

IAC-09.E8.3.10

DETERMINING LIABILITY FOR DAMAGE CAUSED DUE TO DEBRIS IN OUTER SPACE: - PORTAL TO A NEW REGIME

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ABSTRACT

Like other environments, space is damaged by human activity, primarily through the creation of space debris. A continuation of present activities will result in a condition of orbital sprawl whereby orbits will become saturated with such objects, forcing the location of spacecraft away from the optimal slot and posing a growing risk of collision. Despite landmark guidelines adopted by the UNCOPUOS, the creation of debilitating space debris threatens to outpace mitigation efforts. The primary highlight of the article is to address the need for a multilateral, unified approach to liability for damage caused by space debris. The article also points out the failures of the largely illusory-current liability system and provides for a legal mechanism of recovery for damage caused due to space debris. A main concern is the factum of disparity in the abilities of developed and developing nations to counter the space-debris problem. It is a severely difficult proposition for developing countries to be held accountable on the same level for the maintenance of the space milieu, as their developed counterparts. The article also analyzes a number of solutions for establishing a regime for regulation of space debris and the determination of the subsequent liability of the nations.

Introduction

Space is hazardous on its own. Nature provides generous doses of vacuum, radiation, micrometeoroids, and extreme conditions of heat and cold. Once in space, the biggest threat to astronauts and spacecrafts is space debris. Space debris, also known as space junk or space waste, are potentially dangerous and useless objects in Earth's orbit. These objects are either man-made (such as spent stages of rockets, broken off pieces of spaceships or equipment, old unusable satellites, and even small flecks of paint) or natural (such as space rocks, ice, and dust). The problem with space debris is how hazardous they can be if they impact a spacecraft or even a spacewalking astronaut. The problem complex and serious; the danger posed by the human-made debris to operational spacecraft (pilotless or piloted) is a growing concern. Because debris remains in orbit for long period of time, they tend to accumulate, particularly in the low earth orbit. What is certain today is that the current debris population in the Low Earth Orbit (LEO) region has reached the point where the environment is unstable and collisions will become the most dominant debris-generating mechanism in the future.¹ No one with a stake in the future of outer space would dispute the

fact that near-Earth orbit has become increasingly populated with man-made junk. Space debris is the inevitable consequence of the global uses of space—every single space launch will create some amount and form of debris, just as every kind of public transport on Earth creates some amount and form of pollution. Most space scientists and operators have long recognized that pollution in space, like pollution on Earth, is dangerous. But, as with environmental problems on Earth, there remain challenges to characterizing the exact nature of the debris problem, as well as disagreements about the gravity of the situation and how best to address it. One thing that is certain is that failure to stem the creation of space debris will undercut the security of all assets in space, increasing the likelihood of collisions and possible conflict over liability for them. The official catalogue of space objects kept by the US Air Force's Space Surveillance Network (SSN) contains about 9,000 objects, but the Air Force also tracks approximately 4,000 other objects whose origins and exact orbits are not yet confirmed.ⁱⁱ Although there is no unclassified, publicly available data on exactly how many operational satellites are orbiting at any one time,ⁱⁱⁱ US officials say that only about 6% of those 13,000 objects being watched are

working satellites or spacecraft, such as the International Space Station. The rest is debris.^{iv}

Millions of tiny space debris particles orbit the earth today, some traveling ten times faster than a high-powered rifle bullet.^v According to NASA scientist and space debris expert Dr. Nicholas Johnson, millimeter fragmentations are a greater threat than larger objects like defunct satellites as they are too small to be tracked with current technology.^{vi} The estimated 11,000 objects large enough to be tracked are catalogued and monitored, enabling satellite operators to maneuver around them by expending additional fuel. If the orbital debris population remained as it is today with no additional space operations, the level of fragmentation in Earth's orbit would continue to escalate exponentially.

Existing Space Law

The 1967 "Outer Space Treaty," as the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies is known informally, was partially modeled after the Antarctic Treaty of 1961.^{vii} The Antarctic document "sought to prevent 'a new form of colonial competition' and the possible damage that self-seeking exploitation might cause"^{viii} and similar language is seen in the space document drafted six years later. As Articles I and II state:

The exploration and use of outer space, including the moon and other celestial bodies, shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development...Outer space, including the moon and other celestial bodies, is not subject to national appropriation by claim of sovereignty.

The four agreements that followed the 1967 treaty expanded into areas of astronaut rescue, the registration of launched objects, and liability for damage caused by launched objects.^{ix} Article VII of the 1967 treaty put in place a framework for international liability and the 1972 Convention on International Liability for Damage Caused by Space Objects elaborated further, setting out guidelines for a claims committee and monetary reimbursement for damages.^x It also called for any damage reward to be directly reported to the Secretary-General of the United Nations and be made public.^{xi}

While there is no treaty that specifically addresses orbital debris, the Inter-Agency Space Debris Coordination Committee (IADC), an independent and international scientific consortium, seeks to promote the exchange of information and to encourage the remediation of existing space debris.^{xii} Members include India, Russia, China, Japan, the Ukraine, the European Space Agencies, Spain, Britain, Italy and the United States. Research team discussions with domestic experts revealed awareness of the need for global cooperation in this area, though not necessarily in a codified fashion. A new treaty addressing the space debris environment or a debris addendum to the 1967 Outer Space Treaty were both openly rejected.^{xiii}

It is important to note that the field of the space law is still in its infancy. The inception of this field began with the launching in October of 1957 of the world's first satellite by the Union of Soviet Socialist Republic. In 1958, United States and Soviet leaders each asked the United Nations to consider the legal issues associated with space activity. The United Nations subsequently created the previously discussed UNCOPUOS.^{xiv}

Many conventions have been enacted, but the main treaties and conventions were drafted at the beginning of space exploration in the 1960s and 1970s, and under the political and military pressure of the space race between the U.S. and the former Soviet Union. They fail to account for the rapid changes in today's field, where commercial space transportation is becoming widely available with substantially lower launch costs and new countries are becoming active in space exploration. The market for commercial space launchers has witnessed rapid growth over the past several years. The existing treaties and conventions fail to account for this reality.

Other treaties have been presented and ratified, including treaties on the registering of objects launched into Outer Space, agreements on the rescuing of astronauts, and rules on international liability for damage caused by man-made space objects. The treaties all elaborate on provisions of the Outer Space Treaty. The Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and Under Water (5 August 1963) is targeted to control nuclear weapon proliferation. This treaty recognizes that space can be used for undesirable military projects. It bans the carrying out of any nuclear weapon test explosion or any other nuclear explosion in the

atmosphere and beyond its limits, including outer space.^{xv}

Failure to Recognize Space Debris in Legal Regimes

There is a critical weakness in the international law on space debris. Existing space law is related to the use of space and not to debris regulation. Most of existing treaties have been overtaken by technology advancement. While the rules developed by the Outer Space Treaty or the Registration Convention is useful, it does not apply to the space debris issue. This means that commercial and government-sponsored space launches can still create more debris without limits. Today, any country or corporation can launch a rocket and/or place equipment into orbit without permit. The only constraint is that they are required to record the launching as stipulated under the Registration Convention.

Furthermore, nothing is said about the destruction of satellites in space and the creation of space debris resulting from it. In international law, nothing can prevent a nation from destroying one of its own satellites. In the end, China was free to target one of its old weather satellites with an ASAT weapon and blow the spacecraft apart because:^{xvi}

1. it can; and
2. ASAT testing is not forbidden under international law.

The arms control provisions of the Outer Space Treaty forbids the placing of nuclear weapons or any other kinds of weapons of mass destruction in orbit. The treaty also forbids establishment of military bases, installations and fortifications, the testing of any type of weapons and the conduct of military maneuvers on the Moon and other celestial bodies (Art. IV). However, nothing is mentioned about spacecraft destruction and space debris thus created.

Recently, in February 2007, the UN reached a consensus on the draft of space debris mitigation guidelines and adopted them.^{xvii} However, all of the existing guidelines remain voluntary and are not legally binding under international law. At the UN level, some nations have expressed the view that a legally non-binding set of guidelines was not sufficient. Some delegations at the Scientific and Technical Subcommittee (UNCOPUOS) expressed the view that the Subcommittee should consider submitting the space debris

mitigation guidelines as a draft resolution of the General Assembly rather than as an addendum to the report of the Committee.^{xviii}

At the meeting of UNCOPUOS on February 2007 in Vienna, the view was also expressed that the States largely responsible for the creation of the present situation and those having the capability to take action on space debris mitigation should contribute to space debris mitigation efforts in a more significant manner than other States.^{xix}

Weakness of the Space Liability and Dispute Settlement Mechanism

The 1972 Convention on International Liability for Damage Caused by Space Objects, commonly known as the —Liability Convention, sets forth the rules for personal injury and property damage and for resolution of those issues at the international level. Articles I and II of the agreement, for instance, provide that a country which launches or procures the launching of a space object, or from whose territory a space object is launched, is liable for damage caused by its space object on the surface of the earth or to aircraft in flight. With respect to damage caused elsewhere than on the surface of the earth, however, the notion of liability is not clearly established. The notion of direct damage is established under Article VII of the Outer Space Treaty. It says that each —State Party to the Treaty that launches or procures the launching of an object into outer space, including the moon and other celestial bodies, and each State Party from whose territory or facility an object is launched, is internationally liable for damage to another State Party to the Treaty or to its natural or juridical persons by such object or its component parts on the Earth, in air space or in outer space, including the moon and other celestial bodies.

However, there is a terrifyingly large legal gap when it comes to dispute resolution and compensation mechanisms. The issue of liability protocols in case of a commercial disruption by debris is also not covered by any convention.

Right now, the dispute resolution mechanism is informal. Article III Outer Space Treaty says that parties to the treaty shall carry on activities — in accordance with international law, including the Charter of the United Nations. Article 33 of the UN Charter says that parties shall first — seek a solution by negotiation, enquiry, mediation, conciliation, arbitration, judicial settlement, resort to regional agencies or arrangements, or other

peaceful means of their own choice. In the event that such means fail to achieve a resolution of the issue, Article 36(3) indicates — legal disputes should as a general rule be referred by the parties to the International Court of Justice.

In the absence of an agreement establishing binding procedures for the field of space law, it is likely that most national governments will seek to continue to resolve their disputes through the existing diplomatic channels. Private parties to a dispute, i.e. a commercial firm, would therefore be at a disadvantage under the existing regimes.

International Space Policy Organizations

There are several space policy organizations. The four most prominent are as follows:

IADC

The IADC is an international forum of governmental bodies, primarily academics and scientists, studying man-made and natural orbital debris. According to the IADC website, the purpose of the organization is:

- To exchange information regarding space
- Limit debris during normal operations
- Minimize the potential for on-orbit breakups
- Disposal of post-mission satellites and satellite launchers
- Prevention of on-orbit collisions

The Inter-Agency Space Debris Coordination Committee (IADC) is one of the world's leading technical organizations dealing with space debris. ESA is a founding member of IADC, together with NASA, the Russian Aviation and Space Agency, and Japan. IADC is today an international forum of governmental bodies for the coordination of activities related to the issues of man-made and natural debris in space. It is composed of the following members: Italian Space Agency, (ASI), British National Space Centre (BNSC), the Centre National d'Etudes Spatiales (CNES), China National Space Administration (CNSA), Deutsches Zentrum für Luft – und Raumfahrt e.V. (DLR), the European Space Agency (ESA), the Indian Space Research Organisation (ISRO), Japan Aerospace Exploration Agency (JAXA), the

National Aeronautics and Space Administration (NASA), the National Space Agency of the Ukraine (NSAU) and the Russian Federal Space Agency (ROSCOSMOS).^{xx}

The primary purpose of IADC is:

- To exchange information on space debris research activities between member space agencies, to facilitate opportunities for co-operation in space debris research, to review the progress of ongoing co-operative activities and to identify debris mitigation options. Generally speaking, the organizations reached a consensus of adopting the mitigation guidelines as proposed by the IADC. The IADC Space Debris Mitigation Guidelines was drafted. Debris research activities among member space agencies to review progress of ongoing cooperative activities.
- To facilitate opportunities for co-operation in space debris research
- To identify debris mitigation options

The IADC has been successful in its efforts to bring orbital debris mitigation guidelines to the international community. In 2001, the IADC introduced space debris mitigation guidelines based in part on prior work done by the International Academy of Aeronautics and various space agencies. In June 2007, UN-COPUOS approved space debris mitigation guidelines based on revised IADC Space Debris Mitigation Guidelines.^{xxi}

There are 11 national governments and space programs participating in the IADC that assist in providing international perspectives on alleviating the problem of orbital debris. The IADC mitigation guidelines are based on four general principles.^{xxii}

In 2002 as the first international document that is specialized in field of space debris mitigation and based on a consensus among the IADC members. In February 2003, at the fortieth session of the Scientific and Technical Subcommittee of the UN-COPUOS, the IADC presented the IADC Guidelines as its proposals on debris mitigation. This document serves as the baseline for the debris mitigation in two directions: 1) toward a non-binding policy document, and 2) toward applicable implementation standards.^{xxiii}

One criticism of the IADC Space Debris Mitigation Guidelines is that they remain voluntary and are not legally binding under international law. Still, IADC is an ideal forum on space debris due to its wide membership among the leading space agencies and provides a basis for further international cooperation when elaborating a space debris convention. Indeed, IADC standards have facilitated the discussion on space debris mitigation guidelines and opened the door to further research related to the cost of mitigation measures. Thus, recently, various studies have been conducted on the effectiveness and the costs of debris mitigation measures. These studies examine a number of important problems: prevention of on-orbit explosions and operational debris release, reduction of slag debris ejected from solid rocket motor firings, de-orbiting of space systems in LEO with various limitations on the post-mission lifetime, and re-orbiting of space systems to above the LEO & GEO protection zones (graveyard orbiting).

United Nations Office of Outer Space Affairs

The United Nations Office of Outer Space Affairs (UNOOSA) was born in the early days of space exploration. The original concept for The Committee on the Peaceful Uses of Outer Space (COPUOS) was a U.N. effort to put together an ad hoc body to facilitate international cooperation in the peaceful uses and exploration of outer space. The Committee began with 24 members. Now at 69 members, it is one of the largest committees in the United Nations.^{xxiv} Governmental and non-governmental organizations (NGO) provide and exchange information on space activity with COPUOS enabling UNOOSA to provide guidelines and information in areas such as the registry of space vehicles and launchings. In order to begin to address the problem of orbital debris, the UN-arm of COPUOS recognized officially the problem of orbital debris and the need for debris mitigation guidelines. The Committee has the following goals: 1) review the scope of international cooperation in peaceful uses of outer space 2) devise programs in this field to be undertaken under United Nations auspices, 3) encourage continued research and the dissemination of information on outer space matters, and 4) study legal problems arising from the exploration of outer space. The Committee is divided in two standing subcommittees: the Scientific and Technical Subcommittee and the Legal Subcommittee. The Committee and its two

Subcommittees meet annually to consider questions put before them by the General Assembly, reports and issues raised by the Member States.

The agenda of the Committee is quite large. For instance, the forty-fourth session of the Scientific and Technical Subcommittee of the Committee on the Peaceful Uses of Outer Space was held from 12-23 February 2007 at the United Nation Office at Vienna.^{xxv} The session covered a wide array of issues, including space debris; matters relating to remote sensing of the Earth by satellite, including monitoring of the Earth's environment; use of nuclear power sources in outer space; near-Earth objects; space-system-based disaster management support; physical nature and technical attributes of the geostationary orbit; etc. The Committee has also been concerned with space objects with nuclear power sources on board and problems relating to their collision with space debris.

The United Nations Office for Outer Space Affairs (UNOOSA) implements the decisions of the General Assembly and of UNCOPUOS. The office has the dual objective of supporting the intergovernmental discussions in UNCOPUOS and of assisting developing countries in using space technology for development. The Office is the focus of expertise within the United Nations Secretariat. It serves as the secretariat for the intergovernmental Committee (UNCOPUSOS), and implements the recommendations of the Committee and the United Nations General Assembly. The Office is also responsible for organization and implementation of the United Nations Programme on Space Applications (UNPSA).

UNPSA is part of the Office for Outer Space Affairs. Its mission is stated as follows:

Enhance the understanding and subsequent use of space technology for peaceful purposes in general, and for national development, in particular, in response to expressed needs in different geographic regions of the world.^{xxvi}

Its primary function is the organization of a series of 8-10 annual seminars, workshops, and conferences on particular aspects of space technology and applications. These activities are organized primarily for the benefit of the developing countries and emphasize the use of space technology and applications for economic and social development. In the past years, the space debris issues have not been part of the curriculum of the workshops and

seminars. The Programme also provides technical assistance to Member States of the United Nations in organizing and developing space applications programs and projects.

Corporate Responsibility

The role of space corporations is seen as important because commercial activity in space is increasing and thus potentially creating more debris. Until recently, space debris was a subject fraught with uncertainties, usually shunned by aerospace corporations around the world and inadequately addressed by many space agencies. As the issue gained prominence in the mid-1990s, the private sector has been seeking to find the most appropriate response to address the space debris problem. However, the space industry has been struggling to provide the required solutions. As competition has increased and profits have shrunk, many of the space corporations have adopted lean approaches; the better, faster, cheaper concept resting on the interconnection of decreased mission costs and increased risk. Most of the time, the prudent vehicle design and related operation that may decrease the level of debris is coming at a cost that is perceived too high by the industry.

At a time when there is so much talk about the commercialization of space and space tourism, it is important to raise the awareness of the space industry that it is in the interest of all parties to find the best and most acceptable solution to the problem. Today, space corporations around the world are rightly considered the first line of defense for preventing debris to accumulate. As space activity increases, the accumulation of debris is also on an upward trend. Over the recent years, companies have been facing new demands to engage in public-private partnerships and are under growing pressure to be accountable not only to shareholders, but also to society-at-large.^{xxvii}

When addressing the problem posed by space debris, it is thus time to include the space industry in the international effort to tackle this pressing issue. The space industry does not bear the responsibility for leveling the playing field and ensuring that space free of pollution. However, government and the private sector must construct a new understanding of the balance of public and private responsibility and develop new governance for activity in space and thus creating social value.^{xxviii}

Role of Civil Society

The number of non-profit organizations in the area of space is considerable. Many of them have gained prominence, like: the American Astronautical Society that offers society overview, news, publications, schedule of events, member services and scholarship information; the British Interplanetary Society; the International Space Business Council; the Committee on Earth Observation Satellites (CEOS) which provides newsletters, events and publications related to space agencies responsible for earth observation. More scientific and professional associations are also very powerful, i.e. the Forum for Aerospace Engineers or the Foundation for International Development of Space. In the area of space debris, the Center for Orbital and Reentry Debris Studies contains information in the areas of space debris, collision avoidance, and reentry breakup. The Center is part of the Aerospace Corporation, a nonprofit corporation originally serving the U.S. government in the scientific and technical planning and management of its space programs. Web-based organizations are also a source of diffusion of various space information, i.e., Space-Talk, which provides message forums about space, astronomy, and related topics.^{xxix}

However, these non-for-profit and non-governmental organizations (NGOs) have had a limited role to play in the field of space in the recent years. Unlike the representatives of citizen organizations, which are increasingly active in policy making in the traditional field of expertise such as human rights, women's right, the environment, and sustainable development, the space NGOs are not the most effective voices when it comes to space pollution.

Measures for Handling the Issue

Establish a Registration Timeframe

The Registration Convention of 1976 does not require that a country register its space technology within a specific timeframe. There are inherent problems with this. For example:

- The UN registration database at any given time does not include an accurate accounting of space technology (e.g., satellites, space vehicles) currently in outer space.
- Countries with emerging technologies and/or countries that were once priced out of space technologies can now afford to launch a satellite.

- The possibility of a conjunction between an unregistered space satellite (the existence of which was previously unknown) and a registered space satellite or other technology.

An established registration timeframe should address some of these issues.

Establish “Transfer of Ownership” Guidelines

The Registration Convention of 1976 does not provide guidelines specific to transfer-of-ownership in the event of bankruptcy, sale, or other qualifying event. The Iridium Satellite Constellation, a relay system for voice and data phones, fell into Chapter 11 bankruptcy in August of 1999. In the absence of a contingency plan to transfer ownership of the constellation, Iridium satellites were (presume that there was more than one) scheduled to be sent out of orbit to be destroyed in Earth’s atmosphere.^{xxx}

Before the bankruptcy was final, a private group of investors purchased Iridium. As technology advances, global dependency on space-based technologies will also increase as will the probability of bankruptcy, sale, or other qualifying events. Transfer-of-ownership guidelines would address some of these problems.

In general, there is no policy panacea. Rather, a combination of one or more of the following recommendations will facilitate space debris removal:

- Voluntary Non-binding Agreements (international agreements)
- International Research Consortia (research and technology initiatives)
- Rules-of-the-Road Guides to Mitigation (operational definitions)

Voluntary Non-binding Agreement

NASA legal counsel Steven A. Mirmina wrote a journal article for *The American Journal of International Law* titled “Reducing the Proliferation of Orbital Debris: Alternatives to a Legally Binding Instrument.”^{xxxii} In the article, Mirmina asserts that voluntary agreements are effective and serve as an important alternative to legally binding agreements. Mirmina describes how various countries came together to address the growing

concern over the continued proliferation of weapons of mass destruction.

Partner members of the Missile Technology Control Regime (MTCR) Agreement, an agreement dedicated to the prevention of continuing proliferation of weapons of mass destruction, initiated guidelines^{xxxii} to be followed voluntarily by MTCR partner countries.

The agreement is a living document in that it is open to revision as technology advances. The Wassenaar Agreement is an export controls agreement for conventional arms and dual use technologies. Some 40-member countries adhere to the agreement despite maintaining individual export controls. One of the reasons a voluntary agreement would work has to do with national sovereignty. If, as with the Wassenaar Agreement, individual nations are left to regulate themselves and yet remain responsible to a collective reporting mechanism that fosters transparency, the nation state is more likely to participate. There are other means by which to hold a state responsible for damages caused by errant satellites at the end of its orbital life. The Liability Convention entered into as of September 1972 under the auspices of the UN holds the “launching state” of a satellite responsible for damages caused by the satellite.

International Research Consortia

There are currently several international working groups involved in orbital debris mitigation and elimination efforts. However, it is not clear if there is any level of real coordination and information sharing among these. There is a common sense need for some level of communication among them in order to alleviate the potential for duplication and for effective and efficient progress on the problem of orbital debris. The IADC continues to work to facilitate the exchange of information specific to orbital debris and the European Space Agency (ESA), the International Academy of Astronautics (IAA), and others are also carrying out research on the problem of orbital debris.

A Common Sense “Rules-of-the-Road” Guide

A comprehensive guide to the “rules of the road” guide for space operations appears to be a practical way to standardize mitigation process and procedures. Space manner. Two considerations are that industry cannot assume

risk for the global common of outer space and that the cost of debris elimination technologies later will far exceed the cost of mitigation measures implemented now.

Liability, Compensation and Dispute System Design

Disputes are a reality of modern life that can be costly and painful if not addressed quickly and fairly. With the rise of private activities in space, questions of the control of such activity arise, especially those of responsibility and liability. Even if nations can easily agree on tracking and mitigation measures, there is still the question of liability in specific situations and how to resolve disputes. The space debris convention needs to consider the question of liability. First, the cost of equipment is important in the space industry and any destruction could lead to massive loss of assets and business. Second, some debris present serious hazards, i.e. nuclear powered satellites. Thus, the convention should also be aimed at defining a liability and compensation regime for damage. As commercial space activities increase with new space powers entering the field, it is crucial to ensure that the space equipment on which we rely on for communication and other purposes can be safely operated while in orbit. In case of damage, loss and major disruption, it is crucial to have a dispute handling mechanism in place to determine liability and claims compensation. As a result, compensation for damage and injury or death caused by space debris should be governed by an international regime elaborated under the auspices of the UN. The Convention on International Liability for Damage Caused by Space Objects is extended to cover space debris and define the dispute handling mechanism in more details. The convention would lay down the principle of strict liability and create a system of compulsory liability insurance. In terms of damage coverage, space equipment is usually covered by insurance policy. Coverage is usually split into the launch and in-orbit phase. The launch part is particularly risky and includes transport of the satellite through the Earth's atmosphere into space, the positioning of the satellite in orbit followed by commissioning and testing of all systems. The in-orbit policy, usually renewed yearly, covers damage to the satellite caused by technical failures, the harsh space environment with extreme temperatures, high solar radiations and solar flares, and exposure to meteoroids. Orbital debris is usually covered as well. On the other hand, space equipment beyond

normal years of operation but still providing a service is not necessarily covered. Because insurance companies are risk-adverse, it is likely that they will discontinue their coverage when the risk posed by space debris becomes unbearable for them. This is the reason why the proposed convention needs to incorporate a specific mechanism for settling disputes. While several mechanisms can help parties reach an amicable settlement (for example through mediation), all of them depend, ultimately, on the goodwill and cooperation of the members.

Disparity between Liability issues of Developed and Developing Nations

Many of the major space-faring powers (including the European Space Agency, France, Japan, the Russian Federation and the United States) have put regulatory standards into place aimed at limiting the creation of debris from government-sponsored space operations; and other nations (such as China and India) are working to put into place similar "good practices". The various debris mitigation standards now in place are similar, including limiting the amount of debris produced from normal operations, such as throwaway orbital stages or components; burning off fuel at the end of a satellite's mission life; and removing non-operational spacecraft and rocket stages from orbit, either by de-orbiting objects in LEO (over a certain time or boosting them up and out of the way into a so-called "graveyard" orbit for objects in GEO.^{xxxiii}

However, these national efforts vary in scope and in application, for example, contain exemptions that allow waivers if a certain mitigation practice is deemed too expensive. Moreover, some space-faring powers still have not completely embraced the idea of mitigation practices, concerned that added costs might hamper their ability to develop competitive space industries. Another problem is that not all space operations or operators are "national" in nature. Indeed, there are a growing number of international consortia launching and operating commercial satellites. One company, SeaLaunch, launches from ocean platforms and thus technically does not necessarily work within any nation's "territory".^{xxxiv} The global nature of the industry not only has resulted in debate about which nation state is responsible for licensing multinationals – not to mention which state bears liability under the Liability Convention – but also, even more generally, the international community continues to argue about what the term "launching state" actually

means. In this way, space is very much like the high seas, where regulating shipping has been complicated by the ease at which shady operators “change flags”.

In an attempt to “internationalize” an approach to debris mitigation, the United Nations and the Inter-Agency Space Debris Coordination Committee (IADC) are attempting to develop coordinated, international debris mitigation guidelines. Space debris has been on the agenda of the Scientific and Technical Subcommittee of the United Nations Committee on the Peaceful Uses of Outer Space (COPUOS) since 1994, with COPUOS issuing the Technical Report on Space Debris (A/AC.105/720) in 1999. The IADC comprises the space agencies from China, France, Germany, India, Italy, Japan, the Russian Federation, Ukraine, the United Kingdom and the United States, plus the European Space Agency (ESA). It was established in 1993 as an information exchange group. In 2001, COPUOS asked the IADC to develop and submit a set of voluntary international guidelines that might eventually be adopted by COPUOS and the United Nations at large. On 29 November 2002, the IADC submitted the guidelines to COPUOS, for consideration at the committee’s 17–28 February 2003 session in Vienna, Austria. It was originally expected that COPUOS would endorse the guidelines in 2004; however, several nations – particularly India, which has been somewhat skeptical of the international efforts at mitigation, and the Russian Federation – have submitted comments asking for changes that require renewed IADC discussions. As both the IADC and COPUOS work on the basis of unanimity, some compromises will need to be found.^{xxxv}

Thus, it can be very well seen that the liability of different countries cannot be held and mitigated at the same level as this goes against the very internationalization of the space-faring activities. What needs to be done in this particular aspect is to establish a system of liability mitigation according to needs and capacity of the country and if required, the policy can be extended to private entities as well.

The best form of mitigation guidelines between developed and developing nations is highlighted in the UN Framework for Climate Change that highlights the principle of common but differentiated responsibilities.

Definition of the Principle of Common but Differentiated Responsibilities

The principle of ‘common but differentiated responsibility’ evolved from the notion of the ‘common heritage of mankind’ and is a manifestation of general principles of equity in international law. The principle recognizes historical differences in the contributions of developed and developing States to global environmental problems, and differences in their respective economic and technical capacity to tackle these problems. Despite their common responsibilities, important differences exist between the stated responsibilities of developed and developing countries. The *Rio Declaration* states: “In view of the different contributions to global environmental degradation, States have common but differentiated responsibilities. The developed countries acknowledge the responsibility that they bear in the international pursuit of sustainable development in view of the pressures their societies place on the global environment and of the technologies and financial resources they command.”

Similar language exists in the *Framework Convention on Climate Change*; parties should act to protect the climate system “on the basis of equality and in accordance with their common but differentiated responsibilities and respective capabilities.”

The principle of common but differentiated responsibility includes two fundamental elements. The first concerns the common responsibility of States for the protection of the environment, or parts of it, at the national, regional and global levels. The second concerns the need to take into account the different circumstances, particularly each State’s contribution to the evolution of a particular problem and its ability to prevent, reduce and control the threat.

Implications of the Principle of Common but Differentiated Responsibilities

In practical terms, the principle has at least two consequences. First, it entitles, or may require, all concerned States to participate in international response measures aimed at addressing environmental problems. Second, it leads to environmental standards that impose differing obligations on States. The principle finds its roots prior to UNCED and is supported by state practice at the regional and global levels.

Common responsibility describes the shared obligations of two or more States towards the protection of a particular environmental resource. Common responsibility is likely to

apply where the resource is shared, under the control of no state, or under the sovereign control of a state, but subject to a common legal interest (such as biodiversity – termed a common concern of humankind). The concept of common responsibility evolved from an extensive series of international laws governing resources labeled as ‘common heritage of mankind’ or of ‘common concern’.

Differentiated responsibility of States for the protection of the environment is widely accepted in treaty and other State practices. It translates into differentiated environmental standards set on the basis of a range of factors, including special needs and circumstances, future economic development of countries, and historic contributions to the creation of an environmental problem. The *Stockholm Declaration* emphasized the need to consider “the applicability of standards which are valid for the most advanced countries but which may be inappropriate and of unwarranted social cost for the developing countries.” In the *Rio Declaration*, states agreed that “environmental standards, management objectives and priorities should reflect the environmental and developmental context to which they apply,” that “the special situation of developing countries, particularly the least developed and those most environmentally vulnerable, shall be given special priority, and that standards used by some countries “may be inappropriate and of unwarranted economic and social cost to other countries, in particular developing countries.”

A number of actions could be taken by the international community to build upon and improve the IADC. Differential responsibility therefore aims to promote substantive equality between developing and developed States within a regime, rather than mere formal equality. The aim is to ensure that developing countries can come into compliance with particular legal rules over time – thereby strengthening the regime in the long term. Practically speaking however, differential responsibility does result in different legal obligations. The techniques available in differentiated responsibility include ‘grace periods’ or delayed implementation and less stringent commitments. In recent interpretation of WTO law, there is movement towards an obligation to consider the particular economic, social and environmental situation of developing countries when adopting environmental measures. The WTO dispute settlement panel in the *Shrimp* case expressly mentioned the principle of ‘common but

differentiated responsibilities in its conclusions.

A particularly important aspect of the principle is international assistance, including financial aid and technology transfer. As developed countries have played the greatest role in creating most global environmental problems, and have superior ability to address them, they are expected to take the lead on environmental problems. In addition to moving toward sustainable development on their own, developed countries are expected to provide financial, technological, and other assistance to help developing countries fulfill their sustainable development responsibilities. In *Agenda 21*, developed countries reaffirmed their previous commitments to reach the accepted UN target of contributing 0.7% of their annual gross national product to official development assistance.

In summary, States have common responsibilities to protect the environment and promote sustainable development, but due to different social, economic, and ecological situations, countries must shoulder different responsibilities. The principle therefore provides for asymmetrical rights and obligations regarding environmental standards, and aims to induce broad State acceptance of treaty obligations, while avoiding the type of problems typically associated with a lowest common denominator approach. The principle also reflects the core elements of equity, placing more responsibility on wealthier countries and those more responsible for causing specific global problems. Perhaps more importantly, the principle also presents a conceptual framework for compromise and co-operation in effectively meeting environmental challenges.

Manifestation of the Principle in Multilateral Treaties and Declarations

Instances of **common responsibility** appear as early as 1949, where tuna and other fish were described as being “of common concern” to the parties by reason of their continued use by those parties. Other examples include outer space and the moon, on the other hand, are described as the “province of all mankind,” waterfowl as “an international resource,” natural and cultural heritage as “part of the world heritage of mankind as a whole,” the conservation of wild animals as being “for the good of mankind” and resources of the seabed and ocean floor and subsoil as “the common heritage of mankind.” Recent state practice supports the emergence of the concept of

“common concern” as reflected in the *Climate Change Convention*, which acknowledges that “change in the Earth’s climate and its adverse effects are a common concern of humankind,” and the *Biodiversity Convention* which affirms that “biological diversity is a common concern of humankind.” While each of these formulations differ, and must be understood and applied in the context of the circumstances in which they were adopted, the attributions of “commonality” share common consequences. Although state practice is inconclusive as to the precise legal nature of each formulation, certain legal responsibilities are attributable to all States with respect to these environmental media and natural resources under treaty or customary law. While the extent and legal nature of that responsibility will differ for each resource and instrument, the responsibility of each state to prevent harm, in particular through the adoption of environmental standards and international environmental obligations, can also differ.

Differentiated Responsibility appears in number of treaties. The 1972 *London Convention* requires measures to be adopted by parties “according to their scientific, technical and economic capabilities.” The special needs of developing countries are expressly recognized at article 11(3) of the 1976 *Barcelona Convention* and in the preamble to the *UN Convention on the Law of the Sea*, where account is to be taken of their “circumstances and particular requirements,” of their “specific needs and special circumstances,” or of their “special conditions” and “the fact that economic and social development and eradication of poverty are the first and overriding priorities of the developing country parties.” Other treaties identify the need to take account of States’ “capabilities,” “economic capacity,” the “need for economic development,” or the “means at their disposal and their capabilities.”

The principle of differentiated responsibility has also been applied to treaties and other legal instruments for developed countries. Examples include the 1988 EC *Large Combustion Directive*, which sets different levels of emission reductions for each member state, the 1991 *VOC Protocol*, which allows parties to specify one of three different ways to achieve reduction, and the 1992 *Maastricht Treaty* which provides that:

“Without prejudice to the principle that the polluter should pay, if a measure [...] involves costs deemed disproportionate for the public authorities of a member state, the Council

shall, in the act adopting that measure, lay down appropriate provisions in the form of temporary derogations and/or financial support from the Cohesion Fund.”

Differentiation within developing countries is specified, for example, in the *Climate Change Convention* that recognizes the “special needs and special circumstances of developing country parties, especially those that are particularly vulnerable to the adverse effects of climate change.” Similarly, the *Desertification Convention* requires that:

“Parties effort: [...] give priority to affected African country parties, in the light of the particular situation prevailing in that region, while not neglecting affected developing country parties in other regions.”

Under the 1987 *Montreal Protocol* the special situation of developing countries entitles them, provided they meet certain conditions, to delay their compliance with control measures. Under the *Climate Change Convention*, the principle of common but differentiated responsibilities requires specific commitments only for developed country parties at this time, and allows for differentiation in reporting requirements. International funding as a means to implement differentiated responsibility has a long history; beginning with the UNEP Environmental Fund and the World Heritage Fund in the 1970’s. A key example of implementation in this context is funding to ozone reductions projects through the Multilateral Fund for the Montreal Protocol. Financing mechanisms, partly implemented by the Global Environmental Facility, are established under the *Climate Change, Biodiversity* and *Desertification Conventions*. These mechanisms provide financial grants for implementing environmental projects and environmentally sound technology.

The above shows that the if the problem of ascertaining liability in the case of other environmental concerns has been addressed in such great detail, the same principles can be extended to the environmental problems of space debris, preferably by drafting a convention for management and liability for space debris using the aforementioned principle of Common but Differentiated Responsibilities.

Suggestions

- As part of the agreement to follow the guidelines, each signatory should pledge not to use launch services of

countries or companies that do not comply with the guidelines. Signatories should also agree to share technology needed to enable the guidelines to be followed, with a special emphasis on helping developing nations defray costs.

- Member States of the United Nations should be encouraged to develop national legislation on space activities to incorporate the IADC guidelines into processes for launching and operating satellites.
- The COPUOS Legal Subcommittee, with the IADC, should begin work to develop recommendations to harmonize national regulations regarding debris mitigation practices and licensing processes standard to a specific minimum degree that could be put into place in 5 to 10 years time.
- The International Organization for Standardization (ISO) should continue its work with IADC (under ISO/TC20/SC14 7th Working Group) to develop underpinning engineering methods for implementation of the guidelines, including looking at the most cost-effective methods for achieving them.
- Recognizing that ISO standardization could take many years, United Nations Members States should in the near-term be encouraged to develop national standards for applying the IADC guidelines – for example, NASA already has such standards for applying the US mitigation guidelines – as a minimum approach to debris mitigation.
- The COPUOS Legal Subcommittee should be tasked with developing, by 2014, international legal standards for debris mitigation to be applied to all

space operators under an international treaty that eventually could be negotiated under the auspices of the United Nations.

- Consideration should be given to how the Liability Convention might be amended with new provisions aimed at creating penalties for space operators whose failure to accept or comply with the internationally recognized debris mitigation guidelines results in debris creation or collisions.

The international community needs to continue to develop better debris tracking technologies, methods and networks in order to improve collision prediction. In particular, there is a need to develop capabilities other than the US Space Surveillance Network to provide continuity of data to the international community and transparency. COPUOS should establish a working group to consult with amateur space tracking networks, such as SeeSat, to explore the feasibility of an open, publicly available space surveillance network and database.

The liability for space debris should be ascertained in accordance with the environmental law principle of Common but Differentiated Responsibilities besides drafting of a convention for management and liability for space debris specifically to take care of this particular issue.

Obviously, some of these suggested measures (particularly those that involve trying to create legal international standards) are likely to be controversial and time consuming to develop and implement. However, this is all the more reason for beginning efforts at the national level now. Ultimately, though, it must be recognized that outer space – like the Earth's atmosphere – is a global resource that must be protected by all if it is to be preserved for the benefit of all.

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