fortieth session of the Subcommittee, in 2003.
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> 2003: IADC presentation on its proposed debris mitigation guidelines, based on consensus of the IADC members. Review by member states of these debris mitigation guidelines, and discussion of the means to endorse the utilization of these guidelines.
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> 2004: IADC continues its presentation on its proposals on debris mitigation (as required) based on consensus among its members. Member States continue to review the IADC proposals on debris mitigation. The Subcommittee may wish to endorse the utilization of the IADC proposals on debris mitigation as guidelines to be implemented on a voluntary basis through national mechanisms.[13]
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> 2005: Member States begin annual reporting on a voluntary basis of national activities to implement the guidelines.

This brings us to the issue of the Legal Subcommittee s role in this activity. The U.S. has stated that it would not exclude the future possibility of LSC consideration of legal issues relevant to debris mitigation practices. However, this would need to be the subject of future discussions, taking account of progress being made in the IADC and STSC.

The reluctance to have COPUOS instruct the LSC to develop legal standards for orbital debris mitigation at this time arises from a concern that promulgation of legal rules is premature

and could be counterproductive. The primary goal must be to reduce growth in the orbital debris population and to preserve the space environment for use by future generations. This goal can be accomplished most quickly by expediting widespread implementation of appropriate mitigation measures by spacefaring nations. This is primarily a technical and programmatic, as opposed to a legal, effort.

Once guidelines are in place, their effectiveness can be assessed and appropriate adjustments made by the IADC or by consensus among the member states of COPUOS. To be genuinely effective, it is obvious that the process will have to be quite flexible. In particular, it will need to be able to facilitate timely adjustments to the guidelines as experience is gained. In my view, this approach is more likely to facilitate speedy adoption and implementation of agreed guidelines than tasking COPUOS with developing them.

There is significant need for swift action, despite the relatively low risk near-term of serious debris-related damage. One reason is that while many states display increased awareness of the issue and increased willingness to implement mitigation measures in governmental programs, commercial entities are naturally apprehensive about requirements that could increase costs. Their concern, of course, is that if their competitors are not held to identical standards, commercial entities in states that are implementing the agreed guidelines will suffer competitive disadvantage in international markets. Thus, there would seem to be considerable advantage — and little risk — in trying to establish and implement at least initial guidelines. The IADC (or COPUOS) could recommend improvements on a continuous basis, as circumstances warrant.

## Legal Options for Implementing IADC Guidelines

The reluctance of the United States and others to support proposals to have the LSC devote significant efforts to developing orbital debris principles at this time should not be construed as reluctance to make the IADC guidelines legally effective. As indicated above, the U.S. has expressed a willingness to consider appropriate measures for implementing the IADC guidelines within national legal systems. Indeed, such an approach could even result in more legally compulsory guidelines than the voluntary principles COPUOS has previously developed for such matters as remote sensing,[14] nuclear power sources (NPS),[15] and Direct Broadcast Satellites (DBS).[16]

Before considering these options, however, we should consider more fully some of the reasons for the reluctance to pursue adoption of legal principles by the LSC at this time. As Mr. Frankle noted in his IISL presentation last year, the modest current level of knowledge and experience concerning the cost and effectiveness of particular orbital debris mitigation practices tends to make states with extensive space interests somewhat cautious about adopting international legal rules or even principles at present.

The apprehension is understandable. While difficult to articulate with precision, there is some concern that

orbital debris mitigation requirements are qualitatively different from other legal principles COPUOUS has promulgated. Unlike existing space law regimes that address more passive subject areas such as liability, rescue and return, or remote sensing (passive in the sense that they establish rights and obligations for states affected by space operations conducted by other states), orbital debris principles portend more direct international involvement in spacecraft design and operations.

This would be a new role for COPUOS, one that should be approached with great care and full recognition of its potential implications. Though individuals with considerable technical expertise often represent member states, particularly in the STSC, COPUOS is not a standards-setting organization. As presently constituted, it can be most effective when it seeks to evaluate, or endorse, technical standards from a policy or legal perspective.[17] Thus, the concern to proceed with caution.

Assuming that agreement upon appropriate and effective guidelines can be agreed, there appears to be a variety of means for making them legally effective. I will discuss three of these very briefly:

The first two, mentioned in the U.S. Government orbital debris policy, involve 1/ incorporating the guidelines in bilateral or multilateral space cooperation agreements (either directly or by reference); and 2/ a voluntary adherence regime, on the model of such arrangements as the MTCR.[18] The latter approach would involve a series of parallel statements by adherent states signifying their intention to apply the guidelines in conducting national space activities.

Incorporation of guidelines in agreements would make them legally effective immediately as between the involved parties, but only for a particular mission or missions. The advantage of a broad adherence regime approach is that it would treat the IADC guidelines as an independent compilation of minimum requirements. States would be free, of course, to utilize more stringent guidelines. Adherent states could agree to amend the guidelines or adopt additional ones over time. As the guidelines are amended, the adherence statements that implement them would not necessarily need to be changed.

The MTCR is not the only available model of an adherence arrangement. Recently, international space law has seen the emergence of a comparable regime: the International Space Station (ISS) Crew Code of Conduct.[19] This Code, required by the Intergovernmental Agreement (IGA)[20] among the ISS Partner States as well as the Memoranda of Understanding between NASA and each of its space agency partners,[21] also exists as a set of independent requirements that each Partner State or agency makes applicable to its ISS crew members in accordance with its own legal system.

The Crew Code of Conduct model has some interesting implications for the issue of international orbital debris mitigation. For one thing, it is binding on the ISS partners because the partners agreed to it as an implementing arrangement under the IGA. Second, it avoids the notion of a control regime; instead, it governs conduct. Finally,

the Code of Conduct model offers the possibility that, unlike the U.N. remote sensing principles or the MTCR, the agreed debris mitigation guidelines could eventually be made legally binding. As such, there could be legal consequences for violations, thus indicating the seriousness with which adherent states took their debris mitigation responsibilities.

Upon accession by a number of states with significant space activities, the IADC guidelines could well become the international standard. Additional states are likely to express adherence, particularly should they wish to conduct joint activities with adherent states already required to abide by the IADC guidelines.

The question remains, then, of COPUOS role in relation to such a regime. Certainly it will remain an important one. COPUOS is in a unique position to assess, from a global perspective, the adequacy and efficacy of the IADC guidelines adopted and implemented by states. Such a role is already envisioned for the STSC under the workplan COPUOS adopted at its plenary meeting in June of this year. It is hoped that the STSC will endorse the guidelines and encourage states to apply them in their programs. Similarly, the LSC could also be tasked to consider discrete legal aspects of the emerging guidelines at an appropriate time in the future. Further, COPUOS can be expected to take an active interest in monitoring progress through continued reports on debris mitigation practices by the IADC and member states.

## Conclusion

Developing effective international standards for orbital debris mitigation poses unique challenges from technical, programmatic and legal perspectives. It requires states to accelerate efforts within the IADC to reach agreement upon viable guidelines in the very near future and to seek STSC endorsement. Equally important, it requires states to implement the guidelines in their national space programs. Achievement of these goals will be neither easy nor without cost. But they are achievable, and it seems likely — or at least possible — to accomplish them relatively soon.

Equally challenging is the question of how best to make the IADC guidelines legally binding upon states. I have suggested in this paper that the issue of orbital debris mitigation, at its core a technical standards issue, is not an appropriate candidate for voluntary principles. Rather, because the guidelines have cost and other implications, states need assurance that other states will adhere to them. Moreover, guidelines need to be put in place quickly. For all these reasons, I have suggested that states with significant space programs should take initial action to adopt and implement the IADC guidelines on a voluntary basis. COPUOUS and its appropriate subcommittees should then review the guidelines, consider possible improvements, actively encourage states to adhere to them, and maintain an active dialogue on the subject through annual reporting, especially to the Scientific and Technical Subcommittee.

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[1] Edward A. Frankle, International Regulation of Orbital Debris, Paper: IISL-00-IISL.4.15 (2000).

[2] One recent example occurred in July 1996, when a fragment of an expended *Ariane* upper stage launched in 1986 collided with a French *CERISE* military satellite launched in 1995. Apart from this instance of known damage resulting from an unintentional space collision of human-made objects, orbital debris has also been blamed for damaging the cockpit windshields of dozens of Space Shuttle missions. *Id.*, at p. 2.

[3] NASA instituted its first orbital debris mitigation policy requirement for depletion of residual propellants from Delta second stages at the end of mission in 1981. *See:* Joseph P. Loftus and Nicholas L. Johnson, *The Current State of Orbital Debris Mitigation Standards in the United States,* American Institute of Aeronautics and Astronautics, AIAA-99-AIAA.6.5.04 (1999).

[4] As Mr. Frankle s paper noted, all NASA programs in current development are required to evaluate their compliance with the U.S. Government standard practices, or NASA s internal directives, when NASA s are more stringent. For example, NASA Safety Standard 1740.14 requires that NASA programs plan for: (1) depleting on-board energy sources after completion of mission; (2) limiting orbit lifetime after mission completion to 25 years or maneuvering to a disposal orbit; (3) limiting the generation of debris associated with normal space operations; (4) limiting the consequences of impact with existing orbital debris or meteoroids; and (5) limiting the risk from space system components surviving reentry as a result of post-mission disposal. Two orbital debris assessment reports are required for NASA programs: one at the Preliminary Design Review and the other 45 days prior to the Critical Design Review. These are reviewed for compliance by the Associate Administrator for Safety and Mission Assurance and by the cognizant program Associate Administrator. *Frankle*, pp. 3-4.

[5] *Id.*, pp. 5-8.

[6] *Id.*, at p. 9, citing *Orbital Debris, A Technical Assessment,* National Research Council, National Academy Press (1999).

[7] *Id.*, at p. 10. The paper also noted the important role of enlightened self-interest to any discussion of orbital debris. Simply put, it is not in the interest of any spacefaring nation to pollute outer space.

[8] *Id.*, at p. 11.

[9] Agreement on Guidelines for the Transfer of Equipment and Technology Related to Missiles, 16 Apr. 1987, reprinted in 26 Int l Legal Materials, American Society of International Law 599 (1987) (MTCR).

[10] U.N. Doc. A/AC.105/C.1/ L.251/Rev.2 (2001).

[11] *Report of the Scientific and Technical Subcommittee on its thirty-eighth session,* U.N. doc. A/AC.105/761/128, p. 21 (2 March 2001).

[12] *Id.*

[13] The subcommittee report notes that the timing of the endorsement is dependent upon how much time COPUOS member states require to review and approve the proposed mitigation guidelines. *Id.*,/130, at p. 22.

[14] *Principles Relating to Remote Sensing of the Earth from Outer Space,* U.N.G.A. Res. 41/65 (3 December 1986).

[15] *Principles Relevant to the Use of Nuclear Power Sources in Outer Space,* U.N.G.A. Res. 47/68, (14 December 1992).

[16] *Principles Governing the Use by States of Artificial Earth Satellites for International Direct Television Broadcasting,* U.N.G.A. Res. 37/97 (10 December 1982).

[17] The NPS Principles do affect the use of spacecraft propulsion systems. However, the principles do not themselves establish standards; rather, they reference independent standards established by other bodies. For example, Principle 3.1.(c) states: To limit exposure in accidents, the design and construction of the nuclear power source systems shall take into account relevant and generally accepted international radiological protection guidelines. Thus, while the NPS Principles do not directly address spacecraft design, they do specify the types of missions on which nuclear reactors and radioisotope generators may be used.

[18] *Supra,* p. 5.

[19] Code of Conduct for the International Space Station Crew, 14 Code of Fed. Regulations Part 1214, 65 Fed. Register, No. 246 (21 Dec. 2000).

[20] *Agreement Among the Government of Canada, Governments of Member States of the European Space Agency, the Government of Japan, the Government of the Russian Federation, and the Government of the United States of America Concerning Cooperation on the Civil International Space Station* (29 January 1998).

[21] Four separate MOUs between NASA and cooperating agencies for each of the other Partners (the Canadian, European, and Russian space agencies, and the Government of Japan) Concerning Cooperation on the International Civil Space Station (29 January 1998).