Chapter 6
Legal Challenges Related to Active Orbital Debris Removal

Introduction

There are currently several sources of international regulatory control and pertinent legal instruments related to orbital debris and its removal. Three of these sources are currently existing international instruments of law, namely the pertinent original principles of international law devised before the Outer Space Treaty was agreed within the United Nations system, the Outer Space Treaty of 1967, and the subsequent Liability Convention of 1972. In addition to these three established sources of international law there are practices of space faring nations and model national laws that define practices for a particular country, but which can also help establish customary practice for other countries as well. Currently there are a number of problems that need to be addressed to facilitate the opportunity for either active orbital debris removal or for activities that would impact the orbits of space objects in attempts to prevent orbital collisions or minimize the likelihood of such collisions. These problems which can be characterized as current challenges to active orbital debris removal include the following:

1. First of all there is a need for a clear definition of what might be considered orbital debris and the specific means and processes that can be used to distinguish a "space object" from what can be characterized as a "space debris element". This distinction which does not currently exist in international law must be clear and unambiguous to all entities who might be involved.
2. A second priority is whether a mechanism might be established to transfer liability from the initial "launching state" to another entity. This involves a number of sub-points such as whether liability can in consistent practice over time be transferred to a "non-state" such as a private entity, an international organization, or a consortia that might include corporations, international organizations and states. There is also the question of whether the launching state could transfer its "ownership" and "launching state status" in terms of liability to another entity and how this could be formally done and whether this could be done multiple times.

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3. There are a number of derivative points of precise process and clear understanding of obligation for those involved with the launch, operation and disposal of space objects/space debris. These include such points: (a) as what could be considered "due diligence" related to the launch of space objects and the subsequent handling of space debris and its removal from orbit; (b) fulfillment of duties and obligations with regard to registration and processing of both "space objects" and the ensuing "space debris elements"; (c) the definition of "due diligence" and "duty of care" with regard to the launch and operation of space objects, the disposal of space objects and/or space debris elements. This obviously involves clarity of definition as to how, when, and why a space object (whether a satellite, a launch vehicle stage, or residual parts) somehow makes the transition to become space debris.
4. Further there is a need to consider a better definition of "fault" with regard to liabilities, especially when there might be operations such as space debris removal or alteration of an orbit to prevent collision, or placing of space debris into parking orbits.
5. Finally there is new issue with regard to operations above commercial space but below conventional understanding of outer space. This so-called Protozone or sub-space arena (i.e. above 21 km and below 100 km) is where a great deal of new activity is currently being planned. These activities might include such things as dark-sky stations, ionic engines flying small payloads to low earth orbit, rocket launches from stratospheric launch platforms, hypersonic transoceanic flights, robotic freighters, and sub-orbital flights. There is particular concern about sub-orbital flights (whether for space tourism or hypersonic transportation). This is because these activities are judged to pose the greatest danger of collision that may occur within the Protozone. Currently there is no agreed oversight regulatory body for this increasingly busy area.

The purpose of this chapter is to address all of these regulatory and legal issues and suggest the most urgent areas that need to be addressed to cope with the growing orbital debris problem and to establish an effective legal regime under which active orbital debris removal might be undertaken in coming years.

The Current Sources of International Law in This Area and Supplementary Sources of Regulatory Support Involving Orbital Debris Issues

The international law of space is quite compact—especially when it comes to the subject of space objects and space debris. The formal international space law that exists in this area was drafted over a relatively short period between 1963 and 1972 and as such does not take into account much that has changed about outer space activities over the last four decades. It is these instruments, however, that set forth who has jurisdiction over space objects (and thus space debris) and what liabilities that these objects can incur.

Essentially there are three prime sources. First there was the 1963 Declaration of Legal Principles. This was followed with the 1967 Outer Space Treaty that evolved from the consensus discussions within the UN Committee on the Peaceful Uses of Outer Space (COPUOS). (It is notable that as of 1 January 2014, the Outer Space Treaty had been ratified by 103 States and signed by 25 signatories including all space faring nations and thus it is the most pervasive in its global acceptance and as such constitutes what might be called a firm basis of "customary international law".) [UN Office of Outer Space Affairs]

Finally there is the so-called Liability Convention of 1972 and it is this last provision that is today the most controversial. Following a decade of negotiations, the so-called Liability Convention was adopted by the UN General Assembly. This Convention, elaborates upon Article VII of the Outer Space Treaty that addressed the liability issue. This Liability Convention was unique in that it imposes on the "launching state" an absolute responsibility to provide reparation for damages even in the absence of wrongful conduct by the launching State and does not take account of the fact that the launch might be for another country or a private company located somewhere else around the world, or that the spacecraft that incurs the damage might have been sold to another party entirely. In short this Liability Convention is considered today to have many logical shortcomings and it is this source of international law that is considered to be flawed and stands in many ways as a barrier to active orbital debris removal. [Nicholas Matte]

In addition to these sources of international law there is also UN General Assembly Resolution 1721 (XVI) adopted in 1961 that called upon all States launching objects into orbit or beyond to furnish information promptly to the Committee on the Peaceful Uses of Outer Space, through the Secretary-General, for the registration of launchings. This has transitioned into the Convention on the Registration of Objects Launched into Outer Space that entered into force in 1976 and currently has 62 Parties and 4 Signatories as of July 2014 (Fig. 6.1).

In addition there is the Inter-Agency Space Debris Coordination Committee (IADC) that has developed consensus guidelines to minimize the creation of

Fig. 6.1 The UN general assembly—the prime body to create outer space law (Graphic courtesy of the United Nations)

Fig. 6.2 The inter-agency space debris coordination committee (IADC)

additional space debris. The IADC has 13 member agencies that include those of the major space faring nations and European Space Agency (ESA) and has four working Groups that address related issues. The IADC guidelines with minor modifications became the basis for the voluntary guidelines agreed within the UN Committee on the Peaceful Uses of Outer Space (COPUOS), and then endorsed by the General Assembly in its resolution 62/217 of 22 December 2007. [Inter-Agency Space Debris Coordination Committee] (Fig. 6.2).

There are also other helpful regulatory sources that go beyond these UN instruments. Perhaps most notably a number of space faring nations such as the United States and France have adopted national space laws or exacting administrative processes that are quite specific in terms of addressing such issues as legal liability, due diligence to limit the creation of orbital debris, and to set guidelines such that launched space objects must de-orbit within 25 years after mission completion or be placed in suitable parking orbits. In this regard the French Operation Space Act is perhaps the most explicit and serves as model of other national laws for space faring nations. Because there have been no major new treaties related to outer space developed for many decades, the development of these other more informal types of agreements helps to establish international norms of behavior related to space that have evolved in more recent years.

The Major Deficiencies and Legal and Regulatory Issues That Exist with Regard to Orbital Debris and Its Removal

Clearly there are many challenges to be overcome in terms of finding cost effective, safe, and technically efficient ways to remove space debris from orbit or even to find effective ways to maneuver space craft to avoid collisions. But, there are likewise a

number of problems and challenges to establishing space law and regulations that allows the cleaning up of space to proceed in an efficient manner without creating political, strategic, or liability claim problems as the removal of space junk takes place. As already noted it is the Liability Convention that because of unfortunate definitional problems and the lack of latitude in being able to transfer liabilities that creates the largest legal barrier to efficient orbital debris removal. There are problems that start with the lack of definition of "space debris elements" (in contrast to an all-encompassing term which is space object). There are also problems in terms of defining what is the extent and nature of jurisdiction and control that applies to a launching state. Further there is a lack of clarity with regard to the relationship that applies to a launching state, a state that registers a launch under the UN Convention, and the entity that actually "owns, operates or controls" a space object. There are certainly a number of terms that would benefit from better definition, particularly terms and concepts that may have changed in meaning or effective process over the last 40–50 years. These terms include active or unintentional alteration of orbits, transfer of ownership and liability, the recognition of both nation states and non-nation states as launching entities, actors, owners and operators in space. Also concepts such as due diligence and duty of care, and fault and liability with regard to space related activities could also be usefully defined and updated with exacting defined meanings.

Unfortunately an amendment to the Liability Convention or a new Liability Convention that clarifies these terms and provides for new and more appropriate liability provisions seems unlikely at this time. This means that either model national space laws or voluntary guidelines that all or most space faring nations accept may have to represent the practical step forward in this area. Although the main concern here is space assets and possible damage to space assets by one country or organization by another, care must also be taken to address legal or regulatory or liability issues that could arise if damage or harm comes to property or humans from space objects that are either deorbiting or are being launched into space. In the following sections these various legal and regulatory issues and definitions are addressed.

Difficulties with Definitions (Orbital Debris, Alterations of Orbit, Jurisdiction and Control, Transfer of Ownership, Nation States and Other Space Actors, Liability, Fault, Liability and Fault: Plus Due Diligence and Duty of Care)

Space Object versus Space Debris: Article VIII of the Outer Space Treaty provides that: "A State Party to the Treaty on whose registry an object launched into outer space is carried shall retain jurisdiction and control over such object, and over any personnel thereof, while in outer space or on a celestial body." (Article VIII of the Outer Space Treaty).

The IADC has defined space debris as "all man-made objects including fragments and elements thereof, in Earth orbit or re-entering the atmosphere, that are non-functional." This definition was adopted by the UN COPUOS. Similarly, the European Space

Agency has defined space debris as: "all non-functional, man-made objects, including fragments and elements thereof, in Earth orbit or re-entering into Earth atmosphere." Nowhere in the 1963 Declaration of Legal Principles, the 1967 Outer Space Treaty, or the 1972 Liability Convention, however, is any distinction made between functional and non-functional space objects. According to Article VIII of the OST, a State Party on whose registry an object launched into outer space is carried shall retain "jurisdiction and control" over such object while in outer space or on a celestial body. This includes not only launched operational spacecraft, but upper stage rockets, dead satellites, and even residual rocket and satellite parts. According to Article VII of the same treaty, a State Party that launches or procures the launching of an object into outer space, and each State Party from whose territory or facility an object is launched, is internationally liable for damage by such object or its component parts. Under the Liability Convention, such liability shall be absolute for damage caused on the surface of the Earth or to aircraft in flight, and be conditioned on fault for that caused elsewhere than on the surface of the Earth to a space object or to persons or property on board. As of now, nothing changes when operational space objects become non-functional and thus space debris. A start for the world space community would be a universally agreed definition of space debris.

Jurisdiction and Control: One of the reasons for a differentiation of a "space debris element" from a "space object" would be the presumed ability to transfer jurisdiction and control of a launched space object to another entity for the purpose of removal, lowering of its orbit to facilitate orbital decay or orbital parameter change to avoid a collision. The word jurisdiction of course has one meaning and control, especially for a non-functional space object (or space debris) quite another. Thus devising new language other than jurisdiction and control would also add greater precision to whether the intent is to cover "legal responsibility and liability" (i.e. jurisdiction) or whether the intent is to cover efforts to control a non-functional space object. This could have several practical implications. One suggestion with regard to changing an orbital parameter to facilitate de-orbit or collision avoidance, is that there could be a collaboration between the entity having "jurisdiction" over a non-functional space object and an entity with the technology to bring about the orbital change. This orbital variation might be via such means as a laser pulse or directed energy system. One concept would be to provide the entity with jurisdiction for the space object with the control of an energy system that would affect the orbital change.

Transfer of Liability Versus Transfer of Jurisdiction and Control: Today under existing space law there is no mechanism to transfer jurisdiction, control or liability of a space object regardless of whether it is functional or non-functional. Many have argued that such a condition creates exactly the wrong incentives to address the orbital debris problem and reduce orbital debris congestion and thereby reduce the threat of orbital collisions that would create yet more orbital debris. Clearly the problem, in part, stems from language in the Outer Space Treaty (1967) and the Liability Convention (1972) that did not anticipate the coming complexity of space activities. The possibility of private entities (i.e. non-State entities) launching,

owning, operating, and buying and selling spacecraft was not anticipated. The current international legal environment suggests that a revision of space treaties and conventions currently in force is not likely to occur soon. Thus other recourses such as model space laws, agreements about codes of practice in space, and discussions and agreements within the Inter-Agency Space Debris Coordination Committee (IADC) or the Committee on the Peaceful Uses of Outer Space (COPUOS) may help define the meaning of these key concepts. Such non-treaty provisions might still be able to help define "space debris", the meaning of "jurisdiction" and "control" of space objects when non-functional, and whether there could be a transfer of "jurisdiction", "control" or "liability" with regard to such non-functional space objects. One subject that has been discussed in various forums is the creation of an orbital debris removal fund that could not only provide the means to undertake orbital debris removal, but also be used to cover the liabilities associated with debris removal. [Pelton]

Liability and Fault—Due Diligence and Duty of Care: The normal situation in law is that liability in a given situation is governed by where the fault lies and whether the entity at "fault" has exercised due diligence or undertaken appropriate duty of care to minimize risk to a reasonable standard. Under the Liability Convention the liability for launching States of a space object exists regardless of whether or not some other State, private entity or subsequent owner or owners have taken "ownership" of the spacecraft or space object and has created the fault or damage to property or individual. This seemingly illogical condition is nevertheless the existing international law and it clearly stands as a barrier to active orbital debris removal or programs that could minimize the creation of new orbital debris. In short the wrong incentives now exist to minimize orbital debris. Owners and operators of space objects that are other than the launching State currently have no special obligation under existing international law to exercise due diligence and duty of care to minimize orbital collisions or orbital debris buildup. Fortunately, they could be held liable under existing and pending national space law. Further as operators of space activities they may very likely have business reasons to avoid such results. In short the biggest problem is that existing international law does not create incentives to "clean up" orbital debris. A global fund that helps to pay for cleanup of orbital debris and becomes the first line of payment in case of an accident involving orbital debris removal occurs, could be one possible solution, especially if supported by national space laws enacted by space faring nations. [Pelton, "A Global Fund."]

Regulatory Responsibility and a Lack of Responsible Agency

The legal challenges and issues related to active orbital debris removal go beyond just the language in the Outer Space Treaty of 1967 and the Liability Convention of 1972. The other major problem is that there is no clear regulatory agency that is

in charge of space safety, traffic in outer space, and other concerns. The International Telecommunication Union (ITU) coordinates the allocation of frequencies on Earth and in near to Earth space. The World Meteorological Organization (WMO) and the United Nations Environmental Programme (UNEP) are responsible for atmospheric and meteorological concerns. The World Health Organization (WHO) is responsible for health standards related to such issues as radiation. Currently the International Civil Aviation Organization (ICAO) is beginning to examine the extent to which the Chicago Convention might be extended to cover coordination of space traffic control and management related to space transportation perhaps even up to GEO orbit. Currently there is no regulatory agency concerned with regulating and controlling space debris even though the UN Committee on the Peaceful Uses of Outer Space is the entity that has ultimately achieved agreement on voluntary procedures to minimize the creation of additional orbital debris. These procedures are currently voluntary and there are no enforcement provisions and certainly do not provide a regulatory basis for such activities as active orbital debris removal or the establishment of a fund to cover active debris removal or possible compensation for liabilities that might arise. [Jakhu and Nyampong] and [Sgobba, Jakhu et al.] Until some form of international regulatory framework is formed it seems unlikely that substantial progress can be made with regard to a coordinated approach to active orbital debris removal.

National Defense and Defensible Actions

In the area of international law there is always a good deal of complexity in that one provision in an instrument might well be trumped by another. National defense and "defensible action" is consistently invoked to justify national state actions in a great many of UN developed legal instruments and treaties. The regime of fault liability, which applies to damage caused elsewhere than on the surface of the Earth, as provided by Article III of the Liability Convention, requires the victim of the presumed wrongful act to prove the fault of the offending State. In contrast to that, the regime of objective responsibility found in Article II, which applies to damage caused by space objects on the surface of the Earth or to aircraft in flight, invokes responsibility as a sole consequence of conduct contrary to an international obligation. Yet Article II also permits the State to invoke defenses that may be available under international law to absolve itself from the responsibility. Fault responsibility must therefore be distinguished from causal responsibility. Thus the obligation to compensate arises only from the causal link between the action and the damage.

This means that a nation that employs an action to undertake active orbital debris removal or to change the orbit of a space object and can demonstrate that such action was undertaken as an act of national defense may be able to prove that this was not a wrongful act and thus was not at "fault" under the provisions of the Liability Convention. [Brownlie]

The Special Issue of the Protozone

The main focus of this book is on the problem of orbital debris which is largely concentrated in low earth orbit. Currently about 2.75 metric tons of the orbital debris in Earth orbit is in close proximity to the planet out of the total space debris of about 6 metric tons. This low Earth orbit is much more densely collected together and thus represents a much greater chance of collision. This is why much greater attention is paid to low Earth orbit debris even though debris such as upper stage rockets near GEO orbit is clearly also a major concern.

There is a further concern that needs careful attention in coming months and years as we see an increase in activities in the zone above normal commercial air space (i.e. above 21 km) and below the area that most nations consider the start of outer space (i.e. below 100 km). (Note: This translates into above 13.167 miles and below 62.5 miles). For years there was little activity in this "protozone" or "sub-space" area, but in recent years there has been an increase in actual or proposed use of this region. Activities include high altitude platforms for telecommunications and remote sensing, "dark sky stations" for scientific experimentation and possible staging to support low thrust ion engine flights to low earth orbit from these dark sky stations, sub-orbital space tourism flights, intercontinental hypersonic transportation flights, and robotic freighters across oceans that could move freight at lower cost and with substantially lower labor costs. This protozone region does not pose a space debris issue because gravity would deorbit all but lighter than air objects relatively quickly.

The problems for the "protozone" are nevertheless many fold. The challenges include space traffic management and control, potential crashes between objects potentially moving at high velocities relative to each other, stratospheric pollution of this very fragile atmosphere, and frequency interference. This is an area that also needs attention and it is not clear whether the International Civil Aviation Organization (ICAO), International Telecommunication Union (ITU), the World Meteorological Organization (WMO), the UN Environmental Programme (UNEP), or the World Health Organization (WHO) would have the greatest concerns and regulatory oversight responsibilities for the protozone. Despite this possible ambiguity the greatest amount of attention in the last few years has been focused on the ICAO responsibilities for air safety, which is seen as the driven regulatory concern at this time. There is clearly a need to consider the mounting applications for the protozone and many risks and dangers that can arise from having no clear-cut regulatory authority established for this region with all of its expanding new applications. [Pelton, "New Integrated Global…"]

Conclusions and Recommendations

The legal challenges related to active orbital debris removal as outlined above are both numerous and also not prone to easy solution. The obvious answer of amending the Outer Space Treaty of 1967 and the Liability Convention of 1972 is actually quite unlikely. The most promising areas to address the mounting problem of

increasing orbital debris would: (a) model national space laws that contain appropriate penalties for violations and incentives for debris removal; (b) discussions between the space agencies on this subject, particularly within the Inter-Agency Space Debris Coordination Committee (IADC); (c) consideration of new and more current definition of key terms as discussed in this chapter and especially within the UN Committee on the Peaceful Uses of Outer Space and its Working Group on the Longer-Term Sustainability of Outer Space Activities; and (d) discussions within various space forums as to codes of conduct for the pursuit of space applications and development and debris removal. An idea of some logic is the creation of a global space development and orbital space debris removal fund that could be used to remove debris from space under licensing processes provided through the UN Office of Outer Space Affairs. Such a fund could in theory be used in case activities related to orbital debris removal led to some form of liability claim. A good start in this area would be discussions as how to define key terms and concepts that relate to today's realities in space. These realities are that private entities are engaged to a variety of space activities, that space assets are transferred from one entity to another, and that removal of space debris (i.e. non-functional space objects) or altering the orbits of space objects to avoid collisions are activities that are mutual benefit to everyone. That is to say that space faring nations, commercial space operators, space defense systems and everyone who anticipate the future exploitation of space would benefit from an improved legal regime. Such a regime should encourage the active removal of space debris from orbit and an improved legal and financial framework that could facilitate the prevention of collisions of space objects, create incentives for debris removal, and cover on a "no fault basis" the cost of liabilities in the event damages are somehow incurred in space.

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