

IAC-10- E7.4.8

LEGAL ISSUES SURROUNDING NEAR EARTH SPACE

Atsuyo Ito, Ph.D.

Social Science Research Institute

International Christian University

Tokyo, Japan

iatsuyo@nt.icu.ac.jp

ABSTRACT

At present, the international legal regime governing near-Earth space is inadequate to address the injury/loss of human life in orbit. The current framework is not sufficient to address the damage caused to humans by debris in space, and rules are absent to respond to instances of injury or murder that might occur onboard a space hotel. It is necessary to set certain guidelines to respond to such potential problems. The paper discusses the present lawlessness in near-Earth space, as well as its impact, and then examines the need for a particular legal regime that can respond to civilian activities in this environment.

INTRODUCTION

Although civilians have flown in space on-board the International Space Station(ISS), access to space or 'space tourism' by the general public has become increasingly likely in the near future. Apart from suborbital flights, orbital flights as well and even space hotels are in the course of development. However, outer space remains an unsafe and a potentially lawless environment for civilians to stay. In particular, the proposed space hotels are not yet subject to any legal regulations or jurisdictions. As a result, potential incidents are not addressed and an adequate legal protection for space flight participants is not available.

This paper examines the legal aspects associated with the injury/loss of human life in orbit. The first issue to be addressed the case where debris from a third party spacecraft or rocket causes injury or death on-board the space

hotels that are proposed for the near future. The second issue to be addressed is the jurisdiction of human-to-human induced injury or death in orbit - such as murder on-board a space hotel. This paper reviews the current situation regarding these hypothetical events, highlights shortcomings or ambiguities in the present regime, and suggests possible approaches.

INJURY/LOSS OF HUMAN LIFE CAUSED BY DEBRIS

The first issue addresses the loss of human life in orbit caused by debris. Near Earth space is increasingly congested with operational satellites and debris. There are a number of non-functioning man-made space objects or fragments and components of such objects in Earth orbit or entering the Earth's atmosphere, referred as debris.¹ Debris exceeding two

¹ French law on Space Operations, 3 June 2008.

centimetres can be lethal if it collides with a functioning spacecraft.² At orbital velocities of more than 28,000km/h, an object as small as 1cm in diameter has enough kinetic energy to disable an average-size spacecraft.³

The situation became much more serious recently due to extensive debris fields that have been created through the in-orbit destruction of satellites. One incident was a deliberate destruction of a decommissioned satellite by a Chinese ground-based missile on 11 January 2007⁴. The debris generated, said to have amounted to 10,000 fragments, is scattered between orbits lower than 200km to more than 3,850km.⁵ The second instance was the accidental in-orbit collision of the US and Russian satellites on 10 February 2009⁶. In this first time incident of a collision of full size satellites in outer space, the US Iridium 33, a commercial telecommunication satellite and Cosmos 2251, a Russian military

telecommunication satellite, collided at the altitude of 790 km and both of them were destroyed. Whilst Iridium 33 was part of the Iridium satellite phone constellation of 66 satellites, Cosmos 2251 was already defunct, and had ceased its operation around 1996.

A similar possibility of a collision in outer space between a satellite or a debris fragment and a manned orbital vehicle remains long into the future and that is thus threatening to humans. Whilst the probability of a space hotel colliding with full size satellites or orbital vehicles is not high, its collision with debris is much more probable. In fact, on 13 March 2009, the International Space Station crew was obliged to take refuge in the Soyuz rescue vehicle after a 13cm piece of debris was detected on the station's trajectory.⁷ If a space hotel is hit by debris, and consequently civilians are injured or lost their lives, what measures of compensation is available? The present legal regime does not provide adequate answers.

² European security and space debris, Report submitted on behalf of the Technological and Aerospace Committee, Document A/2073, 2010, 8.

³ T. Sénéchal, Space Debris Pollution: A Convention Proposal, available on the Internet at <http://www.pon.org/downloads/ien16.2.Senechal.pdf>, 44.

⁴ See in general K. Nair, China's Test: A Demonstrated Need for Legal Reform, 33 *Journal of Space Law*(2007), 191-194.

⁵ T. Sénéchal, Space Debris Pollution: A Convention Proposal, available on the Internet at <http://www.pon.org/downloads/ien16.2.Senechal.pdf>, 39.

⁶ See generally, Iridium 33-Cosmos 2251 Collision, Fact Sheet, Secure World Foundation, http://www.secureworldfoundation.org/siteadmin/images/files/file_273.pdf. See also D.Wright, Colliding Satellites: Consequences and Implications, available on the Internet at: <http://www.ucsusa.org/assets/documents/nwgs/SatelliteCollision-2-12-09.pdf>.

The Inadequacy of the Liability Convention

The Convention on International Liability for Damage Caused by Space Objects addresses both in-orbit and terrestrial damage caused by a space object⁸. In order to analyze that what kind of damage occurred in outer space is covered, a closer look at the definition of a space object is necessary. Article I of the Liability Convention does not fully define a

⁷ European security and space debris, Report submitted on behalf of the Technological and Aerospace Committee, Document A/2073, 2010, 6.

⁸ Convention on International Liability for Damage Caused by Space Objects, 29 March 1972, 24 U.S.T. 2389, 961 U.N.T.S. 187. [Hereafter: Liability Convention]

space object, but clarifies that it: “includes component parts of a space object as well as its launch vehicle and parts thereof”.⁹ Component parts of a space object are not specified in size, and therefore could include space debris of any size. A scope of damage in orbit envisaged under the Liability Convention can be construed to cover the collision of manned objects with debris.

Article III of the Liability Convention provides that “In the event of damage being caused elsewhere than on the surface of the Earth to a space object by a space object of another launching State, the latter shall be liable only if the damage is due to its fault or the fault of persons for whom it is responsible.”¹⁰ Man-made space objects including debris of a considerable size are catalogued and tracked. A launching state is liable for in-orbit damage on the basis of fault insofar as the link between the damage and its launched object is established. However, the Liability Convention has ambiguities and shortcomings.

The first point concerns the phrasing of “the latter shall be liable only if the damage is due to its fault”. The Liability Convention limits the fault of the launching states of two collided space objects, and the provision does not cover cases if the damage occurs due to the fault of the third party.¹¹ The provision contains a loophole, and does not address the chain of events situation. Such circumstances are conceivable

nevertheless where debris hit the space object of state B, led to its loss of control and/ or change of its orbit to collision with a space hotel of state C. On the basis of fault, State A should be liable to both state B and state C for damage.

The second point concerns the interpretation of fault. A foremost question to clarify is that under what circumstances a launching state would be at fault. Liability on a fault basis means that circumstances of how the damage occurred would be considered.

The Liability Convention does not specify as to how the fault is determined, and the consideration of what constitutes fault for damage in outer space where, most notably, in-orbit collision needs to be approached from a practical standpoint. There are roughly three categories of fault that can be considered under circumstances of in-orbit collision: 1) intentional destruction of space object in orbit; 2) leaving a defunct satellite in orbit leading to damage; and 3) omission to conduct avoidance manoeuvres despite of the alert issued.

It would not raise any question as to whether it would constitute fault to intentionally destroy manned objects of other states e.g., intentional destruction of a space hotel by a missile. Even if in-orbit destruction is not deliberately targeted for another state, the impact of destruction to the environment of outer space is significant. In fact, two incidents of 2007 Chinese destruction of a defunct satellite in orbit, and 2009 accidental collision of US and Russian satellites generated by themselves 5,000 objects measuring more than 10cm, increasing the total population of that category of debris by about

⁹ Article I, Liability Convention.

¹⁰ Article III, Liability Convention.

¹¹ See A. Kerrest, *Liability for Damage Caused by Space Activities*, *Space Law: Current Problems and Perspectives for Future Regulation*, M. Benko and K. Schrogl(Eds.), Eleven International Publishing, 2005, 102.

50%.¹² Growing concerns for debris has led to the UN COPUOS to establish guidelines for mitigation of space debris in 2007.¹³ Whilst these guidelines are not legally binding, the principles set certain standards of conduct with regard to generation and mitigation of debris. The Guideline 4 of the UN Space Debris Mitigation Guidelines provides that “Recognizing that an increased risk of collision could pose a threat to space operations, the intentional destruction of any on-orbit spacecraft and launch vehicle orbital states or other harmful activities that generate long-lived debris should be avoided.”¹⁴ A conclusion can be drawn therefore that intentionally creating debris that turn out to damage manned objects undoubtedly constitutes fault.

With regard to the second category, whether leaving a defunct satellite in LEO constitutes fault is subject to debate. A number of decommissioned satellites in outer space is already significant and continues to rise. Whilst operational spacecraft takes up 8% of the catalogued orbital population, 50% of catalogued debris population account for decommissioned satellites, spent upper stages, and mission related objects.¹⁵ In the light of

abundant population of defunct satellites in space, leaving space objects after its lifetime can be construed as fault. In fact, Guideline 6 of the Space Debris Mitigation Guidelines of COPUOS states that “Spacecraft and launch vehicle orbital stages that have terminated their operational phases in orbits that pass through the LEO region should be removed from orbit in a controlled fashion.”¹⁶ Vast majority of space debris is uncontrollable and the key to avoid collision with space debris is through successful avoidance manoeuvring of the space object. It is generally recognized that if a space object is not manoeuvrable, the risk for a potential collision with debris becomes significantly higher. A satellite that runs out of fuel cannot manoeuvre, and in many cases ceases to be of any value.¹⁷ Under these circumstances, a defunct satellite can only be a cause of disruption to other space objects in operations whilst it gives no benefits to the states.

The third category, the omission of avoidance manoeuvre, is perhaps the most suited categories of all three to adopt a fault-based liability, and represents the most complex cases to determine the elements of fault. It depends on the circumstances of how the damage occurred, the probability of collision, the cost involved to take avoidance measure, and the presence of other risks. Probability of an in-orbit collision is usually perceived as low. In contrast, there is a significant cost to manoeuvring to avoid every close approach as many satellites utilize precise ground tracks or pointing to perform their

¹² Cf. European security and space debris, Report submitted on behalf of the Technological and Aerospace Committee, Document A/2073, 2010, 6. Cited from J.C. Liou, An Upsate Asesment of the Orbital Debris Environment in LEO, NASA Space Debris Quarterly News, January 2010.

¹³ [Hereafter: UN Space Debris Mitigation Guidelines].

¹⁴ Guideline 4, UN Space Debris Mitigation Guidelines.

¹⁵ T. Sénéchal, Space Debris Pollution:A Convention Proposal, available on the Internet at <http://www.pon.org/downloads/ien16.2.Senechal.pdf>, 43.

¹⁶ Guideline 6, UN Space Debris Mitigation Guidelines.

¹⁷ B. Weeden, Space Review:Billards in space, 9. Available on the Internet at <http://www.thespacereview.com/article/1314/1>.

missions, and avoidance manoeuvring are likely to disrupt data collection or create end-user outages.¹⁸ Furthermore, avoidance manoeuvring may result to the risks of greater losses - such as avoiding a small debris raises the risk of collision with another satellite or other debris. In such cases, a satellite at risk of collision may be better off not to manoeuvre. Detailed circumstances of the proximity of two space objects should be taken into account and carefully analyzed before fault is established. Nevertheless, the standard of care should be set higher for avoiding a potential collision with the manned objects.

Just like car accident situations, different scenarios can be envisaged for collisions in outer space. As in the case referred to of the in-orbit collision of two satellites, on the one hand the Russian satellite was defunct with no possibility of manoeuvre, but on the other hand the US satellite could have manoeuvred to avoid the collision, it is not impossible to argue that both parties were at fault. In such cases, 'offset of liability' may be applicable and neither parties is liable to one another. It is desirable to set clear guidelines to determine fault that can be applicable to any circumstances. Overall, the provisions of the Liability Convention with regard to in-orbit damage are ambiguous and need to be rectified to address the 'fault' of any party concerned with being the cause of collisions of space objects of other launching states.

Implication of In-orbit Damage to a Liable Launching State

Under the circumstances of damaged unmanned objects, the damage concerned comprises the loss of a space object and the consequential economic loss of operations provided by the satellite. It will mostly be a matter to be settled between the two launching states. However, damage to manned objects is not straightforward as it would likely to involve human lives and depending on their nationality, may concern more states other than just launching states of the collided objects.

It therefore has the possibility to involve a number of states representing the nationalities of the space flight participants. If the life of a space flight participant is taken away by the debris of another state, the family of the victim may sue the launching state responsible for the debris collision directly. In fact such a possibility is provided for as an alternative to state-to-state claim: "Nothing in this Convention shall prevent a State, or natural or juridical persons it might represent, from pursuing a claim in the courts or administrative tribunals or agencies of a launching State."¹⁹ It is possible that multiple actions may be brought by different plaintiffs claiming for a loss of each space tourists. Whilst Article XI further provides that "A State shall not, however, be entitled to present a claim under this Convention in respect of the same damage for which a claim is being pursued in the courts or administrative tribunals or agencies of a launching states or under another international agreement which is binding

¹⁸ B. Weeden, *Space Review: Billards in space*, 9. Available on the Internet at <http://www.thespacereview.com/article/1314/1>.

¹⁹ Article XI, Liability Convention

on the States concerned”,²⁰ it is not certain whether the destruction of a manned object and loss of space tourists onboard such an object will be treated as ‘same damage’. In such cases, proceedings in parallel: 1) a state-to-state claim between launching states of manned objects; and 2) individual claims brought against the liable launching state may take place.

JURISDICTION OF HUMAN-TO-HUMAN INDUCED DAMAGE

In contrast to the cases of damage due to inanimate objects in orbit, where the Liability Convention is applicable, a legal regime is completely missing for damage inflicted by a person upon another person onboard a space vehicle – such as a space hotel. The Liability Convention does not apply, as it limits the scope of damage to ‘damage caused by a space object’, and does not cover human-to human induced damage in outer space.

Risk of Human-to-Human Induced Damage onboard a Space Hotel

However, there may be instances of human-to-human induced damage onboard a space hotel. Perhaps the most extreme damage onboard a manned object is manslaughter or a murder. Whilst murder on a space hotel may sound extreme, such a scenario is not completely from the world of a suspense novel. In reality, in an experiment conducted by the Russian Institute of Biomedical Problems in 1998 and 1999 in which seven male astronauts of Russian and Japanese nationalities and a female Canadian astronaut spent 110 days aboard the

replica space station,²¹ the two Russian astronauts reportedly committed battery, assault and attempted murder.²² More recently in 2007, although the incident occurred on Earth after flight, a female NASA astronaut stalked her romantic rival, assaulted her, and was charged with an attempted murder. In contrast to a military or space agency astronaut, where the criteria for a selection are high, a space tourist is selected primarily on the candidate’s financial capability to meet the cost of the space flight. Combined with the stress resulting from unusual and closed environment in outer space, the risks of any incident where damage is inflicted from one flight participant to another or to a crew member onboard a space hotel is not at all inconceivable.²³

The Lawlessness of a Space Hotel

The case of a murder on-board a space hotel is subject to an uncertain legal regime. Agreement amongst the government of Canada, the 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

²¹ Cf. J. Hermida, Crimes in Space A Legal and Criminological Approach to Criminal Acts in Outer Space, XXXI *Annals of Air and Space Law*(2006), 4. See 110-Day Isolation Ends in Sullen ... Isolation, Moscow Times, 30 March 2000, Available on the Internet at <http://www.themoscowtimes.com/stories/2000/03/30/003-full.html>.

²² J. Hermida, Crimes in Space A Legal and Criminological Approach to Criminal Acts in Outer Space, XXXI *Annals of Air and Space Law*(2006), 4.

²³ See C. Ford, Culture of inequality plagues Russia, Daily News (14 April 2000), 16, cited in J. Hermida, Crimes in Space A Legal and Criminological Approach to Criminal Acts in Outer Space, XXXI *Annals of Air and Space Law*(2006), 4.

²⁰ Article XI, Liability Convention

States of America concerning cooperation on the civil international space station²⁴ is solely applicable to the governmental International Space Station, and not to a commercial space hotel designed for civilians.

The resulting question to evaluate is the determination of a suitable jurisdiction to address potential cases of injury or death on-board manned objects in space. For a murder case on-board a space hotel, several jurisdictions may be involved and multiple proceedings may occur. It is possible that the state registration of the hotel, the nationality of the deceased, and that of murderer would all be different.

In absence of a pre-designated jurisdiction, an incident may give rise to multiple proceedings of both civil and criminal nature under differing jurisdictions. Most of all, families of the deceased are likely to bring actions under the local court of the state in which they reside. There is a possibility that a space hotel owner may sue the murderer for a degradation of reputation of a space hotel, and loss of income in the jurisdiction of the state of registration of the space hotel. The family of a victim may choose to bring action to the court of a jurisdiction with heavier penalties. If no rule exists, potential claims encompassing a murder case of a space tourist may be subject to conflicts of jurisdictions and possible 'forum shopping' by the concerned parties. At present, space law is silent as to how to resolve these conceivable problems. It is therefore desirable to

²⁴ Agreement amongst 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. [Hereafter:IGA]

determine which law of a state is applicable to an incident onboard a space hotel and under which jurisdiction, a court will hear the case.

Since there is no existing rules that address such matters, laws applicable to a general regime governing outer space as well as to the International Space Station should be referred to. Three types of jurisdictions are commonly recognized: territorial, national and quasi-territorial jurisdiction. The predominant principle governing a jurisdiction in outer space is that a state that registers a space object exercises jurisdiction on the registered space object as well as for personnel thereof.²⁵

On-board the International Space Station (ISS), the rules are in line with the provisions of the Convention on Registration of Objects Launched Into Outer Space²⁶: the jurisdiction is exercised by the State of Registry of the module. Article 5(1) of the IGA states that "In accordance with Article II of the Registration Convention, each Partner shall register as space objects the flight elements".²⁷ Article 5(2) of the IGA states that "Pursuant to Article VIII of the Outer Space Treaty and Article II of the Registration Convention, each Partner shall retain jurisdiction and control over the elements it registers in accordance with over personnel."²⁸

²⁵ Article VIII of the Outer Space Treaty states 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 or any personnel thereof, while in outer space or on a celestial body."

²⁶ Convention on Registration of Objects Launched Into Outer Space, 14 January 1975, 28 U.S.T. 695, 1023 U.N.T.S. 15. [Hereafter:Registration Convention]

²⁷ Article 5(1), IGA.

²⁸ Article 5(2), IGA.

However, when it comes to the criminal jurisdiction, the national jurisdiction can be exercised as Article 22 of the IGA provides that “Canada, the European partner States, Japan, Russia, and the United States may exercise criminal jurisdiction over personnel in or any flight element who are their respective nationals”.²⁹ That means regardless of the location of a crime, jurisdiction of the nationality of the offender is applicable e.g., Russian astronaut murdering another in the US module of the ISS will be charged under Russian law.³⁰

In the case of the ISS and applying the nationality jurisdiction, the resulting situation is that it would still be limited to jurisdictions of Canada, Europe, Japan, Russia and the United States. In contrast, when considering the applications of nationality jurisdiction to space tourists, there are virtually unlimited numbers of jurisdictions of each nationality of potential space tourists. Moreover, the nationality jurisdiction does not address the issue of dual nationality of space flight participants. Adopting a nationality jurisdiction in a sense is a random application of rules to a same incident depending upon the nationality of a perpetrator. For instance, a death penalty is applicable in certain jurisdictions whilst not recognized in other jurisdictions. In an extreme case, a following situation may arise: for a same charge of a murder on a space hotel, a murderer of a national where death penalty exists may be sentenced to death whereas the murderer of a

national where death penalty does not exist receive a life sentence. Such an unequal situation needs to be minimized and consistency in the application of criminal jurisdiction should be achieved.

Rather than adopting the ISS approach of applying the nationality principle to the criminal jurisdiction, it is more suitable to adopt a quasi-territorial jurisdiction established under the Registration Convention, that is, applying the law of a launching state and/or state of registry of a space hotel to potential cases onboard a space hotel. A quasi-territorial approach would enable to identify a single state to exercise a jurisdiction in the module in question regardless of nationality of space flight participants.

CONCLUSION

The lawless environment of near-Earth space needs to be rectified to better address potential incidents in outer space. The examination of issues of loss of human life by an inanimate object in orbit has highlighted that the need for elaboration of the term ‘fault’ under the Liability Convention. Guidelines for what constitute fault of a launching state in causing damage humans should be established.

It is recommended that state should be liable:

- 1) When a state intentionally destroys space object in orbit and damages humans;
- 2) When a state leaves a defunct satellite into LEO that lead to damage other humans; and
- 3) If a state is at fault to omit to conduct avoidance manoeuvring that result to damage to humans.

Furthermore, the scope of application of the

²⁹ Article 22, IGA.

³⁰ J. Hermida, Crimes in Space A Legal and Criminological Approach to Criminal Acts in Outer Space, XXXI *Annals of Air and Space Law*(2006), 7.

Liability Convention should be broadened to cover the chain of events type of circumstances of damage.

With regard to the appropriate jurisdiction to address the criminal case of human-induced injury or death onboard a space hotel, a quasi-territorial jurisdiction is a suited approach. A state of registration of a space hotel should be applicable to settle claims concerning human-to-human induced damage onboard. If a

different legal system is adopted within that state, such as the US which has a different legal system depending on each State, the applicable jurisdiction should be pre-determined e.g., the law of the state where a company is established. The above recommendations may clarify certain aspects of injury/loss of human lives in orbit, and could serve as guidelines to address potential problems.