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AN ALTERNATIVE APPROACH TO SOLVING THE DILEMMA OF LITIGATION AND LIABILITY DISPUTES IN OUTER SPACE

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Research Declaration

I confirm that I have already submitted my Project Synopsis and Ethical Approval Form, which has been signed by my supervisor. I further confirm that this project is entirely my own work and that the research undertaken for the completion of this project was based entirely on secondary material or data already in the public domain (case law, journal articles, published surveys etc). It did not involve people in data collection through empirical research (eg, interviews, questionnaires or observation).

Signed: **Selcuk Mert Evirgen**

Dated: **14/05/2019**

Acknowledgement

To my grandfather, Cetin Evirgen.
For your ongoing support on this Earth
And from the Stars.

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Introduction: The Eagle has landed

The aim of this paper is to address the issues that hinder efficient and effective liability dispute resolution in Outer Space and to create proposals to solve the dilemma based on the factors explored throughout this work. It is also to depict the fragility of the balance that currently exists in the utilised part of Space. There are many parties with a vested interest in Space but there is a lack of adequate provisions for solving disputes. This paired with the fact that Space is a hostile environment where incidents are likely to occur (and as shown throughout this work, do occur). This is an issue that is likely to raise international tensions. Another aim of this work is to establish that this is a matter of urgency and to implement ADR so that this problem may be avoided.

Ambassador Gregory L. Schulte[1] spoke about the term of the "three C's" of Space and described the current environment as: Congested, Contested and Competitive.[2] This, in essence, is why this particular area of research is important. It is an area with a rapidly growing interest from across the international theatre. For example, the current valuation of the Space industry is at $350 billion and predicted to $1 trillion or more by 2040.[3] Moreover, the sector has witnessed a huge increase in new stakeholders investing in Space projects,[4] the arena is no longer dominated by the cold war superpowers as it was when the Outer Space Treaties were originally drafted. Therefore, the combinations of a tense environment, economic advantages of Space and increase in participants will naturally result in disputes. In particular, disputes in which litigation is not a practical solution. Space is a swiftly developing sector with constant technological innovations and commercial competition ensuring that the industry does not stagnate. However, the complication of such expeditious development is the difficulty in providing a framework to govern the processes of the sector. Because of this, litigators cannot provide a thorough system of dispute resolution that can match the progress

[1] Ambassador Gregory L. Schulte stated this phrase while acting as deputy assistant secretary of defence for space policy for the US Department of Defence

[2] Space Foundation, 'Schulte: Space is Congested, Contested, Competitive' (Space Foundation, 1 June 2011) <https://www.spacefoundation.org/news/schulte-space-congested-contested-competitive> accessed on 12 May 2019

[3] Jeff Frost, 'A trillion-dollar Space industry will require new markets' (Space News, 5 July 2018) <https://spacenews.com/a-trillion-dollar-space-industry-will-require-new-markets/> accessed on 12 May 2019

[4] Violetta Orban, 'New Global Space Actors: Issues and Perspectives' (Space Safety Magazine, 3 December 2015) <http://www.spacesafetymagazine.com/space-on-earth/national-space-programs/new-global-space-actors-issues-and-perspectives/> accessed on 12 May 2019

of the Space industry. Space is also an international matter, it is not as simple as a government passing a law for its citizens to adhere to. This raises the question, how can disputes of matters in Outer Space be resolved?

This paper will begin with the relevant law in place for liability in Space. This will be demonstrated with the example of the Iridium Cosmos collision and applying the relevant law to the facts of the incident, which will highlight the relevant international procedures for dealing with realistic threats in the current Space environment. Then the discussion will continue by exploring ways in which liability may occur in Space operations. This will include a variety of examples of incidents in Outer Space where claims for liability may become a reality. The aim of this is to provide an understanding of the complexity of liability in this area of law and to emphasise why an efficient dispute system is crucial for further positive development in Space. Afterwards the paper will focus on the use of ADR and why it is preferable to litigation. To demonstrate the importance of ADR two examples will be relied upon, which are the Iridium/Cosmos incident as well as introducing the Cosmos 954 incident to provide examples of where issues can arise in orbit and on the surface of the Earth. Once these issues are discussed, the uses of ADR will be explored. Finally, this paper will begin to implement the previous discussions and combine their findings, in order to reform the current Claims Commission and to present viable alternatives of ADR.

Relevant law for liability in Space

Space is a congested, contested and commercialised arena, governed by a set of international Treaties. Governed is used in a loose term, because they set a series of guidelines which nations adhere to and have become customary international law. They are often criticised for lacking detail and being ineffective, although the effectiveness depends on individual interpretation. There are contrasting schools of thought on this matter, which will be discussed in this paper.

It is crucial to be cognisant of the fact that the wide range of actors in this arena is one of the main reasons as to why setting a form of governance is so difficult. This matter is not of state and citizen where the state governs, and the citizen abides. Each actor is a powerful entity and their aims, more than often, clash. Furthermore, there is a direct correlation between the

increase of parties in space[5] as space becomes more accessible. Space is no longer a contest between two superpowers of the cold war, vying for prestige, it is a hotbed of entrepreneurs who are aware of its economic potential. It is an investment, albeit a risky one, as will be discussed later on. This risk is essentially why liability often arises, the economic viability is why we must protect the environment and find a suitable system of dispute resolution. With the aforementioned increasing presence of entrepreneurs and the amount invested, human activity in space is developing at unprecedented rates. Litigation cannot keep up with this. Therefore, to ensure that we do not stifle our development, ADR is the most current and effective solution.

The current focus will be on the international Treaties and how matters of liability are affected by them. This will be achieved through the use of a case study; the Iridium Cosmos collision. To demonstrate that accidents/collisions in space are a reality and a pressing concern. As well as to apply the law to a practical scenario, so that the vague black letter law of the Treaties can be clarified.

An inactive Russian military communications satellite, Cosmos 2251, collided with a US (based Iridium Satellite LLC) active commercial communications satellite.[6] This collision took place at 800km (497 miles) above Siberia and produced nearly 2000 pieces of debris, at ten centimetres diameter as well as thousands more smaller pieces.[7] This debris will remain in orbit for decades and pose a collision risk to other objects in Low Earth Orbit (LEO).[8]

As mentioned briefly above, the Outer Space Treaties are the by-product of two factors: the cold war and both parties involved in the cold war being the only ones that could access Space.[9] The mistake of many critics of the Treaties is that most overlook or understate the biggest success of the Treaties, which is that space cannot house nuclear missiles or weapons

[5] UNITED NATIONS Office for Outer Space Affairs, 'A/RES/68/74' (UNOOSA) <http://www.unoosa.org/oosa/oosadoc/data/resolutions/2013/general_assembly_68th_session/ares6874.html> accessed 26 April 2019

[6] Secure World Foundation, 'The Persistent Problem of Orbital Debris' (Secure World Foundation, October 17 2018) <https://swfound.org/space-sustainability-101/the-persistent-problem-of-orbital-debris/> accessed 2 May 2019

[7] Brian Weeden, '2009 Iridium-Cosmos Collision Fact Sheet' (Secure World Foundation, November 10 2010) <https://swfound.org/media/6575/swf_iridium_cosmos_collision_fact_sheet_updated_2012.pdf> accessed on 2 May 2015

[8] Ibid

[9] Hertzfeld HR, 'Developing Issues in the Law of Outer Space.' (2015) 3(1) Penn Undergraduate LJ 1

of mass destruction and the moon as well as celestial bodies must be used for peaceful purposes.[10] Although critics claim that "while no state wants to be the first to openly weaponise Space, many are investing in dual-use technology"[11] (Dual-use technology refers to satellites which may be used for civilian and military purposes) and "It is clear that the distinction between military and non-military uses of outer space, is becoming increasingly blurred".[12] They fail to recognise the severity of a crisis which these Treaties avoided. The effective de-militarisation and peaceful intentions of the Treaties stopped two superpowers competing to use Space as the next venue for their nuclear power struggle. As a result, we can now experience the commercial boom and liability matters which naturally follow that. The Treaties may not be well equipped to solve disputes but they played a large part in calming tensions. The issue of the latter is something that this paper will attempt to address. There are four international Treaties to examine, the Outer Space Treaty (OST),[13] the Rescue Agreement (RA),[14] the Liability Convention (LC)[15] and the Registration Convention (RC).[16] The Moon Treaty (MT)[17] is the final and controversial international Treaty. However, it will not be

[10] Article IV of the OST, can be found at http://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/introouterspacetreaty.html

[11] Quinn AG, 'The New Age of Space Law: The Outer Space Treaty and the Weaponisation of Space.' (2008) 17(2) Minn J Int'l L 475

[12] Ferreira-Snyman A, 'Selected Legal Challenges Relating to the Military Use of Outer Space, with Specific Reference to Article IV of the Outer Space Treaty.' (2015) 18(3) Potchefstroom Elec LJ 488

[13] Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (Herein referred to as the Outer Space Treaty or OST) was adopted by the General Assembly of the UN on 19 December 1966 by virtue of Resolution 2222 (XXI). It was opened for signature on 27 January 1967 and entered into force on 10 October 1967. It can be found here: http://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/introouterspacetreaty.html

[14] The 1968 Treaty on Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space (Herein referred to as the Rescue Agreement or RA) was adopted by the General Assembly of the UN on 19 December by virtue of Resolution 2345 (XXII). It was opened for signature on 22 April 1968 and entered into force on 3 December 1968. It can be found here: http://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/introrescueagreement.html

[15] The 1972 Treaty on Convention on International Liability for Damage Caused by Space Objects (Herein referred to as the Liability Convention or LC) was adopted by the General Assembly of the UN by virtue of Resolution 2777 (XXVI) and was opened for signature on 29 March 1972. It entered into force on 1 September 1972. It can be found here: http://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/introliability-convention.html

[16] The 1976 Treaty on Convention on Registration of Objects Launched into Outer Space (Herein referred to as the Registration Convention or RC) was adopted by the General Assembly of the UN in 1974 by virtue of Resolution 3235 (XXIX). It was opened for signature on 14 January 1975 and entered into force 15 September 1976. It can be found here: http://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/introregistration-convention.html

[17] Agreement Governing the Activities of States on the Moon and Other Celestial (Herein referred to as the Moon Treaty or MT) was adopted by the General Assembly of the UN on 1979 by virtue of Resolution 34/68. It was opened for signature on December 18 1979 and entered into force on 11 July 1984. It can be found here: http://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/intromoon-agreement.html

included in this explanation because of its lack of ratification and lack of international support in comparison to the previous Treaties. The major issue for the MT stems from the fact that "the space-faring States and the majority of developing countries decided not to become Parties to the Moon Agreement".[18] Whereas the previous Treaties are customary international law because of the international consensus and practice, the MA has been unable to achieve a similar status.

Applying the Treaties to the Iridium/Cosmos Collision, in the case of Iridium

Article I of the OST requires that Space be the 'province of all mankind' and in doing so be free for peaceful use and exploration by all states. The Iridium satellite belonged to a private company that is based in the US so we must assert whether they are afforded the right conferred by Article I. A private company, as provided by Article VI, may operate in Space. Space as stated previously is the province of all mankind and is not limited to nation states. However, as stated in Article VI, nation states are liable for the actions of the private actors. Therefore, the US could be held liable for the collision if liability was ascertained. It is important to keep in mind that this does not mean that private actors cannot be held liable but that the onus is on nation states to enforce this (which will be discussed in detail later on).

For the satellites to be allowed they must also not be an attempt to appropriate or lay claim of sovereignty to Outer Space, in accordance with Article II. Furthermore, the satellites must operate in conjunction with international law as required by Article III.

Article IV states that parties to this Treaty cannot place nuclear weapons, weapons of mass destruction or military installations in Space. As Iridium is a commercial satellite these provisions do not affect it, but it will be addressed later in this discussion as Cosmos is a military communications satellite.

Article V is important in regard to astronauts, but as the satellites do not have any personnel on board it is not relevant for this explanation. This also applies to the RA, although it does have relevance because of the definitions it provides for Space objects.

[18] Tronchetti F, 'The Moon Agreement in the 21st Century: Addressing Its Potential Role in the Era of Commercial Exploitation of the Natural Resources of the Moon and Other Celestial Bodies.' (2010) 36(2) J Space L 489

As mentioned at the start, Article VI places international responsibility on the nation state, even when it is a private actor from within that state. It also states that private actors require authorisation and continuing supervision by the state they reside in. Which is essentially the principle of state responsibility. This principle is the corollary of a triumvirate of articles: Article VI, VII and VIII. For a satellite to be sent into orbit it must fulfil these requirements. Article VII concerns the liability criteria. It provides that a state that launches, procures a launch or allows its territory or facility to be used for a launch is liable building on the requirements of Article VI. Article VII is crucial for the purposes of this scenario as it provides that if an object is launched into Outer Space on a state party's registry, the state party retains jurisdiction and control over that object. On this basis, the Iridium satellite is an active satellite under the direct control of the US.

Articles VI and VII are the foundation on which the LC was developed, similarly the RC was based on Article VIII.

To further analyse the legal positions of the satellites these two further Treaties must be considered as well.

While the LC plays a large role in ascertaining liability, it is important to use them in conjunction with the OST and RC. Article I defines the following: damage, launching, launching state and Space object. Damage is "loss of life, personal injury or other impairment of health; or loss of or damage to property of States or of persons, natural or juridical, or property of international intergovernmental organisations". Launching is defined as "The term 'launching' includes attempted launching". A launching state is "(i) A State which launches or procures the launching of a Space object (ii) A State from who territory or facility a space object is launched". A space object is "component parts of a Space object as well as its launch vehicle and parts thereof". On this basis it is certain that there is damage to the satellites, that the satellites were considered to be launched, and that the launching state for Iridium is the US.

In accordance with Article II of the LC, nation states will be held under absolute liability, for damage caused by their Space objects on the surface of the planet or to aircraft in flight. In essence, if the damage does not occur in Space then there is absolute liability upon the nation state who causes the accident.

The difficulty in determining liability is if the damage is caused in Space, as shown in Article III. It is stated that "In the event of damage being caused elsewhere than on the surface of the earth to a space object…shall be liable only if the damage is due to its fault or the fault of persons for whom it is responsible". This place a fault based liability system, in an environment where fault is incredibly hard to determine. For this reason, the fault in the collision is hard to determine as it raises the issues of, which nation state is at fault for the collisions? Cosmos was an inactive satellite, what is the implication of this? (

Articles IV and V provide provisions for the involvement of third parties and joint liability, respectively, as they are not a part of this case study these Articles will not be discussed.

Articles VI and VII present exonerations from liability. The former Article presents an exoneration from absolute liability, which is only applicable under the basis that the damage has resulted wholly or partially from gross negligence or from an act to cause damage on the part of a claimant state. However, exoneration will not be granted if cases where damage is a result of an activity where a nation state is not in conformity with international law (Article VI(2)). The latter Article applies if damage is caused by a Space object to nationals of that launching state or foreign nationals at a time that they are participating in the operation of that Space object at the time of its launch, or any stage following on from that until its descent then liability shall not apply.

Articles VIII to XXI of the LC provide a compensation procedure, it can be divided into two separate forms of claim. The initial claim which is found in Articles VII to XIV, which governs how states may claim from each other in the case of a liability dispute. Articles XV through to XXI discuss the creation and powers of a Claims Commission (CC). The provisions of claim and the CC will be discussed towards the end of this paper, as the LC has not been invoked[19] and therefore do not apply to this collision.

This Treaty was created to provide nationally and internationally maintained registers in order to identify Space objects (Article II), with relative[20] ease. The importance of the RC lies in several reasons. Firstly, as objects can be traced more efficiently, liability is easier to ascertain.

[19] R Jakhu, "Iridium-Cosmos Collision and its implications for space operations", ESPI Yearbook on Space Policy. 2008/2009: Setting New Trends. Wien: Springer Wien, NewYork: 2010. pp 254-275

[20] Emphasis on relative, Space is notoriously difficult to track objects in, but this treaty has provided a good starting point to be able to keep track of the objects placed in Space and to ascertain liability.

Secondly, it establishes a connection between a Space object and a state for the purpose of jurisdiction, which enables control of the object as well for the return of an Astronaut (Which can be found in Article VIII and Article V respectively). Article I of RC provides definitions, like the LC, in particular 'state of registry'.[21]

The RC provides a register for Space objects. This register requires that:

In accordance with Article IV, the following information is provided to the secretary general of the UN as soon as is practicable. The name of the launching state/states (Article IV 1(a)). An appropriate designator of the space object or its registration number (Article IV 1(b)). Date and territory or the location of launch (Article IV 1(c)). Basic orbital parameters[22] (Article IV 1(d)). General function of the Space object (Article IV 1(e)).

Article II (2) of the RC requires that the launching states decide amongst themselves who will be the state of registry for a Space object.

The difficulty for Iridium arises from the fact that the there is uncertainty in regards to which nation is its launching state as it was not registered as required by the RC. In contrast Cosmos' launching state was Russia.

Applying the Treaties to the Iridium/Cosmos Collision, in the case of Cosmos

All the provisions in the Treaties stated above apply to Cosmos as well, the main differences between the two satellites (which required a separate discussion) is that Cosmos is a Russian military communications satellite. Furthermore, it is inactive. What implications do these factors have?

It was explained that Article I of the OST requires that Space belongs to all of mankind and the use of it must be peaceful. In addition Article IV limits the use and presence of the military in space. The conundrum for this case study is that Cosmos is a military communications satellite, because of this, does it have a right to be in space?

[21] It is defined in Article I(c) as a "launching state on whose registry a space object is carried in accordance with article II.

[22] This includes nodal period inclination, apogee and perigee.

It is important to consider that most satellites have military capabilities.[23] Crucially, Article IV does not specifically ban conventional arms or the military from Space, it just restricts their activities.[24] More importantly, as previously mentioned, these Treaties are predominantly the product of the two superpowers at the time, the US and the USSR. While these Treaties were in their drafting phase, they both had military satellites already in orbit,[25] it would not have been in either states interests to place an absolute ban on the use of military satellites. Furthermore, many satellites are dual-use, they can provide communications for civilian and military installations on Earth. As a result of this, the use of a military communications satellite does not contravene the Treaties.

Inactive Satellites are an academic grey area, specifically opinions on their relation to the Treaties. While there is a school of thought that states "it is questionable whether a state will be liable for a satellite which has ceased functioning or has disintegrated"[26] in contrast, there is also the opinion that "there seems to be no great difficulty in designating inactive satellites [as]…space debris".[27] The International Institute of Space Law define a category of Space debris as "inactive payloads, which cannot be controlled by their operators".[28] Based on the last two definitions and the previous discussion on the LC, Russia could be held to be liable for their inactive Cosmos satellite's collision.

The implications of Iridium/Cosmos

The LC was not invoked in the settling of this collision, which is important as the Treaty is not being used for its intended purpose, one of the reasons why this paper will seek to reform the CC. Furthermore, this collision created the second largest (Cosmos) and fourth largest break up (Iridium) recorded in orbit.[29] This collision is the perfect example of the Treaties

[23] R Lee and S.L. Steele, 'Military Use of Satellite Communications, Remote Sensing and Global Positioning Systems in the War on Terror' (2014) 79 J.Air L. & Comm. 69-112
[24] Larsen, P., & Lyall, F., Space Law: A Treatise, 2nd Ed (Ashgate 2017), (Ch 16)
[25] Ibid
[26] IH Ph Diederiks-Verschoor & V Kopal *An Introduction to Space Law* (3rd Edn, 2008, Alphen aan den Rijn: Kluwer Law International)
[27] L Viikari, *The Environmental Element in Space Law: Assessing the Present and Charing the Future,* Studies in Space Law, Vol 3 (2008)
[28] International Institute of Space Law, '2007 Proceedings of the International Institute of Space Law – 50th Colloquium on the Law of Outer Space 275-276' (IISL, September 2007) <http://iislweb.org/publications/proceedings/> accessed 3 May 2019
[29] NASA, 'Orbital Debris Quarterly News' (*NASA*, July 2010) <https://orbitaldebris.jsc.nasa.gov/quarterly-news/pdfs/odqnv14i3.pdf> accessed 3 May 2019

working, to a certain extent. But also of the ineffectiveness of the Treaties. This collision is a vital example of how liability will arise and increasingly so in the future if action is not taken to remedy the state of Debris. However, it is not the only way liability may arise, whilst it is an important case study and a prime example of how liability does occur, it is not the only way.

Causes of Liability in Space: The Three Stages

There are three main and separate stages where liability can be ascertained, which are the following: pre-launch, at launch and in orbit. This explanation will provide the basis for why there is an urgent need for a solution to the problem of solving disputes in Space. In essence, not only is the Space environment hostile, attempting to reach it is as equally difficult. Each stage provides its own unique challenges and will require innovative solutions to be tailored specifically to resolve the dispute which may arise from them

Often overlooked, this process adds many dimensions to how liability may be ascertained if a rocket launch does not go according to plan. As will be discussed further on, a launch can happen in four separate ways, which is evidenced in Article I (c(i)+(ii)) of the LC as: Through launch, procurement of a launch or if a territory/facility is used for the launch. It is important to highlight how a launch may take place as this effects the pre-launch requirements. The first pre-launch insured satellite was Intelsat-1.[30] During the time of Intelsat-1 (1960's), this insurance covered the issues of construction, transit, storage and testing of the satellite.[31]

The difficulty of the pre-launch is deciding when pre-launch ends.[32] It is usually dependent upon the individual contract prepared for the launch. Because as explained previously, the method of launch can alter how a satellite is to be launched, which in turn will alter what the pre-launch phase is. There is an argument that technically pre-launch is not a part of the liability in Space, specifically that Space insurance starts "not earlier than with the lift off of

[30] Benito Pagnanelli, 'Tracking Take-off of Space Insurance' (2007) <http://www.pagnanellirs.com/downloads/id281107.pdf> accessed 4 May 2019
[31] Ibid
[32] Katarzyna Malinowska, *Space Insurance: International Legal Aspects* (13th volume, Kluwer Law International BV 2017)

the launch".[33] However, it is intricate in the process of a satellites launch and therefore for the purposes of this proposal will still be considered as a stage.

To understand how the launch process can result in a matter of liability, it is important to define which point a rocket is deemed to have begun the launch process and where space begins.

To begin to explain this process it is important to define a launch activity and space object. Launch activities are described by Bin Cheng as 'the act of launching a space object'.[34] Furthermore, the LC defines in its Article 1(b) that the term 'launching' includes attempted launching. A space object in current practice is a generic term used to "cover spacecraft, satellites, and in fact anything that humans launch or attempt to launch into space".[35] The LC and RC provide in an identical fashion that the term Space objects includes component parts of a space object as well as its launch vehicle and parts thereof. These definitions give an ambiguous explanation into the launch process but a reliable foundation. On the other hand, there have been more recent definitive definitions, such as the Ariane 5 LV rocket which its launch is defined as "ignition of the solid propellant boosters".[36] Another definition used in practice is based on the practicality of the physical action of realising the clamps which hold the satellite.[37] Based on the previous definitions, a launch shall begin when the space objects launch procedure begins, then it shall be deemed to have launched and in concurrence with the LC's Article 1(b), an attempted launch will be regarded as a launch. Albeit a subjective definition, it is clear mechanical process and once the definition is applied a test of reasonableness can be applied to pin-point when the launch begins.

In asserting liability in the launching process, the first potential cause of liability is in the failure of the rocket in the launch or during the launch process before the rocket reaches its intended destination. The launch phase is regarded the shortest,[38] but the most dangerous stage.[39]

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[33] K Malinowska, 'Insurance of Risks in Space Activities' (Prawo Asekuracyjne, 2016) <http://prawoasekuracyjne.pl/wp-content/uploads/2017/08/pdf_malinowska_4_2016.pdf> accessed 4 May 2019

[34] Bin Cheng, *Studies in International Space Law* (Claredon Press 1997)

[35] Ibid

[36] n32

[37] n32

[38] C Brunner and A Soucek, *Outer Space in Society, Politics and Law* (Springer, 2012)

[39] Frans von der Dunk with Fabio Tronchetti, *Handbook Of Space Law* (Edward Elgar 2015)

Without belabouring the obvious, every true Space activity requires a launch[40] and it is this mandatory process, along with the insurance requirements, that encompasses the majority of current liability issues in Space. By 2010, 5,038 rockets had been launched, with 4,621 succeeding, thus a success rate of 92%.[41] This is statically succesful, but by 2010, 417 satellites had failed in the launch process. While the success rates have improved since 2010, this is still an explicit sign of how dangerous launches are. Although these statistics have improved recently, in 2018 there have been a total of 114 launches with only 3 failures.[42]

The boundary that marks the end of the atmosphere and start of Space s is currently a highly contested academic matter. This is because there is no internationally agreed definition for where our atmosphere ends, and Space begins, it is often described as gradually fading from the atmosphere into Space as both are interlinked. It is not as simple as a territorial boundary to be declared as separate boundaries. However, attempts to define the boundary have been made. The Von Karman line, at 100km (62.1371 miles), is most commonly accepted as the air Space boundary. The Fédération Aéronautique Internationale (FAI) is an example of an organisation that accepts the Von Karman line as the boundary.[43] The FAI has been working with the International Astronautical Federation (IAF) to create an international workshop, to be held in 2019, that would explore the issue of where the boundary begins.[44] This workshop, if it is created, could be the start of an academically agreed definition for the boundary, but until then this research shall rely upon the distance of 80km to 100km. This boundary will be relied upon because of the Von Karman line, but also because of organisations such as the US air force's practice on the matter. The US grants astronaut wings to any pilot who flies above 80.4572km (50 miles).[45] On this basis, it is pertinent to rely upon a combination of practice and theory where there is not an internationally agreed definition.

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[40] Frans von der Dunk, 'Commercial Space Activities: An Inventory Of Liability – An Inventory Of Problems' (1994) Space, Cyber, and Telecommunications Law Program Faculty Publications 46

[41] Claude Lafleur, 'Spacecraft stats and insights' (The Space Review, 5 April 2010) <http://www.thespacereview.com/article/1598/1> accessed on 5 May 2019

[42] Ed Kyle, 'Space Launch Report: Orbital Launch Summary by Year' (Space Launch Report, 31 December 2018) <https://spacelaunchreport.com/logyear.html> accessed 5 May 2019

[43] STATEMENT ABOUT THE KARMAN LINE, 'FAI ASTRONAUTIC RECORDS COMMISSION (ICARE)' (30 November 2018) <https://www.fai.org/news/statement-about-karman-line?type=node&id=22863> accessed 25 April 2019

[44] Ibid

[45] Federal Aviation Administration, 'Commercial Astronaut Wings Program' (5 February 2019) <https://www.faa.gov/about/office_org/headquarters_offices/ast/programs/astronaut_wings/> accessed 25 April 2019

If a rocket can overcome the most dangerous stage and enter orbit, then it enters an environment where it is susceptible to many dangers. There are natural and artificial hazards that render many satellites inoperative. Any individual with interests in Space must bear these in mind to take the necessary precautions, liability is possible at every stage in this precarious arena.

Once a rocket has reached Space and released its cargo, the first possible form of liability is if the satellite is released incorrectly or is unresponsive upon deployment. This stage is known as Post Separation Phase (PSP). This phase is defined as being from the release of the Launch Vehicle (LV),[46] to the start of the satellites operational service.[47] The period of insurance cover for this phase can include, the satellite orbit settling, for example the use of its own propulsion system to reach its intended orbit.[48] In addition, in-orbit testing to ensure it is operational as well as the initial period of the satellite operational life.[49]

The in-orbit phase can be defined as starting once the PSP has ended. Fundamentally this is when the satellite has taken its intended orbit and is providing its intended purpose.[50] Insurance in this phase tends to last in the 'in-orbit' stage until the end of the satellite's lifetime.[51] It is important to define when a Space object is in Space and when insurance is active for the intended purpose so that liability may be ascertained. The LC, as discussed previously places liability in Space on a 'fault basis', therefore once a satellite is in Space based on the boundary between the atmosphere and Space and positioned in-orbit then parties may know when and how they can claim liability.

Once satellites have begun their operational stage, after a successful PSP, they face numerous challenges. The natural hazards include issues such as Electrostatic Discharge, Solar Storms

[46] The Launching Vehicle (LV) has been referred to as the "rocket" previously
[47] Andrea Harrington, 'Legal and Regulatory Challenges to Leveraging Insurance for Commercial Space' (31st Space Symposium, April 2015) <http://2015.spacesymposium.org/sites/default/files/downloads/A.Harrington_31st_Space_Symposium_Tech_Track_Presentation.pdf> accessed 5 May 2019
[48] Oliver Schoffski and Andre Georg Wegener, 'Risk Management and Insurance Solutions for Space and Satellite Projects' (1999) 24 Geneva Papers on Risk and Insurance – Issues and Practice.
[49] Ibid
[50] n33
[51] David Wade, 'Insurance for Spaceflight' (Royal Aeronautical Society, 3rd February 2016) <https://www.aerosociety.com/Assets/Docs/Events/Conferences/2016/803/David_Wade.pdf> accessed 5 May 2019

and Meteor Showers. The artificial hazards, which are a result of human activity in Space, include problems such as a loss of fuel and Space Debris.

This is one of the most prevalent PSP and in-orbit hazards experienced by satellites. This Electrostatic Discharge is either as a result of solar activity or through the formation of plasma clouds due to the ionisation of meteoroids which collide with satellites.[52] The plasma can be split into two separate categories, low altitude plasma found at Low Earth Orbit (LEO) and high-altitude plasma which is a problem at Geostationary Earth Orbit (GEO), polar orbits and radiation belts.[53] The impact of this phenomena ranges from supressing satellite capabilities to resulting in loss of spacecraft.[54] An example of this is the Aniks E1, E2 and Intelsat K which suffered electronic discharge as a result of a geomagnetic storm, which caused them to malfunction.[55]

Space weather encompasses various natural occurrences in orbit. This covers solar winds, flares and storms. Solar wind is a constant in Space, although the intensity of it changes.[56] The real hazard in Space is from solar flares and storms, labelled as single-event upsets (SEUs) as they can change spacecraft components performance abruptly,[57] usually damaging it beyond repair. When a solar storm erupts they "can bombard a satellite with highly charged particles and increase the amount of charging on a spacecraft's surfaces".[58]

These events are a danger which play a large role in insurance policies, more than often affecting the extent to which a satellite is insured. Insurance and these matters are vital for matters involving liability. Telstar 401, a satellite positioned in GEO, is an example of a total loss of a satellite as a result of a solar storm.[59] The complications that arise as a result of solar

[52] Sarah Goddard, 'Satellite Owners Take Precautions For Meteor Storm' (Business Insurance, 25 October 1998) <https://www.businessinsurance.com/article/19981025/STORY/10006244?template=printart> accessed on 5 May 2019
[53] John B. Bacon, 'Electrostatic Discharge Issues in International Space Station Program EVAs' (NASA) <https://ntrs.nasa.gov/archive/nasa/casi.ntrs.nasa.gov/20110014828.pdf> accessed on 5 May 2019
[54] Ibid
[55] Flight Global, 'Solar storm is suspected in Telstar 401 satellite loss' (Flight Global, 29 January 1997) <https://www.flightglobal.com/news/articles/solar-storm-is-suspected-in-telstar-401-satellite-loss-1534/> accessed on 5 May 2019
[56] Intelsat, 'Space Weather' (Intelsat) <http://www.intelsat.com/tools-resources/library/satellite-101/space-weather/> accessed on 5 May 2019
[57] Ibid
[58] Ibid
[59] n55

weather and electronic discharge are greater than admitted by satellite manufacturers,[60] this emphasises the true danger of Space and the numerous ways liability may occur.

A hazard exclusive to operations in Space, a meteor shower can be described as "a blizzard of meteor particles, some the size of sand, but mostly smaller".[61] One of the small grains in the meteor shower at the speed they travel, can have the same destructive capability of a .22 calibre bullet.[62] A range of US satellites, military and civilian faced this danger through the Leonid meteor storm in 1998.[63] More recently in 2016, the European Space Agency's (ESA) Copernicus Sentinel-1A satellite suffered damage as a result of a collision with a Space particle, which was believed to be a micro-meteorite.[64]

Loss of fuel is an area that is linked to a successful launch. If a launch is carried out successfully and a satellite does not require re-positioning through the use of fuel. If the satellite does not reach the intended orbit and has to use fuel to reach it, this can be regarded as a partial failure in the launch. This is because, a loss of fuel can correlate to a shorter life span for the satellite.

An example of this is the loss of IS-29e satellite. A loss suffered this year, was the result of fuel leak after three years in orbit, while most geostationary communications last 15 years.[65] The uninsured satellite's loss has resulted in the estimated loss of $45 million and $50 million in revenue for Intelsat.[66]

Space Debris is one of the greatest environmental dangers faced in Space and for the future of humanity, if not acted upon. The Kessler syndrome is the theory that the increasing amount of Space debris, if allowed to accumulate will eventually hinder and possibly prohibit human

[60] n55
[61] Paul Recer, 'INTENSE METEOR SHOWER THREATENS DAMAGE TO SATELLITE FLEET' (The Washington Post, 15 November 1998) <https://www.washingtonpost.com/archive/politics/1998/11/15/intense-meteor-shower-threatens-damage-to-satellite-fleet/444d98ad-58b2-4c03-9ac5-7b37be183bfb/?noredirect=on&utm_term=.333e26738e7d> accessed 8 May 2019
[62] Ibid
[63] Ibid
[64] ESA, 'COPERNICUS SENTINEL-1A SATELLITE HIT BY SPACE PARTICLE' (ESA, 31 August 2016) <https://m.esa.int/Our_Activities/Observing_the_Earth/Copernicus/Sentinel-1/Copernicus_Sentinel-1A_satellite_hit_by_space_particle> accessed 8 May 2019
[65] Caleb Henry, 'Intelsat-29e declared a total loss' (Space News, 18 April 2019) <https://spacenews.com/intelsat-29e-declared-a-total-loss/> accessed 8 May 2019
[66] Caleb Henry, 'Intelsat still searching for cause of IS-29e loss, replacement satellite TBD' (Space News, 30 April 2019) <https://spacenews.com/intelsat-still-searching-for-cause-of-is-29e-loss-replacement-satellite-tbd/> accessed 8 May 2019

activity in Space.[67] There are measures such as the Inter-Agency Space Debris Coordination Committee's (IADC) Space Debris Mitigation Guidelines (SDMG) as adopted by the United Nations Committee for the Peaceful Uses of Outer Space (UNCOPOUS), which are voluntary guidelines that are enforced in a manner by major Space powers that create the impression of a mandatory regulations, the problem is that these guidelines only apply to Debris that are created after the guidelines came into effect.[68] However, the threat of Space Debris is apparent from the ESA's 2017 Space Debris Conference where it was determined that current guidelines to deal with Space Debris are inadequate and need to be strengthened[69] in order to avoid making the Kessler Syndrome a reality.

The IADC guidelines have set two categories for Debris, one is a short-term Debris that resides in LEO, which must be deorbited in 25 years and the other is long-term Debris which is situated in GEO. The long-term Debris cannot be de-orbited, instead it is sent to a graveyard orbit before it is inoperative.[70]

The current threat of Space Debris is that it is a more dangerous form of meteor showers. Where its natural equivalent tends to be smaller than sand, Space Debris can range from school bus sizes to fragments of paint, both which at the speed they travel can have serious implications for activity in Space.[71] The case study of Iridium/Cosmos is a good example of the effects of Space Debris and how easy it is to cause it. The defunct Cosmos[72] collided with the operational Iridium and created the second and fourth largest causes of Space Debris.

Another example of this threat is the loss of the satellite Cerise to a discarded Ariane rocket body.[73] The significance of this collision is that it highlights the problem that Space faring

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[67] Donald J. Kessler and Burton G. Cour-Palais, 'Collision Frequency of Artificial Satellites: The Creation Of A Debris Belt' (1978) Journal of Geophysical Research 83

[68] Paul B Larsen, 'Solving the Space Debris Crisis' (2018) 83(3) J Air L & Com 475

[69] ESA, '7th European Conference on Space Debris' (ESA) <https://conference.sdo.esoc.esa.int/proceedings/list?search=&conference=2&publishing-year=All&title=&author-name=&author-organisation=&abstract-full-text=&field_keywords_value=> accessed on 8 May 2019

[70] Matt Williams, 'Eye-opening numbers on space debris' (Phys Org, 21 March 2017 <https://phys.org/news/2017-03-eye-opening-space-debris.html> accessed on 8 May 2019

[71] Aerospace, 'Danger: Orbital Debris' (Aerospace, 4 May 2018) <https://aerospace.org/story/danger-orbital-debris> accessed on 8 May 2019

[72] Cosmos can be arguably referred to as Space Debris for this purpose as it had been abandoned.

[73] Mark Ward, 'Satellite Injured in Space Wreck' (New Scientist, 24 August 1996) <https://www.newscientist.com/article/mg15120440-400-satellite-injured-in-space-wreck/> accessed on 8 May 2019

nations face regarding Space Debris and it is one of the recorded insurance losses as a result of a satellite colliding with Space Debris.

There is currently no effective form of remediation,[74] although there are attempts to create a viable system of remediation.[75] This is discussed because the problem of Debris currently is a growing concern and as a result of this will have a large impact upon liability disputes in Space.

The Iridium/Cosmos case study is the best example of how liability may occur when a satellite reaches the end of its operational period. In relation to that example, a satellite reaching the end of its life-span is a potential source of liability. Cosmos was abandoned once it served its purpose and it resulted in the collision with Iridium. As discussed previously a collision in Space has far reaching implications, the creation of extra Space Debris which could negatively affect other Spacecraft is a serious concern. The IADC set a non-binding standard of dealing with satellites that reach the end of their operation. The descent of satellites positioned in LEO can be potential causes of liability.

While the satellites in GEO positioned into a graveyard orbit are an environmental concern and require thorough provisions to remedy the inefficient and unsustainable solution, they will not be a part of the discussion, as the focus is on liability disputes that are likely to and are occurring in Space currently.

De-orbiting satellites can break up, this is where satellites split off into smaller parts which descend in an uncontrollable manner. Although smaller parts of Debris burn up in the atmosphere during the descent, larger parts can reach the surface of the Earth.

For example, Kosmos 482, a satellite designed to land on Venus which could not make the journey as a result of the craft malfunctioning, is predicted to land back on Earth and survive the journey as it was designed to survive on Venus,[76] a much harsher environment. The two separate ways liability is determined is either in the Earth's atmosphere which is a definite

[74] Remediation is the second proposed limb to dealing with the problem of Space Debris. It is the principle of removing the Debris in Space.
[75] Mike Wall, 'Meet OSCaR: Tiny Cubesat Would Clean Up Space Junk' (Space.com, 24 April 2019) <https://www.space.com/space-junk-cleanup-cubesat-oscar.html> accessed 8 May 2019
[76] Michelle Starr, 'A Failed Space Probe Meant for Venus Might Soon Come Crashing Down to Earth' (Science Alert, 27 February 2019) <https://www.sciencealert.com/a-1972-space-probe-meant-for-venus-never-left-earth-orbit-it-could-come-tumbling-back-this-year> accessed on 9 May 2019

fault basis and in Space which is a on a fault basis. The descent of Space objects can have serious implications for liability.

Skylab was a US space station launched in 1973 which was abandoned in 1974. In 1979 NASA became aware that Skylab began to break up in-orbit and started to re-enter the atmosphere.[77] Skylab crashed in Australia, scattering debris across Nullarbor[78] (An area in Western Australia).[79]

Another space station, Tiangong-1, started its descent in 2018. This event caused international concern in regard to where it would land,[80] it eventually landed in the Pacific Ocean.[81] Space objects descending to Earth is a much more common phenomenon then would be usually perceived, on average "a total of 200-400 traced objects enter Earth's atmosphere every year".[82] While the possibility of these objects hitting populated areas is low, it is still an important consideration in a way liability may be formed as a result of activities in Space.

It is evident that liability can occur in a multitude of ways. What does remain to be answered in terms of the aims of this paper is how ADR may be implemented to avoid litigation and ensure that disputes of liability are resolved efficiently. This paper will answer this question by further discussing the case study of Iridium/Cosmos and the principles of Alternative Dispute Resolution (ADR). Furthermore, there will be an examination of the wide range of possible methods of ADR and their uses, in order to ascertain the most applicable methods to solving disputes in Outer Space.

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[77] Emma Wynne, 'When Skylab fell to Earth' (ABC Goldfields, 9 July 2019) <http://www.abc.net.au/local/photos/2009/07/09/2621733.htm> accessed on 9 May 2019

[78] Ibid

[79] The town council of Nullarbor fined NASA $400 for littering as a light hearted joke, but interestingly NASA did not pay the fine. This raises an interesting question of whether NASA should be held liable for the damage debris of Skylab.

[80] Elizabeth Howell, 'Chinese Space Station Tiangong-1 Falling to Earth Now, But Where?' (Space.com, 2 April 2018) <https://www.space.com/40164-chinese-space-station-crash-last-day.html> accessed on 9 May 2019

[81] Matt Williams, 'Did you know that a satellite crashes back to earth about once a week, on average?' (Phys org, 4 April 2018) <https://phys.org/news/2018-04-satellite-earth-week-average.html> accessed on 9 May 2019

[82] NESDIS, 'Does Space Junk Fall from the Sky?' (NESDIS, 19 January 2019) <https://www.nesdis.noaa.gov/content/does-space-junk-fall-sky> accessed on 9 May 2019

How ADR can benefit development in space: a comparison with current practice

Humanities use of space is fraught with danger and hazards. It is an environment alien to our own and one that requires extensive resources and capabilities to manage successfully, which we do not possess currently. This extends to a very basic requirement, the ability to observe. While it is unusual to be unable to view the Earth now, due to satellite technology and the utilisation of Space, it is the opposite for outer space. It is this inability to know what is happening in this environment that causes such a risk of liability and legal action. We cannot pin point when a satellite might collide with another or Space debris, or when it may fall prey to the hostile environment. An educated guess may be made, but we are limited by the current technology. Cosmos 964 and Iridium 33/Cosmos 2251 are two examples of worst-case scenarios that are a current certainty for Space. These examples raise liability concerns as well as a question that the industry is unsure on how to proceed with. The same question that this paper will answer. What is the best solution for when the inevitable worst case scenario does happen? Space is developing too quickly for litigation, which is a slow and costly process. When a company has finished litigation, other competitors may advance during that time.[83] This is one of the fundamental reasons as to why ADR is better suited as a solution for disputes in outer Space.

Cosmos 954 Accident, liability on Earth

In 1978 a USSR satellite, Cosmos 954, crashed in Canadian territory and spread radioactive material. The US-Canadian joint clean-up operation, "Operation Morning Light", resulted in an expenditure of 14 million Canadian dollars and 2-2.5 million American dollars.[84] The compensation that Canada received in 1981 was 3 million Canadian dollars, whereas the US received no compensation.[85] As this was one of the first incidents of its kind, both in the nature of the accident and its resolution, it set a standard of norms, such as the duty of notification, relaying information to facilitate damage control, assisting political allies in clean-up operations and sharing the cost of compensating the injured state, regardless of causation or fault.[86] The fact that norms were set is essential in the development of dispute resolution

[83] Schaefer M, 'The Contours of Permissionless Innovation in the Outer Space Domain.' (2017) 39(1) U Pa J Int'l L 103
[84] Cohen AF, 'Cosmos 954 and the International Law of Satellite Accidents.' (1984) 10(1) Yale J Int'l L 78
[85] Ibid
[86] Ibid

and understanding the lack of codified practice in Space law. For example, the LC requires that an incident causes damage for liability to exist. Based on the LC's definition of damage, a strict interpretation would cast doubt as to whether there was any damage caused by the Cosmos 954 incident because there was no loss of life, personal injury or other impairment of health.[87] The lack of uniformity and codified practice results in an ambiguous interpretation of the international Treaties. In this case, Canada received minimal compensation for the damages incurred.

Iridium 33/Cosmos 2251 Accident, liability in Orbit

In 2009, Iridium 33, a US telecommunications satellite collided with a defunct Russian military telecommunication satellite, Cosmos 2251. The issue faced by the US in this incident was whether a reasonable standard of care had been applied. The US had the most advanced tracking capability of any state at the time, therefore it was argued that it had a responsibility to inform Iridium, which is a US company.[88] The question of Russian liability was related to the failure to dispose of the satellite at the time it became defunct. Although there were no binding international agreements at the time which required disposal, the Russian government was aware of the threat posed by this piece of Space debris because of their involvement in the Inter-Agency Debris Co-ordination Committee.[89] These are examples of the many issues raised by this incident, but they highlight the complexity of problems faced in Space law for resolving matters of liability. As an increasing number of actors are entering the Space sector and accidents in Space are now realistic concerns as opposed to hypothetical scenarios,[90] the use of ADR in Space must adapt to counteract the difficulty in evaluating the standards for fault and negligence in liability.

In this case, it may be argued that, similarly to Cosmos 954 in which a standard of norms was set, there was a positive development in practice to ensure that these accidents can be avoided in the future. For example, the US military stated that the monitoring of operational

[87] Dembling PG, 'Cosmos 954 and the Space Treaties.' (1978) 6(2) J Space L 129
[88] Hertzfeld HR and Basely-Walker B, 'Legal Note on Space Accidents, A / Juristische Anmerkungen zu Weltraumunfallen / Annotations Juridiques Relatives aux Accidents Spaitaux.' (2010) 59(2) ZLW 230
[89] Ibid
[90] Ibid

satellites had been implemented to avoid collisions.[91] However, the size and hazardous nature of Space requires more than minor and gradual developments to deal effectively with the issues faced. Furthermore, owing to the scale and congestion of Space in areas that currently host human activities, there is a greater risk of accidents occurring. The Grand Sky theory no longer applies to this area of Space.[92] Therefore, resolutions for liability must be addressed and dealt with effectively to ensure that humanity's progress in Space is not inhibited.

The in-orbit and on earth collision incidents raise the question of where ADR may have been utilised to avoid the amount of time taken to find a solution as well as the disproportionate remedies. The current practice unequivocally does not provide an adequate solution.

While there are international Treaties in place to attempt a form of governance and unification for cooperation Space, there is not any substantive law. Reynolds states that the increase in activity in outer Space will require more expansive laws and regulations to deal with damage and liability in Space.[93] What Reynolds omits is the use and importance of ADR where there are multiple parties involved in an area. If humanity was united under one banner or organisation the use of a codified system of rules would be practical. However, this is not the case. Although Shin's work is older than Reynolds, it successfully takes into consideration the importance of ADR. ADR is more flexible than a judicial proceeding, not only can the arbitrators be chosen for their expertise but they can also incorporate time constraints that can speed the proceedings or compensation for the winning party, time is of the essence for Space, the efficient management of time is something that ADR can ensure more successfully than litigation.[94] A further strength of ADR is the potential for a panel of arbitrators to exercise jurisdiction over both parties. The Outer Space Treaties do not provide exact provisions for when more than one state enforces jurisdiction.[95] Furthermore, as there

[91] Andrea Shalal-Esa, 'U.S. Military Vows to Track 800 Satellites by October 1' REUTERS, March 31, 2009, <https://uk.reuters.com/article/us-usa-satellites/u-s-military-vows-to-track-800-satellites-by-october-1-idUKTRE52U0MR20090331?sp=true> accessed 21 February 2019

[92] Bressack L, 'Addressing the Problem of Orbital Pollution: Defining a Standard of Care to Hold Polluters Accountable.' (2011) 43(4) Geo Wash Int'l L Rev 741

[93] Reynolds G, 'Space Law in the 21st Century: Some Thoughts in Response to the Bush Administration's Space Initiative.' (2004) 69(2) J Air L & Com 413

[94] Shin H, 'Oh, I have Slipped the Surly Bonds of Earth: Multinational Space Stations and Choice of Law.' (1990) 78(5) Calif L Rev 1375

[95] Ibid

is no court or legal process to deal with matters of liability arising in Space, ADR is less likely to create a concern of bias over the use of a certain sovereignties court over another's to settle a dispute,[96] law jurisprudentially aims to offer a objectively fair and impartial solution to disputes, which in this context ADR can provide more than traditional litigation. Space is an area which no state may claim sovereignty over. This creates complications in the implementation of rules. Just as we must adapt to be able to survive in Space, we must adapt our solutions for disputes to be able to develop further. Much like maritime law, Space law must be its own separate and distinct area of law, until we can implement legal provisions to guide human activity in Space successfully, ADR will be far more successful[97] and potentially the foundation of a legal system for outer Space in the future.

Moreover, the challenges faced by merely forming a comprehensive system of litigation prove why ADR is currently a practical and efficient solution for dispute resolution.

While this paper focused on the benefits of ADR, it will now focus on the problems that we would face in an attempt to implement litigation. In 'Recent Developments in Litigation'[98] Trinder correctly points out that "It is often space law litigation that appears the most daunting to both legal practitioners and those involved in space activities.'. Litigation is commonly linked with two undesirable factors; length of proceedings and it being an expensive process. However, Trinder identifies a range of issues in successfully implementing litigation. The four main areas of focus are; Environmental concerns, contractual issues and sovereign immunity.

Environmental concerns in the utilisation of Space re-emerged in the 1990's, the time of the publication of Trinder's article. However, it is now at the forefront of concerns for parties involved in Space. The Space environment is more fragile than Earth's and currently nearly impossible to remedy any damage inflicted upon the alien environment.[99] Any litigation will need to encapsulate environmental concerns as all parties in Space must be vigilant in the preservation of such a vital environment. The Outer Space Treaties have received criticism for

[96] Ibid

[97] Wong K, 'Collaboration in the Exploration of Outer Space: Using ADR to Resolve Conflicts in Space.' (2006) 7(2) Cardozo J Conflict Resol 445

[98] Trinder RB, 'Recent Developments in Litigation.' (1990) 5 JL & Tech 45 – Although this article was published in 1990, the points it makes are so pertinent that it makes it relevant and current.

[99] B SandeepaBhat, 'Application of Environmental Law Principles for the Protection of the Outer Space Environment: A Feasibility Study.' (2014) 39 Annals Air & Space L 323

their lack of environmental provisions, while the Treaties can be argued to have attempted to set a foundation for future development, any further litigation will have to integrate this topic. The success of ADR is its flexibility. When resolving a dispute between parties, ADR can include and create further provisions, whereas litigation cannot react as quickly.

Space is increasingly becoming a commercial entity. With new methods of utilising it for this method increasing. While in Trinder's article there is, understandably, a focus on the issues that arise from satellite launches, new litigation cannot focus on that alone. Space Tourism, Space Mining and new Space Stations are becoming a reality. Space Tourism developed from a wild dream to an actual enterprise, with the first successful test flight of Virgin Galactic.[100] It is important to consider that the areas to litigate for Space are only increasing and will continue to develop, while litigation might be a necessity in the future, it would struggle to encapsulate the varied requirements and interests of such an international theatre, for the moment. Contractual issues in Space also offer the added dimension of ascertaining fault, which depends on where the accident or issue occurred, on Earth it is full liability whereas in Space it depends on a basis of negligence. The time taken to assert fault via litigation can cripple a company, which in the current development of Space is counterproductive as Space is already difficult to access, putting further barriers in that process in the form of litigation would slow progress in all aspects, technological and legal.

Perhaps the most pertinent point raised by Trinder; sovereign immunity is one of the biggest challenges faced by the international community. The interlocking relationships between governments and commercial parties can often present problems which courts may struggle to address. The defence of sovereign immunity, although eroded, can still cause complications as it protects nation states from suits in domestic and foreign courts without consent. For example, the US, a major nation state in Space, invokes sovereign immunity and it is correctly defined as deciding "unless it deigns otherwise, the federal government cannot be sued – even by citizens seeking redress for government-inflicted harms – a privilege belonging so clearly to the sovereign that it is labelled 'sovereign immunity.'".[101]

[100] Alex Knapp, 'With Virgin Galactic's Latest Flight, Has Space Tourism Finally Arrived? (*Forbes*, 14 December 2018) <https://www.forbes.com/sites/alexknapp/2018/12/14/with-virgin-galactics-latest-flight-has-space-tourism-finally-arrived/#31ec2d4143d9> accessed 23 April 2019

[101] Brinton SL, 'Three-Dimensional Sovereign Immunity.' (2014) 54(2) Santa Clara L Rev 237

Sovereign immunity, as a principle, causes issues. In accordance with the Outer Space Treaty, nation states are liable for any negligence either from them or their citizens, how can that system work efficiently in litigation with clauses such as sovereign immunity? Moreover, that is not the only concern. It is the matter of sovereignty which causes friction. Where two states fall into dispute, which court can host the litigation without bias?

ADR is the current solution. It can provide an independent solution and address the shortcomings of litigation. However, that does not mean that litigation will never be a possibility or should be ruled out. As a side note, when litigation is a possibility it would beneficial to implement the recommendations of Trinder. These recommendations are universally applicable in all forms of resolution and would be valuable for ADR. In particular involving lawyers at the start of a project so both sides may be well versed and advise each other to avoid a potential dispute. As well as the recommendation for lawyers involved in these Space related matters to be educated on the technological aspects, law and Space utilisation are two different industries and must learn to understand one another to succeed.

As outlined above, there is a lack of clarity in the international Treaties. However, the future risks of Space exploration and commercialisation were considered in the drafting processes of these Treaties. The vagueness in the drafting of the Treaties may be considered to be intentional, as human activity in space is developing at a rate that the law which governs it cannot meet. Therefore, it is vital that the need develop the legal framework which governs human activity in space, in this case the effective resolution of disputes, is acknowledged. There are several proposals on ways to create a suitable framework. These are referred to as 'Muddling through it', 'A more elaborated normative regime',[102] 'Strict Liability Amendment to the Liability Convention', 'Improved System of Fault Liability' and 'A Multilateral Approach'.[103]

This principle encompasses the continuation of current practice within the international community, namely operating under the shared but vague interpretations of the international Treaties.[104] The creation of rules is ad hoc and piecemeal, without a focus on comprehensive

[102] The first two proposal are suggested in the article n108. While they are valid suggestions, they are not the most successful solutions.
[103] The last three proposals are from n104.
[104] Tannenwald N, 'Law versus Power on the High Frontier: The Case for a Rule-Based Regime for Outer Space.' (2004) 29(2) Yale Int'l L 363

rules to govern human activities in Space. This is the current position of many countries, such as the US.[105] While this system is currently sufficient, it operates under the assumption that the Space environment will remain constant. However, this assumption is no longer tenable.[106] Thus, an effective international system of ADR must be created. ADR is not only flexible and able to meet the needs of a fluctuating environment, but it can also present an attractive option to nation states, such as the US, that wish to avoid codified rules governing national activity in Space.

This approach involves a concentrated effort by the international community to negotiate rules to secure commercial, security and scientific interests in Space. It does this while emphasising international cooperation through focusing on peace and widespread participation in the negotiations, which would also include non-state actors.[107] This proposal places a preference on principles of comprehensive security and equity in Space rather than one of operational regime.

There are strong contentions amongst commentators of the LC that article III should be amended, from fault-based liability to strict liability.[108] While there are arguments in favour of a strict liability amendment, such as the weaknesses in the current fault-based system, there are also many rationales against a strict liability system. The main weakness in the current system are the vague definitions of fault, the difficulty of proving culpability and the problem of foreseeability.[109]

However, it is unlikely that nation states will be prepared to accept the standard of strict liability.[110] Therefore, the implementation of this proposal is improbable and impractical.

Another proposal is to improve the system that is currently used. The highlighted areas of improvement are an improved definition of care, a change in the burden of proving

[105] Ibid
[106] n92
[107] n104
[108] Lampertius J, 'The Need for An Effective Liability Regime for Damage Caused by Debris in Outer Space', (1992) 13 Mich. J. Int'l L. 447
[109] Ibid
[110] Robert Q. Quentin-Baxter 'Preliminary report on international liability for injurious consequences arising out of acts not prohibited by international law' (UN, 1980) <legal.un.org/docs/?path=../ilc/documentation/english/a_cn4_334.pdf&lang=EFS> accessed 22 February 2019 This source is used based on its description of each states "natural prolongation" which determines the delimitation of their individual rights and obligations to other states.

negligence and a reduction in the identification procedures. While an improvement of the current system is in theory resourceful and practical, Lampertius fails to consider the international reluctance in relation to signing new Treaties, evidenced by the lack of nation states which have ratified the latest Treaty, the Moon Agreement.[111] Conversely, it is argued that although the Moon Agreement is not a successful Treaty because the main space actors have not ratified it, through the ratification and use of minor Space actors it can become customary law[112], although unlikely. The principle of an amendment to a Treaty is viable.

While there is an opportunity for customary law[113] to resolve dispute matters in Space, as explained earlier, it is implausible to rely upon an assumption of a constant Space environment. Similarly, customary law cannot be expected to compensate the ambiguity of the LC.[114] The Multilateral Approach proposes a unified approach to resorting contentions in Space.

Tannaweld's 'A more elaborative normative regime' and Lampertius' 'A Multilateral Approach' share a focus on combining the relevant parties to resolve an issue. They successfully consider the increased presence of actors in Space and the need for alternative approaches to solving disputes.

To summarise the creation of new law to remedy the issues faced within the LC is doubtful. Furthermore, as the major Space actors are reluctant to ratify Treaties or reduce the presence they have in Space, the most effective solution is to produce an efficacious system of ADR to govern disputes in Space.

In order to analyse the role of ADR in Space, it is important to review the basis of current dispute resolution in Space. The Outer Space Treaty 1967 (OST) and Liability Convention 1972 (LC) are the main international Treaties which set a form of governance for the resolution and remediation of liability in Space. The first stage set out in the LC is to initiate diplomatic

[111] n19 – The 1984 Agreement Governing the Activities of States on the Moon and Other Celestial Bodies (Herein referred to as the Moon Treaty or MT) was adopted by the General Assembly on the UN in 1979 by virtue of Resolution 34/68 was opened for signature on 18 December 1979 and entered into force July 11 1984 It can be found here: http://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/intromoon-agreement.html

[112] Michael Listner, 'The Moon Treaty: failed international law or waiting in the shadows?' (The Space Review, 24 October 2011) <www.thespacereview.com/article/1954/1> accessed 22 February 2019

[113] Ibid

[114] n108

negotiations, which, if unsuccessful, are followed by the creation of a claims commission[115] with authority to recommend an award unless the parties agree otherwise.[116] This procedure is a variation of ADR but the outcome of past cases, such as Cosmos 954, may cast doubt in the effectiveness of this system. The uncertainty derives from several issues, one of them being the lack of uniform international procedure. The OST enables and encourages states to create their own legislation to tackle the issues of state activity and liability in Space. Whereas most countries have created their own legislation, such as the UK's Outer Space Act 1986 (OSA)[117] and Space Industry Act 2018 (SIA),[118] Germany, which is a major European space-faring nation, still does not have its own national legislation.[119] This lack of uniformity creates competing views and standards on the best solutions for disputes. Therefore, while ADR is currently used, it is not always effective. Which is why a uniform implementation of ADR could create a more effective system and encourage further developments in Space.

There is no agreed definition of ADR, although in academic texts it is often assigned as a "full range of alternatives to litigation that might be available to a lawyer and client to resolve a civil dispute".[120] The aforementioned definition of ADR will be relied upon. There are two distinct branches of ADR, adjudicative and non-adjudicative. Adjudicative involves the presence of an impartial third party who makes the decision on the case. This involves options such as Arbitration, Expert Determination and Adjudication. Whereas non-adjudicative ADR also involves a third party, the purpose of its involvement is to investigate options and encourage settlements, while leaving the outcome of the process in the control of the affected parties. This can range from options such as Negotiation, Mediation, Early Neutral and/or Expert Evaluation and Inter-client discussion.[121]

ADR is becoming increasingly popular as a form of settling disputes. The legal system of England and Wales implements an active encouragement of the use of ADR before a case is brought to court. This is evident from Civil Procedure Rule 1.4.11, which is titled "Encouraging

[115] As explained at the start of the paper, once a claim is made, both parties have a year to settle their dispute. If a settlement cannot be reached, then a claims commission will be established at the request of either party.
[116] Gorove S, 'Liability in Space Law: An Overview.' (1983) 8 Annals Air & Space L 373
[117] Outer Space Act 1986
[118] Space Industry Act 2018
[119] Schladebach M, 'Fifty Years of Space Law: Basic Decisions and Future Challenges.' (2018) 41(2) Hastings Int'l & Comp L Rev 245
[120] S Blake, J Browne and S Sime, *A Practical Approach to Alternative Dispute Resolution* (5th edn, OUP 2018)
[121] Ibid

the use of alternative dispute resolution"[122] and encourages parties to undertake ADR before approaching the courts. ADR is not only restricted to state practice; it is also used to settle disputes in many international contexts. The International Chamber of Commerce (ICC)[123] and World Intellectual Property Organisation (WIPO)[124] all use or provide forms of ADR to settle disputes. The International Tribunal for the Law of the Sea (ITLOS)[125] acts in the capacity of an international court but it can also act in an advisory capacity in proceedings, which is a form of ADR. ADR has several advantages over litigation which may account for its increasing popularity. These range from lower costs, quicker settlements, a client-focused control of proceedings, wider discussion of potential issues, greater flexibility of the process, a wider range of potential outcomes and an increase in confidentiality for the respective clients. One of the main concerns that face litigants in any legal proceedings is the expense. Litigation is a time-consuming process; there is a propinquity between the length of a case and the increase in costs. Essentially, ADR is more cost effective and it resolves disputes faster while ensuring that an appropriate measure of formality is upheld.[126] However, ADR also has several disadvantages. While it is used both nationally and internationally, there is a lack of consistency concerning the rules that govern its procedures. This inconsistency may result in a lack of efficacy similar to that inherent in litigation.[127] In spite of this disadvantage it is nevertheless a useful and important tool. Not only can be an alternative to litigation, it can also be a supplement. If the use of ADR results in reducing delays, costs or producing quicker resolutions in vital determinations for legal cases, it has a served a useful purpose.[128] Ultimately it is the flexible nature of ADR which makes it a crucial asset in any legal proceeding and potentially as a successful solution for solving disputes in Space.

To be able to implement ADR it is pertinent to explore the different available forms.

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[122] Sir Geoffrey Vos, *Civil Procedure Rules The Whitebook* (Vol 1, Sweet and Maxwell 2018)
[123] ICC, 'International Centre for ADR' <https://iccwbo.org/dispute-resolution-services/mediation/icc-international-centre-for-adr/> accessed 19 February 2019
[124] WIPO, 'World Intellectual Property Organisation Alternative Dispute Resolution' <https://www.wipo.int/amc/en/> accessed 19 February 2019
[125] ITLOS, 'International Tribunal for the Law of the Sea' <https://www.itlos.org/the-tribunal/> accessed 19 February 2019
[126] Harvey PE, 'ADR: an Evolutionary Process.' (1998) 56(4) Advocate (Vancouver) 545
[127] Ibid
[128] Debelle BM, 'Arbitration, Expedition and ADR' (1990) 3(1) Corporate & Bus LJ 69

'ADR Principles and Practice'[129] differentiates Arbitration from ADR on the basis that firstly, while both systems involve a choice for parties as to whether they join the process, Arbitration unlike most forms of ADR, results in a legally binding and enforceable award. Secondly because, in Arbitration it is the duty of the arbitrators to work in accordance with the rules of natural justice (as known in English Law) or due process (as known in American Law).[130] However, despite the aptly described distinction, the ultimate decisions of the authors will be relied upon, which is the following, "the prevalent view is that we should regard arbitration as part of ADR".

Arbitration is a process which rests on an agreement between the two parties and binds them to the decision of the arbitrator. In principle, ordinary courts may not hear a dispute which is to be referred to arbitration and proceedings are stayed to allow the arbitration process to proceed. The parties appoint the arbitrators, but the tribunal has a duty to act impartially.[131] Another unique feature of Arbitration is the procedural freedom, the parties may organise the proceedings in such a way that would benefit them.

Expert Determination is normally opted for if both parties are divided by a technical question. Usually a contractual agreement is entered between the parties and an expert is picked to either make a decision or provide an opinion, mostly in the form of a valuation.[132] Because this is only a valuation, the courts view it as having different legal characteristics and remedies from an arbitral award.[133] The distinction between this form and Arbitration is that the expert is not acting as an arbitrator, the opinion of the expert is not reviewable by courts. Expert Determinations are becoming used more often as there is substantial literature and case law on how experts may proceed in various jurisdictions.[134]

Adjudication is a process that should be agreed between the parties and is finalised by a contract so that both parties are bound to the process in case of dispute in the proceedings. An example of this is in the UK which can be found in the Construction Act,[135] this process is

[129] H Brown and A Marriott, *ADR PRINCIPLES AND PRACTICE* (3rd edn, Sweet & Maxwell 2011)
[130] Ibid
[131] Article 12 of the (UNCITRAL) United National Commission on International Trade Law (1985) It can be found here: http://www.uncitral.org/uncitral/en/uncitral_texts/arbitration/1985Model_arbitration.html
[132] K Mackie, D Miles, W Marsh, T Allen, *The ADR Practice Guide Commercial Dispute Resolution* (3rd edn, Tottel publishing 2007)
[133] Ibid
[134] n129
[135] Housing Grants, Construction and Regeneration Act 1996, s 118

extensively used to settle construction disputes as governed by the aforementioned statute.[136] The key elements of this process are normally similar to arbitration but they are adapted to the needs of the industry which can lead to quicker resolutions, primarily why it is popular in construction disputes. If agreed, the adjudication can lead to a binding decision, or one that can only be binding on the agreement of both sides.[137] However, it is important to note that the process of adjudication and adjudicative processes in ADR are two separate entities. Where the former is a form of ADR, the latter encompasses a group of solutions that can have a binding effect.

Negotiations are, as expected because of this being a defining feature of ADR, truly flexible. They range from relatively informal processes to more formal settlement meetings.[138] The process can work in many formats; in person, by letter, email, over telephone or conference call. It is dependent on the severity and complexity of the dispute. That is one of the better functions of negotiations, they can be tailored to requirements of the parties. They can also take place during any point of a trial and can be used to deal with certain issues rather than the whole dispute.[139] A negotiation can deal with the entire dispute or be a supplement for a case. On the other hand, negotiations are flexible and can be used at any point in litigation or dispute resolution, but the timing is vital. The procedure must be allowed time to be thoroughly evaluated and researched before negotiations may begin. The main advantages of negotiation, apart from flexibility are; the low costs, the control they offer clients in the proceedings as they decide the instructions given to the negotiators and the confidentiality aspect.[140]

Mediation can be described as "simply as a negotiation conducted with the assistance of a third party".[141] A specially trained mediator (although there is not a requirement for a mediator to be trained, parties tend to opt for those who have received appropriate training) will construct a process to provide both parties with an opportunity to create inventive solutions, which go beyond the usual remit of courts.[142] In contrast to arbitrators, mediators

[136] n131
[137] n120
[138] n120
[139] n120
[140] n120
[141] H Abramason, *MEDIATION REPRSENTATION* (2nd edn, OUP 2011)
[142] Ibid

do not have decision making powers but can involve clients deeply in the process of the settlement.[143] Similarly they maintain strict confidentiality. Furthermore, UK government policy is increasingly encouraging the use of mediation when it is more cost effective than litigation,[144] this is a clear sign as to the effectiveness of ADR.

Mediation does not have a set procedural system, a provider of mediation services may offer a standard process, but it is often dependant on a written mediation agreement between parties.[145] This written agreement becomes an enforceable contract between the parties. Procedures such as these tend to be successful because there is facilitation of co-operation between the parties, unlike court the parties can agree whether they want to take part. Parties that tend to attend ADR procedures such as mediation, do so because they intend too or are open too, resolving the issue. A criticism of mediation is that the success of the process partially relies upon the capability of the mediator,[146] but this criticism is a broad one which can be applied to any form of resolution. In the same light, successful litigation requires competent lawyers and judges.

Early Neutral Evaluation and Expert Evaluation is essentially an assessment of some, or all issues in a case by an independent third party.[147] While it is similar to Expert Determination, this is a non-adjudicative form of ADR and therefore is not binding on the parties. This is particularly useful in cases which require a particular expertise or interpretation on bespoke issues. An agreed expert provides an opinion for both parties to evaluate their cases with, in the aims of reaching a solution. However, for this form of ADR to be successful, it should be undertaken as soon as possible, as when parties evaluate the case themselves and form their own, often entrenched opinion, the opinion of an expert which is not binding, may not have the desired effect.[148]

There are examples of the legal system adopting this method and a judge giving their own evaluation of the case, but it can cause tensions if a judge offers an evaluation before giving judgement, as noted in the case of *Seals v Williams*.[149] Nonetheless, this is a good example of

[143] Ibid
[144] n120
[145] n120
[146] n120
[147] n120
[148] n120
[149] *Seals v Williams* [2015] EWHC 1829 (Ch)

how ADR plays a large role in litigation and how it can influence legal systems, as judiciary can see the merit in the procedure to implement it themselves.

This form of resolution is unique as it, more often than not, will not involve other parties than those involved in the dispute. The parties may contact their legal teams to seek advice but the essence of this procedure is to settle a dispute personally. It is a useful demonstration of the versatility of ADR and the spectrum of possibilities it offers, from the strict binding system of arbitration to the personal system of Inter-client discussion.

It is important to highlight that the LC does create a provision for the use of ADR, the effected parties enter negotiations for a year and if the negotiations are unsuccessful, a claims commission can be created at the request of either party. Although these provisions are a competent foundation, the Space environment has developed significantly since the formalisation of the original Space Treaties. This requires a new approach in the use of ADR so that matters may be dealt with in a way which would counteract the ambiguity of the LC.

There are various international bodies that benefit from their use of Alternative Dispute Resolution. It would be concurrent for the theatre of Space to take advantage of this resourceful tool. As Space is becoming increasingly commercial, large disputes will undoubtedly arise in the future.[150] ADR should be implemented by the Space industry to resolve matters and promote further co-operation between Space actors.[151]

An understanding of the Iridium/Cosmos incident is crucial in the process of creating a system that is practical and attractive to Space powers and it is a fundamental case with regard to liability in Space.

A proposal to resolve disputes in Space

In order to begin this proposal, it is important to outline the findings of the past paper which can be divided into three findings.

The first finding is that the current law requires reform. It showed that, while using Iridium/Cosmos as an example, the Treaties are not as effective as they should be, the lack of

[150] Bostwick PD, 'Going Private with the Judicial System: Making Use of ADR Procedures to Resolve Commercial Space Disputes.' (1995) 23(1) J Space L 19
[151] Ibid

enforceability of the Treaties along with the vague provisions does not provide nation states with enough of an incentive to invoke them, an issue which this paper will seek to amend.

The second finding provides that liability is a complex matter that can arise in a variety of ways which can also affect multiple parties. This finding is vital in highlighting the requirement for a viable alternative to the current system.

The final finding shows that ADR is a viable alternative. It was also found that there are methods in national legislation that can be incorporated to provide a reformed Claims Commission with a level of enforceability required to make it a viable alternative for nation states.

To ensure a successful proposal, it is important to examine the current system in the LC. It provides a claims procedure from Articles VIII to XXII. These allow nation states that have suffered damage at the hands of another nation state an opportunity to claim damages as long as fault can be ascertained. Specifically, there are two limbs to this branch of the LC. The first is the Claim Procedure (CP) and the second is the Claims Commission (CC). Although the Iridium/Cosmos case did not invoke the LC and use the provisions it provides, in order to explain the Treaty, this paper will present the provisions in the style of if the LC had been invoked by the Iridium/Cosmos collision.

For the hypothetical explanations, the party which suffered the damage will be Iridium and Russia will be regarded as having fault for the collision because they have control over Cosmos (as in the actual scenario it had been abandoned and therefore state that they do not have control).

In this situation the US, who contracted Iridium's satellite and, the party that suffered the damage would bring a claim against Russia as they are the launching state of Cosmos. The US would present their claim for damages to Russia through diplomatic channels. If the two states, for whatever reason could not keep their diplomatic channels open with each other, then the US could ask another state which has open diplomatic channels with the launching state to present the claim on their behalf, for the purposes of this explanation that state can be the United Kingdom (UK). The US may also present its claim through the Secretary General of the UN.

The US would have to present their claim to Russia no later than one year after the occurrence of the damage or the identification of the launching state which is liable. As Cosmos is Russia's satellite, the time of expiration for the US would begin when Cosmos collided with Iridium. If the US did not know of the damage or was unable to identify the launching state of Cosmos, then the year period would begin on the date that they became aware of either requirement. If the US was not fully aware of the damage to Iridium and applied for a claim of damages and then realised the damage was worse than initially inspected, the one-year expiration still applies. However, the US can revise their claim and submit extra documentation, until one year after the date of full knowledge of the damage.

In accordance with the LC the US would not need "prior exhaustion of local remedies"[152] while bringing their claim to Russia. The compensation that Russia would have to pay the US would be determined in "accordance with international law and the principles of justice and equity".[153] The crucial part of the compensation is that the amount Russia would have to pay the US would be so that the US would find itself in the position it would have been, before the Iridium/Cosmos collision. Russia, unless asked for an alternative form of currency by the US, would have to pay the US in dollars.[154]

If neither party can reach a settlement through diplomatic channels one year from the moment that the US notified Russia of the submission of the documentation of their claim, then the parties shall establish a CC, at the request of either the US or Russia.

A CC is composed of three members. One that is appointed by the claimant state, which in this scenario is the US, on by the launching state which is Russia and the third member, the Chairman, which is chosen by the US and Russia jointly. Each party makes their appointment in two months of the request of either party for a CC. If the US and Russia were unable to choose a Chairman in four months of the request for establishment for a CC, then the US or Russia may ask the Secretary General of the UN to appoint a Chairman. The Secretary General will have a further two months to appoint a Chairman.

[152] n15
[153] n15
[154] As the LC requires that the party that caused the damage pay the claimant party in the currency used by the claimant party, unless specified otherwise.

If either the US or Russia failed to make an appointment within the provided time frame the Chairman shall, at the request of the US or Russia, create a single member CC.

The CC determines its own procedure to solve the dispute as well as determining the place(s) where it shall preside. For example, the Chairman may decide to carry out its obligations in the UK as a neutral ground for both parties.

Unless the CC is formatted on a single member basis, all decisions and awards will be decided by a majority vote. In the context of this hypothetical scenario, if the US and Russia entered a CC and outcome was decided, the decision would be based on a majority vote between appointed officials by the US and Russia as well the Chairman.

Importantly, the decisions of the CC are only binding if the parties agree, otherwise the award is recommendatory. If the US and Russia could not agree on a sum, then the CC would provide both parties with a recommended amount. Any expense incurred through this process would be shared equally by the US and Russia, unless the CC decided otherwise.

If the collision of Iridium/Cosmos created a "large-scale danger to human life, caused interference with living conditions or the functioning of vital centres"[155] then the nation states, in particular Russia as the launching state, "shall examine the possibility of rendering appropriate and rapid assistance to the State which has suffered the damage, when it so requests".[156] If a large piece of Space Debris from the collision descended onto a nation state, the UK in this scenario, and caused damage to either of the aforementioned criteria, there would be an expectation of the US and Russia, as well as other nation states to provide assistance to the UK.

First and foremost a change must be made because the LC has never been invoked, even in the case of Iridium/Cosmos.[157] Liability disputes resulting from Space activity are not a myth. If a set of provisions set to deal with these disputes are not being used by the parties to the Treaty, then there is an issue in the Treaties which must be addressed.

[155] n15
[156] n15
[157] Michael Listner, 'Revisiting the Liability Convention: Reflections on ROSAT, Orbital Space Debris, and the future of Space Law' (The Space Review, 17 October 2019) <http://www.thespacereview.com/article/1948/1> accessed on 10 May 2019

Furthermore, if there is not a practical and useful process set by the LC that nations states would want to adhere too, it will only thwart the purpose of the LC[158] by pushing states to compromise between a use of the LC and other remedies. If the process is refined and the use of it would be beneficial for nation states then this would set a precedent, a much-needed form of unified procedure to govern disputes in Space.

The aim is not to create the only system of governance, instead it is to create a system that is useful and reliable to ensure that disputes are dealt with effectively, efficiently and quickly so that the Space industry may avoid unnecessary litigation.

The range and variety of parties involved in Space has grown exponentially[159] since the creation of the Treaties. This change coupled with the reluctance of the international community to accept further binding Treaties as witnessed by the final Treaty, the Moon Treaty (MT),[160] are factors which must be considered while preparing this proposal. Furthermore, successful templates used for Space governance and in current legal practices must be examined. The Space Debris Mitigation Guidelines (SDGM) and the integration of ADR with legal practice in English Civil law are examples of this.

In comparison with the other Treaties the MT is largely thought of as a failure and the end of binding Treaties on the International community. This is because none of the major Space powers have signed or ratified the Treaty.[161] For example, the agreement concerning the International Space Station (ISS), the Space Station Intergovernmental Agreement acknowledges the OST, RA, LC and RC but not the MT.[162] Moreover, there have been 18 ratifications and 4 signatures to the MT to date.[163] which when compared with the OST's 109

[158] Joseph A Burke, 'Convention on International Liability For Damage Caused By Space Objects: Definition And Determination of Damages After The Cosmos 954 Incident' (1984) 8 Fordham International Law Journal
[159] Dave Baiocchi and William Welser IV, 'The Democratization of Space' (Foreign Affairs, May/June 2015) <https://www.foreignaffairs.com/articles/space/2015-04-20/democratization-space> accessed on 11 May 2019
[160] n17
[161] n112
[162] US Department of State, 'Agreement among the Government of Canada, Governments of Member States of the European Space Agency, the Government of Japan, the Government of the Russian Federation, and the Government of the United States of America Concerning Cooperation on the Civil International Space Station' (US Department of State, 29 January 1998) <https://www.state.gov/documents/organization/107683.pdf> accessed 11 May 2019
[163] UNCOPOUS, 'Status of International Agreements relating to Activities in Outer Space' (UNCOPOUS, 1 April 2019) <http://www.unoosa.org/documents/pdf/spacelaw/treatystatus/AC105_C2_2019_CRP03E.pdf> accessed 11 May 2019

ratifications and 23 signatures[164] portrays why the MT is viewed as a failure. It is also argued that the MT failed to receive ratifications as it was viewed to be premature,[165] understanding these factors are crucial in presenting a viable proposal to reform the Claims Commission.

A relatively new alternative method to the traditional form of Space governance, created to face the "challenge of space sustainability and security".[166] The guidelines are non-binding. The International community currently complies with the recommendations[167] of the IADC SDGM.[168] The real success of this non-binding method is shown in the fact that IADC first published the guidelines in 2002 as a body of 12 principal governmental Space agencies. By 2014 these guidelines achieved consensus among 77 nations[169] represented by UNCOPOUS.[170]

It is the lack of enforceability faced by the international Treaties which dissuades the international community from using them. The solution to that problem is to grant more power to the CC, while retaining the non-binding feature. The example relied upon previously will be used again, the integration of ADR with English Civil law. In this example, the use of ADR is optional but on the other hand, the party which avoids using it can receive a form of punishment once the dispute reaches court, usually in the form of costs. It is clear that new guidance and legal frameworks in the theatre of Space need to be non-binding in order to gain international support, therefore a combination of the system in English Civil law with the CC would create an enforceable and internationally agreeable version of the CC.

Space law is a conglomeration of many components. The varied participants, international diplomacy and law, national law and economic factors are some of the main elements to it. In the preparation of any new form of governance or regulation it is vital for its success that these factors are taken into consideration. Crucially, distinguishing the failure of the MT and

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[164] Ibid
[165] Gennady M. Danilenko, 'International law-making for outer space' (2016) Space Policy 37, 179 - 183
[166] Sergio Marchisio, 'Security in Space: Issues at stake' (2015) Space Policy 33, 67 - 69
[167] Joana Ramos Ribeiro, Luciele Cristina Pelicioni, Ilmo Caldas, Carlos Lahoz, Mischel Carmen Neyra Belderrain, 'Evolution of Policies and Technologies for Space Debris Mitigation Based on Bibliometric and Patent Analyses' (2018) Space Policy 44-45, 40-56
[168] Inter-Agency Space Debris Coordination Committee, 'IADC Space Debris Mitigation Guidelines' (IADC, September 2007) <http://www.unoosa.org/documents/pdf/spacelaw/sd/IADC-2002-01-IADC-Space_Debris-Guidelines-Revision1.pdf> accessed 11 May 2019
[169] Dave Finkleman, 'Rethinking Space Debris Mitigation' (Space News, 25 August 2014) <https://spacenews.com/41659rethinking-space-debris-mitigation/> accessed on 11 May 2019
[170] UNCOPOUS stands for United Nations Committee on Peaceful Uses of Outer Space

success of the IADC SDGM and the factors that have contributed to their respective positions in the international theatre will influence the correct development of the proposal for a reformed CC.

We will now discuss the proposed reforms for the CC. This will be done by stating each article in the LC that would be reformed and the proposed change. Afterwards the hypothetical Iridium/Cosmos scenario will be applied to the amended CC. The hypothetical scenario will be applied in order to depict how the proposed changes would work.

Article XIV of the LC

The proposed change: 'If no settlement of claim is arrived at through diplomatic negotiation as provided for in Article IX, within six months from the date on which the claimant State notifies the launching State that it has submitted the documentation of its claim, the parties concerned shall establish a Claims Commission at the request of either party.'

The change from the original document is halving the amount of time required to invoke the CC. Space is a quickly developing arena and if an alternative to litigation is sought it is important that it not be encumbered by lengthy procedures. This theme will carry on through the proposal.

Article XV of the LC

The first proposed change: 'Each party shall make its appointment within one month of the request for the establishment of the Claims Commission'.

The second proposed change: 'Either party may request the Secretary-General of the United Nations to appoint the Chairman within a further month.

The proposed change is to half the time given to each party, while these matters may require time to carry out efficiently, too much of it will allow the risk of delaying procedures.

Article XIX of the LC

The first proposed change: 'The commission shall give its decision or award as promptly as possible and no later than six months from the date of its establishment'.

The second proposed change will be a time limit placed of XIX (3). In this proposal further time may be granted in the interests of a fair and just outcome, however, in the interests of

an efficient procedure these extensions will not go past three months. The extension given, within the limit, is at the discretion of the Chairman.

The addition to this Article would be Article XIX (5): 'If parties choose to litigate instead, the Claim Commission may be considered as an attempted form of Alternative Dispute Resolution. Accordingly, avoidance of this procedure may be considered as not attempting Alternative Dispute Resolution and carry any penalties which the national legislation may place.'.

The aim of this addition is to provide the enforceability to the CC whilst ensuring that it still remains true to the principles of ADR and requirements of the Space arena and as a result, is voluntary.

Article XX of the LC

The addition to this Article: 'The expenses in regard to the Claims Commission shall be borne equally by the parties, unless otherwise decided by the Commission. Furthermore, if either party wish to pursue litigation for the relevant dispute, the conduct of each party throughout the Claims Commission may be considered when deciding how costs should be paid.'.

The main difference would be both the US and Russia would have less time to appoint and complete the requirements of the CC. Furthermore, if either party decided to pursue litigation, for the sake of neutrality, the US filed their case against Russia in the UK then the implications would be the following.

If Russia avoided the use of the CC and provided the English courts accepted the new proposal, once liability is ascertained and the case is decided, no matter which party is found to be liable Russia could face costs sanctions such as being required to pay the costs of the procedure. This would apply to either party that attempted to avoid using a form of ADR or the CC.

The provided proposal and amendments to the CC is a hypothetical proposition endeavouring to answer the question of finding a viable solution to dispute resolution in Space. However, its success is not guaranteed. It is a proposal that should be considered in conjecture with the most effective form of ADR for Space disputes.

Mediation would be the most effective form of resolution for any dispute. The proposal to reform the CC relies on a similar Civil legal system to that of the UK, which while it can be implemented, would require either other states adopting similar laws, adapting their own or avoiding partnerships with UK if they decide that system of resolution is unfavourable.

Mediation provides a non-binding and efficient system that the international community requires for solving disputes. It would also be relatively simple to form into an international agreement, like the IADC SDMG. This non-binding agreement could be used to supplement[171] existing Space Treaties. Therefore, the use of the Treaties and an ADR agreement as a supplement could be another viable alternative to solving the issue at hand.

Expert Determination would be a successful appendage to the proposal of a mediation agreement. As described previously, this form of ADR is opted for when the parties involved are divided by a technical matter. It is that quality that makes it a valuable addition to mediation, as technical matters are a constant when solving disputes in satellite collisions such as Iridium/Cosmos.

The solution

The proposals are suggestions and potential templates for a solution to dispute resolution. It is evident ADR can play a large role in creating an efficient system. This paper aims to create a step forward rather than the final statement on the matter. Space is a fragile environment in terms of human participation and international politics, as made clear by the failure of the MT any attempt to create new frameworks of governance will require careful planning and being fully aware of all the factors involved in the process.

Specifically, the main question this paper seeks to answer is: how can we solve the dilemma of disputes in Space? This discussion provides several answers to that question. To summarise, the reformed CC can provide a quick and relatively simple solution, it would be an amendment or addition to a current Treaty which is customary international law and as it does not seek to or could be construed to limit the power of states, there is a high chance of its success. However, as this paper recognises that the international Treaties are not currently as successful as their non-binding agreement counterparts, the current analysis will take that

[171] n27

into consideration. The solution of a mediation/expert-determination hybrid has been determined to be the most effective form of ADR available to the Space environment. It is voluntary, non-binding and effective.

Conclusion: From out here on the Moon, International politics looks so petty[172]

The dilemma presented by the research question in this paper, as presented throughout is: How can issues of litigation and liability be solved by ADR?

To conclude it is important to review the findings once again.

The first finding is that the current law requires reform. It showed that, while using Iridium/Cosmos as an example, the Treaties are not as effective as they should be, the lack of enforceability of the Treaties along with the vague provisions does not provide nation states with enough of an incentive to invoke them, an issue which this paper will seek to amend.

The second finding provides that liability is a complex matter that can arise in a variety of ways which can also affect multiple parties. This finding is vital in highlighting the requirement for a viable alternative to the current system.

The third finding shows that ADR is a viable alternative. It was also found that there are methods in national legislation that can be incorporated to provide a reformed Claims Commission with a level of enforceability required to make it a viable alternative for nation states.

Through a detailed analysis of the legal, liability and ADR situations, viable alternatives could be provided. As witnessed at the end of the paper, the proposed reform used the Iridium/Cosmos incident, but this time with pre-determined conditions[173] to explain the process of the claim procedure and claims commission. In answering the research question, it is crucial to combine the conclusions of this paper. Which were an amended claims commission and the most effective forms of ADR to either implement with the reformed claims commission or to use separately. The forms of ADR presented are a combination of mediation and expert determination for the flexibility and effectiveness of the procedures as

[172] Quote from NASA Astronaut Edgar Mitchell

[173] Such as fault assigned to a party, which did not happen in the actual Iridium/Cosmos incident, this change was made to present the two systems of resolution

well as the likelihood of acceptance they would receive from the international community. Subsequently, this system would present a voluntary, non-binding yet efficient system as based on the findings of this paper.

The proposals created suggestions based on the findings throughout this work, it is clear ADR can fix the presented issue. However, these proposals are not a definitive statement and in order to succeed require international participation and understanding of the developed principles. The solution does not have to be a reformed claims commission or mediation. In this precarious environment an acknowledgement of the need for reform or the creation of an efficient dispute resolution system with the use of ADR is a success. The question posed throughout this paper is: How may the dilemma of litigation and disputes in Space be resolved? The answer to this, is through the use of Alternative Dispute Resolution. It is a viable solution, because of its flexibility, efficiency, speed, non-binding and voluntary nature. These elements found in ADR are vital for success in the dangerous and tense Space environment.

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