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SPACE LAW: A TREATISE

BY FRANCIS LYALL AND PAUL B LARSEN
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I Introduction and Orientation

It is easy to overlook the law when you can watch a rocket launch before your eyes. There is a significant quantity of international and domestic law applicable to outer space and a number of texts have emerged over the years that attempt to clarify the various obligations that follow these laws. Literature in the field is dominated by the initial works of reputable international law scholars such as Bin Cheng,[1] Stephen Gorove,[2] and Carl Q Christol.[3] These texts are complemented by the early works of renowned experts such as Manfred Lachs[4] that provide wide-ranging, early stage commentary on the status and content of space law, the implications for states, and the intentions of state parties as to how the law was to be formed.

More recently, the modern 'space lawyer' has emerged, a professional who splits their time between considering not only international space law, but the impact that law can have on up-and-coming commercial space operations. Academics such as Frans von der Dunk have edited hefty volumes focusing on selected issues in outer space, with von der Dunk's most recognised work, *The Handbook of Space Law,* spanning almost 1200 pages.[5] Similarly, large groups of academics have collaboratively developed hugely popular resources in the public international law realm. Series such as the *Cologne Commentaries on Space Law* stand out for their thorough article-by-article commentary on the major treaties and 'soft law' instruments in the

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1 Bin Cheng, *Studies in International Space Law* (Oxford University Press, 1997).

2 Stephen Gorove, *Studies in Space Law: Its Challenges and Prospects* (AW Sijthoff-Leyden, 1977); Stephen Gorove, *Developments in Space Law: Issues and Policies* (Martinus Mijhoff, 1991).

3 Carl Q Christol, *Space Law: Past, Present, and Future* (Kluwer, 1991); Carl Q Christol, *The Modern International Law of Outer Space* (Peragmon, 1982).

4 Manfred Lachs, *The Law of Outer Space* (AW Sijthoff International Publishing Company, 1972).

5 Frans von der Dunk (ed), *Handbook of Space Law* (Edward Elgar, 2015).

field, delving into the historical development, foundational contexts, and the current prevailing academic interpretations.[6] This is contrasted against books that cover niche aspects of the applicable law.[7] The 'popular culture' associated with outer space and the limited cache of reputable literature in the field makes it an interesting area to publish in. Despite this, many works merely pass as restatements of previous literature; analysis and new ideas run thin when authors and editors aim for publication volume over quality.

In this context, the second edition of Professor Francis Lyall and Professor Paul B Larsen's flagship '*Space Law: A Treatise'* is warmly welcomed. Published at the beginning of 2018, it is the second iteration of their book initially released in 2009.[8] The volume seeks to act as a guide for students studying the field, practitioners venturing into the depths of space law, and to provide an accessible resource for interested persons. The book considers a broad variety of issues including the foundational concepts of international space law and its domestic counterparts, telecommunications law, extra-terrestrials, and many of the issues that face the present-day actor in the space domain.

The first edition of this book was presented as an introductory text to outer space, a position retained in the second edition. It stays well clear of the popular 'selected issues' approach of the edited collections that the field seems to elicit, while still dealing with many of the more specialist areas of commercial and practical relevance for law in outer space. With a title as simple as 'Space Law' it is likely to be the first port of call for many people, just as attractive as the other major texts in the area such as *The Handbook of Space Law*.[9]

Lyall and Larsen state that they have attempted to produce a 'fresco' of space law and that an 'etching', focused on intricate detail, would be 'impossible to achieve in a mural of c. 330,000 words', especially in an area so diverse and broad (in both the literal unending expanse and law applicable to the domain sense).[10] Furthermore, it is an attempt at exploring space law in a comprehensive manner while recognising that

> [t]he literature of space law, both national and international, is considerable, if of variable quality. Books are appearing, many being collections of chapters by various hands that usefully focus on particular areas. … Some writers, vociferous in their conclusions, appear to lack knowledge of legal principle or existing law.

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6 Stephan Hobe, Bernhard Schmidt-Tedd and Kai-Uwe Schrogl, *Cologne Commentary on Space Law* (Carl Heymanns Verlag, 2009–15) vols 1–3.

7 See, eg, Patricia McCormick and Maury Mechanick (eds), *The Transformation of Intergovernmental Satellite Organisations: Policy and Legal Perspectives* (Martinus Nijhoff, 2013); Ray Purdy and Denise Leung (eds), *Evidence from Earth Observation Satellites* (Martinus Nijhoff, 2013).

8 Francis Lyall and Paul B Larsen, *Space Law: A Treatise* (Ashgate Publishing, 2009).

9 von der Dunk, above n 5.

10 Francis Lyall and Paul B Larsen, *Space Law: A Treatise* (Routledge, 2nd ed, 2018), xi.

> Some contributions are simple propaganda and amount to 'result-orientated jurisprudence'.[11]

It is from this position that the authors attempt to provide a quality and academically robust assessment of space law whilst trying to go beyond a restatement of rights and duties at law to provide a detailed analysis of the issues at hand. The authors achieve this in nearly every instance, adding colour and depth to an area of law that is characterised by its environment: dark and empty.

The contents of the book can be grouped into three main themes which clearly demonstrate a focus on the practicalities of the law. The first considers the general international and domestic sources of law applicable to outer space, fora, and the basic legal principles applicable in outer space. This first part of the text orients the reader, introducing the context and content for the chapters that follow.

Second, the authors clearly reach their areas of expertise in the thrust of the book, driving through the more complicated commercial and practical legal implications of outer space — the use of telecommunications, broadcasting, environmental law, and activities more broadly — all while ensuring relevance to the fundamental principles that underpin the boundless domain.

Finally, the authors draw our attention to the future and carefully consider the major driver of modern outer space to be exploration for advantage. They practically draw on financing, trade restrictions, commercial law, and military perspectives while also considering extraterrestrial intelligence, and address the legal questions for the future.

This review will consider the efforts of the authors to provide a basic introduction to the law of outer space while comparing it to other interpretations, practice and broader literature. This approach confirms that the authors have developed a highly robust and academically rigorous text, one which sits in the enviable position of being a go-to book for a range of audiences, from the law student right through to the experienced international lawyer looking for further information on a booming discipline.

II Part 1 — Introduction and Founding Concepts

This book does well to orientate the reader and ensure they are aware of the immense volume of law applicable to outer space. The first seven chapters acquaint us with the major players in outer space, the basic law, and the elements of the outer space domain.

Lyall and Larsen clearly recognise the significance of humans moving into the outer space domain, especially from a legal perspective. They state that the jumping into

11 Ibid 28.

space 'has involved law, and appropriate law has had to be developed,'[12] an explicit recognition of the applicability of law to space even before humans reached into its depths. Now that the human species is relatively active in outer space, a comprehensive and relatively useful range of legal principles governing the basic activities of the actors in the domain has been developed.

A *The Actors*

In their first chapter, Lyall and Larsen introduce the major players in the space domain and outline the international obligations that have shaped practice. This is a realistic and pragmatic introduction of the major actors, although it may be open to the criticism that the authors have placed excessive significance on traditional interest groups and academic pursuits at the expense of the modern commercial players who are likely to be the key drivers of space activity in the decades to come.

The authors make the useful and often overlooked point that although space law is thought by many to have sprung into existence the moment the Union of Soviet Socialist Republics ('USSR') successfully launched Sputnik 1 into orbit (4 October 1957), its 'origins lay much further back.'[13] What Sputnik 1 did do (in addition to creating customary international law regarding the right of overflight in outer space),[14] was trigger a movement to expand and clarify the applicable law and develop appropriate institutions to regulate outer space. It was the pressure of the Second World War that truly sparked the development of the space age, and even now 'there is nothing like war for producing progress in technology' which will inevitably need to be matched with new law.[15]

It is from the post-WWII position that the authors begin to explore the primary institutions they believe have developed space law; the reader is provided with overarching and broad introductions to the International Astronautical Federation, the International Academy of Astronautics, and the International Institute of Space Law ('IISL'). As has been presented in the text, it is clear that each of these groups has impacted the development of the law to varying degrees. However, these bodies have supported space law in a primarily academic sense. Even today, these international institutions are primarily associated with their large annual conferences. In recent years, the International Astronautical Federation has gained increased exposure as the organiser of the International Astronautical Congress which entered its 69th year in 2018. The recent emphasis has been bolstered by presentations by notable figures

12 Ibid 2.

13 Ibid 3.

14 Myres McDougal, 'The Emerging Customary Law of Space' (1963) 58 *North Western University Law Review* 618. There is still some disagreement in the academic field about the ability for customary international law to form instantaneously, see Diego G Mejía-Lemos, 'Some Considerations Regarding "'Instant' International Customary Law", Fifty Years Later' (2015) 55 *Indian Journal of International Law* 85.

15 Lyall and Larsen, above n 10, 6.

in the space industry such as Elon Musk.[16] The organisation most suited to space law, the IISL, is a collection of lawyers who hold an academic or, in limited circumstances, practical interest in outer space. Although an academic institution, the IISL continues to promote international space law and attempts to shape its development. In the modern era these institutions mainly sit on the periphery, providing opinion as they deem necessary. Alongside these institutions, the authors also recognise the input of universities in both teaching space law and fostering the development of it more broadly.

The United Nations is where the majority of space law has been developed. The Committee on the Peaceful Uses of Outer Space ('UNCOPUOS') is the primary international committee supported by the Office for Outer Space Affairs. These bodies are recognised by the authors as '[t]he most obvious forum for developing space law within the operational structures of the United Nations itself'.[17] This has been the primary venue for the development of international space law over the last century, facilitating the introduction of the five outer space treaties,[18] numerous General Assembly Resolutions[19] and the more recent principle-based documents

16 Tony Shepherd and Jamie Seidel, 'Elon Musk Unveils Lofty Vision at International Astronautical Congress in Adelaide to Pay His Way to Mars', *The Advertiser* (online), 29 September 2017 <https://www.adelaidenow.com.au/news/south-australia/elon-musk-to-detail-his-mission-to-mars-at-international-astronautical-congress-in-adelaide-on-friday/news-story/53708c3d16e4070a66aab3d0b8b7477a>.

17 Lyall and Larsen, above n 10, 13.

18 *Treaty on Principles Governing the Activities of the States in the Exploration and use of Outer Space, including the Moon and Other Celestial Bodies*, opened for signature 27 January 1967, 610 UNTS 205 (entered into force 10 October 1967) ('*Outer Space Treaty*'); *Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space*, opened for signature 22 April 2968, 672 UNTS 119 (entered into force 3 December 1968) ('*Rescue Agreement*'); *Convention on International Liability for Damage Caused by Space Objects*, opened for signature 29 March 1972, 961 UNTS 187 (entered into force 1 September 1972) ('*Liability Convention*'); *Convention on Registration of Objects Launched into Outer Space*, opened for signature 14 January 1975, 1023 UNTS 15 (entered into force 15 September 1976) ('*Registration Convention*'); *Agreement Governing the Activities of States on the Moon and Other Celestial Bodies*, opened for signature 18 December 1979, 1363 UNTS 3 (entered into force 11 July 1984) ('*Moon Agreement*').

19 See, eg, *Application of the Concept of the 'Launching State',* GA Res 59/115, UN GAOR, 59th sess, 71st plen mtg, UN Doc A/RES/59/115 (25 January 2005); *Recommendations on National Legislation Relevant to the Peaceful Exploration and Use of Outer Space*, GA Res 68/74, UN GAOR, 68th sess, 65th plen mtg, UN Doc A/RES/68/74 (16 December 2013); *Recommendations on Enhancing the Practice of States and International Intergovernmental Organizations in Registering Space Objects*, GA Res 62/101, UN GAOR, 62nd sess, 75th plen mtg, UN Doc A/RES/62/101 (10 January 2008, adopted 17 December 2007); *Recommendations on Enhancing the Practice of States and International Intergovernmental Organizations in Registering Space Objects*, GA Res 62/101, UN GAOR, 62nd sess, 75th plen mtg, UN Doc

on different elements of the outer space domain.[20] Of significance is the authors' criticism of UNCOPUOS's present and modern role; that diplomatic processes are significantly hampered when some states 'want precise language, while others seek to fudge'[21] and the frequent use of representatives 'for whom space questions are not a priority.'[22] This is a position that was recognised by the Greek Representative in 2000 when they asked

> [i]f the Legal Subcommittee is not the appropriate global forum for discussion of the thorny question[s] … then my delegation wonders where it is that these questions should be discussed? In the corridors, at the coffee counter, or in Vienna restaurants?[23]

They followed by suggesting that

> [t]o avoid there being any hidden agendas on the part of certain States to see the role of the [Legal] Subcommittee deteriorate so that they could take action at the international level without legal commitments, in a totally deregulated environment, then we all must work together so that … tax payers the world over should not be forced to pay taxes so that representatives of some countries spend that money on spring holidays in Vienna.[24]

This demonstrates a clear degree of discontent from at least one member state with the status and progress of UNCOPUOS, a point recognised by the authors.

Of course, the text continues to explore the other actors in the space domain, the role of national space agencies and major international organisations such as the European Space Agency. Although these agencies do not make international law, they shape domestic law, contribute to the international policy setting and act as the agent of the state in outer space.

A/RES/62/101 (10 January 2008, adopted 17 December 2007); *Principles Relating to Remote Sensing of the Earth From Outer Space*, GA Res 41/65, UN GAOR, 41st sess, 95th plen mtg, UN Doc A/RES/41/65 annex.

20 Including: *Principles Relating to Remote Sensing of the Earth From Outer Space*, GA Res 41/65, UN GAOR, 41st sess, 95th plen mtg, UN Doc A/RES/41/65 annex; *Principles Relevant to the Use of Nuclear Power Sources in Outer Space*, GA Res 47/68, UN GAOR, 47th sess, 85th plen mtg, UN Doc A/RES/47/68 (14 December 1992); *Space Debris Mitigation Guidelines of the Committee on the Peaceful Uses of Outer Space*, UN GAOR, 62nd sess, Supp No 20, UN Doc A/62/20 annex (22 December 2007).

21 Lyall and Larsen, above n 10, 17.

22 Ibid 18.

23 Committee on the Peaceful Uses of Outer Space, Legal Subcommittee, 'Unedited Transcript 633rd Meeting' (3 April 2000) UN Doc COPUOS/LEGAL/T.633, 3.

24 Ibid.

B *The Law*

While the actors in the space domain are essential to understanding the overarching policy context of the law of outer space, they tell us very little about the relevant legal regimes. The law applicable to outer space comes from two quite distinct sources — international law and domestic law — a point the text conveys well. Interestingly, unlike many other books, there is no distinct separation of the two sources into different chapters. For example, the *Handbook of Space Law* dedicates three chapters to reciting the relevant law; the first on international space law, the second on national space law and the third on European space law (due to the complexities of the European legal system and framework surrounding the European Space Agency).[25] Lyall and Larsen divide their focus differently. First, they address the sources of law in a general fashion in one chapter, 'Sources of Space Law', while leaving specific detail to chapters that deal with the subject matter. Domestic space laws are relegated to the end of the book and considered after reviewing commercial activities in outer space. This approach is intuitive and ensures the practical relevance of any legal principle raised is fully understood in the context of the law that proceeds it. Despite this, the authors broadly demonstrate how space law can be found in diverse sources including domestic law, contracts and agreements, public international law, international customary law, United Nations documents, and a range of other soft law instruments.

C *An Outer Space Treaty?*

The most significant and well adopted of the five space law treaties is the 1967 *Outer Space Treaty*,[26] a text the authors rightly dedicate an entire chapter to considering, unlike the other treaties which are discussed in the relevant topical sub-sections.[27] Lyall and Larsen successfully encapsulate the broad background of the *Outer Space Treaty* and provide the relevant context to the reader, whomever they are.

There is an intriguing analogy used to describe the creation and context of international space law. The authors suggest that while the 'maritime law of today was largely the creation of the English merchant fleet', the United States has played a 'similar role in the development of general world space law'.[28] Although in many regards this might be true, especially when considering the development of the commercial space industry, the United States is in no way the inventor of space law, a point clearly exemplified in the development of the *Outer Space Treaty* which required significant compromise between all parties (mostly the United States and the USSR). To some extent this remark reflects the bias of the authors' overall focus

25 von der Dunk, above n 5.

26 *Treaty on Principles Governing the Activities of the States in the Exploration and use of Outer Space, including the Moon and Other Celestial Bodies,* opened for signature 27 January 1967, 610 UNTS 205 (entered into force 10 October 1967) *('Outer Space Treaty').*

27 Lyall and Larsen, above n 10, 50–1.

28 Ibid 29.

which sees a tendency to address American space policy in more detail than that of other major space-faring nations. This should not be faulted too highly though; many books in this field frustratingly only repeat the law as it stands, without colour or analysis, resulting in a dry restatement of the law. It should also be noted that space law as it stands today is definitely, in part, a result of the influence of the United States as one of the most active states in the outer space domain. Despite these points, it is misleading to suggest that the United States created space law, with a well-documented history of compromise during treaty negotiations between what is now Russia and the United States, as well as a vast number of other stakeholder nations.[29]

What must be commended is the authors' use of extensive referencing, with citation of United Nations documents, *travaux préparatoires*, UNCOPUOS documents, and all manner of other background documents, all adding to the quality and presentation of the text; one which commands authority throughout its substantive components.

D *A Question of Custom*

Where the authors enter into rocky ground is their discussion of the *Outer Space Treaty* existing as customary international law. They assert that, 'as a minimum' articles I, II, III, VI and VII have all entered into customary international law and 'cannot be evaded'.[30] These are incredibly general articles and, in most instances, are unlikely to be controversial in their application. What should be questioned, though, is the blanket application that the authors refer to.

Article III imports international law to outer space. As a consequence, and with very little evidence to counter this assertion, it is unlikely to be questioned by any rational actor and has likely become customary international law without much fuss. Similarly, the principle codified in article I — that space is to be free for all to explore — would have entered into customary international law the moment the United States and USSR space race begun.

Claims of sovereignty over parts of space are prohibited by Article II. To claim that this article is customary is precarious. On one level, any state that claims an entire planet, or substantial part of one will likely be condemned. On another, mining of space resources is being proposed as a valid use of outer space, an action that would require an entity to exercise possession and control of material found in space, arguably amounting to a claim of sovereignty.[31] With viable off-planet settlement plans afoot that would require sovereignty or claims over space in some form or another, it would be sensible to recognise that the overarching concept as codified in article II is customary. It is the exact scope and application that remains in question.

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29 Ibid 69.

30 Ibid 64.

31 See, eg, *US Commercial Competitiveness Act*, Pub L No 11490 § 51303, 129 Stat 704 (2016).

When looking to arts VI and VII, the assertion of customary international law falters. The articles consider the responsibility and liability of states in the space domain and each are unique to the outer space context.

Article VI presents a regime of law that is incompatible with general international law as it stands, essentially removing the well-established concept of 'attribution' that is required for any act contrary to international law. The International Law Commission spent a significant period of time, nearly 40 years, developing what is in essence a codification of the customary international law position of state responsibility: the Articles on the Responsibility of States for Internationally Wrongful Acts.[32] If the status of article III as customary law is to be accepted, it would import the terrestrial concept of state responsibility into the outer space domain to cause a conflict of laws with the text of article VI[33] not explicitly displacing the well understood concept of state responsibility. This is where many invoke the principles of *lex specialis* (that specific laws will displace the more general rules), a logical conclusion based on more traditional concepts of law. With this conflict in mind, it would be expected that any claim of custom be comprehensively supported due to the conflicting international obligations. It is here that the authors fail. Events have also transpired since the book's publication that question this interpretation, with the first ever publicly known incidence of an unauthorised payload entering orbit in early 2018.[34] There was no outcry, no statements that even though the payloads were rejected under the relevant United States law they would be attributed to the United States.

Article VII of the *Outer Space Treaty* presents nations with the ability to claim damages from another in the event of an accident. Although claiming damages for the consequences of internationally wrongful acts is well established, invoking a claim for damages under article VII does not require a wrongful act.[35] The authors do not go into detail trying to support this article as customary, they merely state that

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32 *Responsibility of States for Internationally Wrongful Acts*, GA Res 56/83, UN GAOR, 56th sess, 85th plen mtg, Agenda Item 162, UN Doc A/RES/56/83 (28 January 2002) annex; James Crawford, *State Responsibility* (Cambridge University Press, 2013) 36.

33 *Outer Space Treaty* art VI:

> States Parties to the Treaty shall bear international responsibility for national activities in outer space, including the Moon and other celestial bodies, whether such activities are carried on by governmental agencies or by non-governmental entities, and for assuring that national activities are carried out in conformity with the provisions set forth in the present Treaty. The activities of non-governmental entities in outer space, including the Moon and other celestial bodies, shall require authorization and continuing supervision by the appropriate State Party to the Treaty …

34 Mark Harris, 'FCC Accuses Stealthy Startup of Launching Rogue Satellites', *IEEE Spectrum* (online), 9 March 2018 <https://spectrum.ieee.org/tech-talk/aerospace/satellites/fcc-accuses-stealthy-startup-of-launching-rogue-satellites>.

35 *Responsibility of States for Internationally Wrongful Acts*, GA Res 56/83, UN GAOR, 56th sess, 85th plen mtg, Agenda Item 162, UN Doc A/RES/56/83 (28 January 2002) annex, art 31.

it is.[36] As a distinct legal concept that only applies to state parties and with incredibly limited state practice it is difficult to support an assertion without justification.[37]

Noting that all space-faring states are party to the *Outer Space Treaty* and have not overtly acted in contravention of its terms should not be considered sufficient to establish a rule of customary international law. The essential components of state practice and *opinio juris* should always be highly valued. Although the authors attempt to justify their position, it is only done in generalities. The authors refer to the principle enshrined in the *North Sea Continental Shelf Case*; that the actions of those states that have a particular interest in a situation or circumstance have a more significant role in the development of the relevant customary international law.[38] The primary argument presented for all articles being customary is to suggest that, as no state has acted contrary to the foundational principles of the *Outer Space Treaty* (arts I–III, VI, VII), the content becomes customary; this argument should only be cautiously accepted at most. There is no significant consideration of the state practice or *opinio juris* of non-space-faring states. While focusing on the interests of those nations already in space aligns with the principle presented in the *North Sea Continental Shelf Case*, customary law does not form merely because five to ten states have not overtly acted contrary to their treaty obligations. The interests of current space-faring nations are relevant but should not be considered determinative, especially when it is recognised that space activities require a certain financial and technical capability; a capability that most states do not possess. It is unlikely that many poorer states would accept the imposition of customary law created almost exclusively by wealthy Western states as they reached space first. Furthermore, this goes against article I of the treaty, which clearly articulates that space is to be used in the 'interests of all countries' and remain 'the province of all mankind'.

Although there is little evidence to support all five introductory articles of the *Outer Space Treaty,* article I through III are the main candidates to be classified as custom, they are broad and generally compatible with terrestrial international law as it stands. Overall, it does need to be recognised that the status of these articles as customary international law is tempered by the authors later in the text where they assert that only articles I through IV sit as custom despite article IV not being raised in the earlier discussion.[39]

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36 Lyall and Larsen, above n 10, 64.

37 There has only been one claim for damages cause by a space object. This claim was settled by diplomatic negotiation rather than by the terms of the *Liability Convention*: see 'The Canadian Statement of Claim' (1979) 18 *International Legal Materials* 899; *Protocol and Settlement of Canada's Claim for Damages Caused by Cosmos 954*, Canada–Union of Soviet Socialist Republics, entered into force 2 April 1981, 20 ILM 689.

38 *North Sea Continental Shelf, (Federal Republic of Germany v Denmark) (Judgment)* [1969] ICJ Rep 3, 43.

39 Article IV of the *Outer Space Treaty* stands as a prohibition on the use on use of weapons of mass destruction in space and establishment of military bases and installations; Lyall and Larsen, above n 10, 167.

E *Basic Principles and Definitions*

The remaining chapters of what can be called Part I of the book deal with a number of other significant and essential components of space law. The authors contemplate 'space objects', a legal construct clouded in ambiguity and uncertainty, especially when different laws apply to different space objects based on nationality, treaty ratification patterns, and where they may have been launched from. Despite this, the complicated *Rescue Agreement, Liability Convention* and *Registration Convention* are navigated in a way that clearly articulates the status of the law and the obligations of states.[40]

A similar sentiment can be expressed when the authors deal with the position of 'astronauts' at law, especially when every relevant international instrument conveniently neglects to define what an 'astronaut' is. When looking to the *Outer Space Treaty,* it is clear that 'astronauts' are to be accorded some significance as 'envoys of mankind', although this term has been given little to no legal significance.[41] With very few humans reaching outer space over time, the authors review the domestic policies of states to conclude that there is no certain definition.[42] At the same time, academia appears relatively settled on the matter, with a person needing a degree of professional purpose, training and responsibility to the space craft to be classified as an 'astronaut'.[43]

Reviewing the practices of many states this conclusion is tenuous, but understandable, due to the ambiguity caused by potential space tourism. The United States has been using a number of different classifications for humans travelling into space for quite some time; even the *Space Transportation System Handbook* — the book used to train NASA personnel who would be travelling on the Space Shuttle — acknowledges the presence of different classes of crew, with the commander and pilot described as 'crew' and the remaining classified as mission specialists (engineers, scientists, etc). It further recognises the potential for 'noncareer crewmembers' who undergo the 'minimum STS training considered necessary' to travel into outer space.[44]

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40 *Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space*, opened for signature 22 April 2968, 672 UNTS 119 (entered into force 3 December 1968) ('*Rescue Agreement*'); *Convention on International Liability for Damage Caused by Space Objects*, opened for signature 29 March 1972, 961 UNTS 187 (entered into force 1 September 1972) ('*Liability Convention*'); *Convention on Registration of Objects Launched into Outer Space*, opened for signature 14 January 1975, 1023 UNTS 15 (entered into force 15 September 1976) ('*Registration Convention*').

41 Frans G von der Dunk and Gerardine Goh, 'Article V' in Stephan Hobe, Bernhard Schmidt-Tedd and Kai-Uwe Schrogl (eds), *Cologne Commentary on Space Law* (Carl Heymanns Verlag, 2009) vol 1, 94, 98 [17].

42 Lyall and Larsen, above n 10, 119.

43 von der Dunk and Goh, above n 41, 94, 98 [15].

44 National Aeronautics and Space Administration, *Space Transportation System User Handbook* (June 1977) 4-22.

Furthermore, the rules in place to guide the selection of crew for the International Space Station notes that there are crew, 'professional astronauts', and spaceflight participants, the latter of which is not to be termed an astronaut.[45] With significant uncertainty in the state practice, the prevailing academic view, as referenced by Lyall and Larsen, should generally be favoured and accepted until overt and contradictory state practice indicates otherwise.

F *Celestial Bodies*

The final chapter of 'Part 1' of the book moves us to one of the more interesting areas of outer space; the law applicable to planets, moons, and other 'bodies' present in space. As is very clearly and accurately set out in the first few lines of this chapter, '[t]he legal regime of the Moon, asteroids and other celestial bodies is not finally settled and will require adaption' especially in a time where '[c]ommercial exploitation of the Moon and of asteroids is under active discussion.'[46] The essence of this chapter is a reminder that the law, especially the *Outer Space Treaty*, 'goes well beyond Earth-orientated matters',[47] and it is not the law of the sea that applies (as was erroneously stated by Matt Damon's character, Mark Watney, in the 2015 movie *The Martian*). This is a fact that is easily overlooked, especially with the majority of human activity outside of low earth orbit ending in 1972; the exceptions being purely scientific endeavours.[48]

In recent times, as has been well captured by the authors, there is an enthusiastic drive to push humanity further into our solar system, be it for the scientific cause or to exploit space for commercial gain. In an interesting and well-positioned discussion, the authors raise a definitional question: what is a planet? This is not really an 'every day' question, but one that has been left to scientific experts in the first instance. It was these experts who famously demoted Pluto to a 'dwarf planet' in 2006 and continue to review and reclassify the natural objects within our solar system.[49] Of course, lawyers have ignored the technical question in its entirety and opted for 'celestial bodies' as a blanket term for the naturally occurring objects in outer space — be they planets, asteroids, or comets — a classification that is undefined but features in the full title of the *Outer Space Treaty* and *Moon Agreement*.

The Moon is the only non-earthly body that humans have physically reached and, depending on the policy of any particular government or company (mainly the

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45 ISS Multilateral Crew Operations Panel, *Principles Regarding Processes and Criteria for Selection, Assignment, Training and Certification of ISS (Expedition and Visiting) Crewmembers*, (November 2001) 4–5.

46 Lyall and Larsen, above n 10, 163.

47 Ibid 166.

48 The final Apollo mission, Apollo 17, was completed with successful splashdown into the Pacific Ocean on 19 December 1972.

49 Lyall and Larsen, above n 10, 163.

United States) at any point in time, may be a target for human activity once again.[50] With much of the law of outer space explained in the context of orbital activities, it is important to recognise that the concepts of non-appropriation, peaceful purposes, and general international law all apply to the Moon. The authors raise the influence of United States President Eisenhower in the development of the *Outer Space Treaty*, recognising that there was an overt attempt to prevent claims of sovereignty in a manner analogous to the Antarctic, which is governed by a treaty that entered into force in 1961.[51] The use of the Antarctic sovereignty analogy is intentionally and wisely restrained, primarily due to the fact that seven nations maintain claims to Antarctic territories despite the treaties in place.[52]

It is from here that the authors recognise the *Moon Agreement* — officially the 'Agreement Governing the Activities of States on the Moon and Other Celestial Bodies'[53] — which aims to clarify the legal obligations of states not only on the Moon, but on any other celestial body. After the first draft was presented to UNCOPUOS in 1970, drafting of a new treaty was severely hamstrung by a focus on the *Rescue Agreement, Liability Convention* and *Registration Convention*. The *Moon Agreement* opened for signature in 1979 and, unlike the other treaties, faced an uphill battle to enter into force in 1984. As is recognised throughout the space law community, the treaty sits well outside the main body of law, with no major space-faring state parties.[54] The authors acknowledge the advantages of the treaty, recognising the 'useful aspects' and that it 'may yet prove to be the Sleeping Beauty of the five UN space treaties'.[55]

In the modern context, as is reinforced in numerous parts of this book, profit is a significant motivator and the viability of space mining and resource exploitation operations has become a fascination for many. The authors assert that the 'Moon and any other celestial bodies are *res extra commercium*'.[56] An unfortunate quirk of this book is the extensive use of Latin without clarification or explanation, requiring those without an intricate understanding of historic legal maxims to rely on online searches

50 Jacqueline Klimas, 'Trump Makes New Moon Landing Official US Policy', *Politico* (online), 11 December 2017 <https://www.politico.eu/article/trump-moon-landing-official-u-s-policy/>.

51 *Antarctic Treaty,* opened for signature 1 December 1959, 402 UNTS 71 (entered into force 23 June 1961) art 4.

52 Nations with a claim over parts of Antarctica are: Argentina, Australia, Chile, France, New Zealand, Norway and the United Kingdom.

53 *Agreement Governing the Activities of States on the Moon and Other Celestial Bodies*, opened for signature 18 December 1979, 1363 UNTS 3 (entered into force 11 July 1984) ('*Moon Agreement'*).

54 With the exceptions of France and India as signing but not ratifying parties.

55 Lyall and Larsen, above n 10, 169.

56 Ibid 170.

or dictionaries to fully understand some assertions.[57] The *res extra commercium* concepts closely link with the terms of article II of the *Outer Space Treaty*, but also the basic provisions of the *Moon Agreement.*[58]

It is here that the authors begin to discuss the interface between the principles of law and practice. Although it is relegated to a footnote, their inclusion of the case of *Nemitz v National Aeronautics and Space Administration*[59] is an interesting one. In that case, Nemitz sought to register an interest over Eros, an asteroid. When NASA landed their NEAR Shoemaker probe on the asteroid in 2001, Nemitz sent a bill to NASA for 'parking and storage'. Of course, they refused to pay and Nemitz sued. The US Court of Appeals for the Ninth Circuit dismissed Nemitz's appeal after the trial judge found against the Nemitz.[60] This proves an interesting point of state practice and treaty interpretation, one that is not discussed in any particular detail by the authors.

The *Moon Agreement* does actually provide for the ability to exploit the resources on the Moon (and other celestial bodies), although it is relatively ineffective in its current form. Despite this, the authors begin to describe the actions of states towards resource exploitation without the backing of the *Moon Agreement*. The most obvious of these is the provisions of the United States Code that allow American companies to apply for authorisation to exploit resources from celestial bodies.[61] There has been significant resistance to this though, with the United States Congress quoted as saying that 'the United States does not … assert sovereignty or sovereign or exclusive rights or jurisdiction over, or the ownership of, any celestial body', a line that concords with the concept presented in the *Nemitz* case above.[62] The authors raise the main contradictory argument that

> by granting to US citizens engaged in asteroid mining entitlement to any resource so [obtained], including rights of possession, ownership, transportation, use and sale, the new USC § 51303 is a sovereign act recognising rights of property, and would therefore appear to be an act of national appropriation.[63]

To further clarify this statement — and in what can only be regarded as an attempt at humour — the authors footnote the 'Duck Test' in respect of the above quote, that

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57 *Res extra commercium* is defined as 'things outside of commercial intercourse', an essential concept that is not explicitly conveyed in the text. Aaron Fellmeth and Maurice Horwitz, *Guide to Latin in International Law* (Oxford University Press, 2011) <http://www.oxfordreference.com/view/10.1093/acref/9780195369380.001.0001/acref-9780195369380-e-1822>.

58 *Moon Agreement* art 11.

59 *Nemitz v National Aeronautics and Space Administration* (9th Cir, No CV-03-00599, 10 February 2005).

60 Lyall and Larsen, above n 10, 171.

61 51 USC §51303 (2015).

62 Lyall and Larsen, above n 10, 184.

63 Ibid 185.

'[i]f it looks like a duck, walks like a duck, and quacks like a duck, it is a duck.'[64] This is a line that can only be interpreted as an opinion that the position of the United States will likely be in breach of their international obligations in the future.

Although there is potential for article II of the *Outer Space Treaty* to be breached as a consequence of the American legislation, the authors rightly recognise that there is no international opposition to this policy, with countries such as Luxembourg following suit and the IISL sitting on the fence on the matter, relying on the potential for subsequent state practice to inform the future of space law.[65] This chapter is a representative encapsulation of one of the most controversial issues in international space law. The authors recognise that there is no answer and no real reason to reach one yet: it will be dealt with 'when celestial mining becomes feasible.'[66]

III Part 2 — Commercial and Practical Law

Moving on from the basic principles that underpin outer space, as was foreshadowed in the introduction, the centre of the book is where the authors hit their stride, writing on the legal principles related to the more commercial and practical uses of outer space. This includes the regulation of radio communications and the International Telecommunications Unit ('ITU'),[67] unusual or developing uses of outer space,[68] environmental regulations,[69] navigation and communication,[70] remote sensing,[71] and the more delicate areas of finance and trade for space activities.[72]

A *The ITU Cannot Be That Complicated?*

It is interesting to see the development of organisations to meet the needs of evolving industries. One of the most prominent international organisations that has shaped itself to meet the needs of outer space operators is the ITU. The authors demonstrate their comprehensive knowledge of this area of law in what is one of the longer chapters of the book.

As is outlined in the first paragraph of the chapter, 'radio is integral to almost all uses of space', as without communication there would be no real use to infrastructure in

64 Ibid 186, n 126.

65 International Institute of Space Law, *Position Paper on Space Resource Mining* (20 December 2015) International Institute of Space Law <https://iislweb.org/docs/SpaceResourceMining.pdf>.

66 Lyall and Larsen, above n 10, 186.

67 Ibid ch 8.

68 Ibid ch 9.

69 Ibid ch 10.

70 Ibid chs 11, 12.

71 Ibid ch 13.

72 Ibid ch 14.

the domain.[73] The majority of present day regulation over radio communications is governed by the ITU. What is interesting, and noted by the authors, is the development of the ITU and how it fell into the role of regulating radio communications in outer space, a role that also sees it essentially regulate geostationary orbit.

In this book there is little reference to the activities of humans before the early 1900s, especially because there was no genuine capability to exploit space prior to this period. However, the authors begin their exploration of the ITU in the late 1800s, beginning with the inception of the telephone and telegrams as a method of international communications. On this background, to say that the authors skim over the ITU would be manifestly incorrect.

Delving into the detail of this chapter here is unlikely to do it justice. The authors should be commended for the way they explore the intricate detail of the three major instruments (Constitution, Convention[74] and Administrative Regulations[75]) that constitute the ITU and govern the activities of not only states, but private activities in the outer space domain. They also acknowledge the major limitations and challenges that face the organisation moving forward. It is here that we see the true application of the constitutive documents applied to practical and real-world situations. The commercialisation of outer space is seen as a great threat to many different aspects of outer space; primarily, the lack of overall control that comes with more actors and the privatisation of operations. When governments are the only parties acting in a domain, there is less risk of overt actions that blatantly contradict founding legal principles. This is not so with commercialisation due to international law's limit of only applying to states, not the citizens within them (subject to certain exceptions). As acknowledged by the authors, the ultimate power to control spectrum allocation (radio signals) is 'a matter for the sovereign power of a state'[76] and they recognise that the existing protocols in place that protect spectrum allocation could be ignored.[77]

From here the authors acknowledge that the ITU is heavily reliant on 'the practices of compromise and mutual accommodation' and that they fear that 'privatised commercial providers of space telecommunications may press their governments to engage in dispute for commercial rather than proper or procedural reasons' recognising the influence of 'free market' principles.[78] This very closely relates to the issue of spectrum congestion in the future, that with increasing commercial activities, the

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73 Ibid 189.

74 The Constitution and Convention of the ITU are grouped into a single document: ITU, 'Collection of the Basic Texts of the International telecommunication Union Adopted by the Plenipotentiary Conference' (2015) <http://search.itu.int/history/HistoryDigitalCollectionDocLibrary/5.21.61.en.100.pdf>.

75 The Administrative Regulations are split over a significant number of different, area specific, volumes. These can be viewed at: ITU, *Administrative Regulations Collection* <http://handle.itu.int/11.1004/020.1000/1>.

76 Lyall and Larsen, above n 10, 220.

77 Ibid.

78 Ibid.

existing spectrums that are ideal for orbital operations will become congested and ultimately lead to disputes between private actors and nations.[79] With internet and other 'radio reliant' services becoming viable operations in orbit, there is little that could be argued to rebuff the concerns of the authors in this context.

B *Space and Unusual Problems?*

'Unusual problems' is never expected to be a title in a textbook, but in the context of outer space it is not particularly surprising. This chapter contemplates three 'issues': space tourism, planetary defence, and small satellites in large constellations. These are not, per se, unusual, but scenarios that will arise with increasing frequency in the future. Space tourism and small satellite constellations are commercial issues that require a number of different points of law to be drawn together. Of the three, planetary defence is most likely the *unusual* one as it is something that is not frequently contemplated, unless you are a fan of the 'asteroid destroys the earth' genre of films. The most valuable component of this chapter is the traditional approach of applying law to fact in a clear and comprehensive way.

1 *Tourism*

Space tourism has begun to pick up momentum in the market.[80] In most instances, it is a precarious balance between sub-orbital flight and actual space flight, but the main concept is to sell flights into space. The authors raise a number of significant legal questions and correspondingly apply what is likely the most correct legal conclusions. Their methodology in approaching the legal questions is almost flawless, breaking the business into its practical parts beginning by clarifying that 'space tourism is a lawful use of space in terms of' the *Outer Space Treaty*.[81] Drawing on the principles from the *Outer Space Treaty, Rescue Agreement, Liability Convention*, radio regulations, and the importance of domestic space law, the concise summary of space tourism is well conceived. One thing that must be questioned is the pessimism of the authors when they assert, quite plainly, that '[s]pace tourism will involve disaster.'[82] Back to the positive, the use of foreshadowing the content of the book and considering the broader impacts of activities is effectively used, with recognition that the outer space environment is 'fragile because, unlike the Earth, outer space is not able to heal itself from the effects of human activities.'[83]

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79 Ibid 223.

80 For a relatively up to date collection of news and features about the increasing references to tourism in the space domain, see *Space Tourism: The Latest News, Features and Photos*, Space.com <https://www.space.com/topics/space-tourism>.

81 Lyall and Larsen, above n 10, 228.

82 Ibid 231.

83 Ibid 233.

2 *Planetary Defence*

As mentioned above, planetary defence is not something that comes to mind when thinking about outer space. The authors acknowledge that the majority of interest in this area comes from creatively named films such as *Meteor* (1979), *Asteroid* (1997), *Armageddon* and *Deep Impact* (both 1998).[84] As would be likely expected from Hollywood movies, the law does not play a major role in the storyline of each. What is most interesting about this analysis is that 'defending the planet' does not present any prima facie legal issues and the authors do not overtly consider any of the legal barriers to protecting the planet, focusing more on the administrative and political processes in place that recognise a threat to humanity.[85]

Although Hollywood has a fascination with nuclear weapons and stopping asteroids, scientists have suggested it would be unlikely that Bruce Willis' character in *Armageddon* would have been successful in his approach.[86] This would have been an opportunity to discuss the prohibition on 'nuclear weapons or any other kind of weapons of mass destruction' space,[87] and if any exceptions for the purposes of planetary protection could be reasonably sustained.

3 *Small Satellites and Large Constellations*

Many companies have already begun exploring the viability of large constellations of satellites to provide basic communications-based services. This is presenting one of the more pressing and contemporary issues facing the space sector moving forward. For example, SpaceX have received preliminary regulatory approval to launch 4425 small satellites to provide global internet services.[88] This is in addition to a number of other companies that have sought approval for large constellations (albeit not as large as those of SpaceX). Despite these types of constellations being given regulatory approval, the authors raise a number of legal questions and concerns, some which would clearly fall into the 'policy' category but should not be ignored merely because they are not 'legal'. It is well-acknowledged that this style of satellite deployment, alongside many of the advances in space technology, has been driven by the miniaturisation of technology and the corresponding decreases in initial costs.[89]

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84 Ibid 235.

85 Ibid 236–9.

86 University of Leicester, 'Bruce Willis Couldn't Save Us from Asteroid Doom' (Press Release, 7 August 2012) <https://www2.le.ac.uk/offices/press/press-releases/2012/august/bruce-willis-couldn2019t-save-us-from-asteroid-doom>.

87 *Outer Space Treaty* art IV.

88 Caleb Henry, 'FCC Approves SpaceX Constellation, Denies Waiver for Easier Deployment', *Space News* (online), 29 March 2018 <http://spacenews.com/us-regulators-approve-spacex-constellation-but-deny-waiver-for-easier-deployment-deadline/>.

89 Lyall and Larsen, above n 10, 240.

Small satellites, many of which fall into the 'CubeSat'[90] category, are designed to carry out a wide range of tasks, generally with a shortened expected life.[91]

As with tourism, the authors divide the issues and apply the relevant law accordingly, moving between treaties in a swift, accurate and concise manner. Of great significance is the references to debris and end-of-mission disposal, an issue that is of incredible importance when looking at small satellites, especially if they have short life spans.[92]

An extreme limitation of this chapter is its positioning. Right in the centre of the book, this chapter is not informed by the significant volume of commercial law that follows later in the book, making the analysis seem superficial and light. The chapter ticks the boxes when it comes to the relevant international law but seems to skim what will be the true limiting factors of any commercial venture: domestic law.

C *The Space Environment*

Many would not consider the space environment as a major factor that could influence how people operate in the domain. Environmental protection has increased in importance in recent decades, with it accurately recognised that '[i]t would be wrong to consider the law of the space environment as something separate, distinct and different from the concepts of terrestrial environmental law.'[93] Of course the outer space environment faces different threats when compared to Earth, but nonetheless they have the ability to impact on the long-term viability of space activities and access to the domain for all who wish to use it. Unsurprisingly for an instrument drafted in the mid-1900s, there is no overt consideration of the space environment in the *Outer Space Treaty*. There are a number of more terrestrial concepts that the authors attempt to import into orbit and beyond through the article III mechanisms under the *Outer Space Treaty*.[94] Of course, due to the nature of international law only binding parties if in treaty form unless a rule is custom,[95] the majority of the discussion in this chapter is related to customary international law, and unlike some previous suggestions by the authors, there is little that could be considered controversial in their discussion.

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90 CubeSats (cube satellites) are small satellites that are comprised of $10cm^3$ units. See California Polytechnic State University, *CubeSat Design Specification (CDS) Rev 13* (6 April 2015) <http://www.cubesat.org/s/cds_rev13_final2.pdf>.

91 Lyall and Larsen, above n 10, 240–1, n 82.

92 Ibid 244.

93 Ibid 245.

94 Ibid 246.

95 James Crawford, *Brownlie's Principles of Public International Law* (Oxford University Press, 8th ed, 2012) 31.

Drawing on concepts from the *Trail Smelter Arbitration*[96] and *Corfu Channel Case*,[97] the authors suggest that despite the lack of sovereignty in orbit, states and other actors in space must not cause detriment to another's activities. This assertion is then supported by drawing on a number of other instances of laws that prohibit the causing of harm to another despite 'such declarations and statements [being] largely chronicles of aspirations and intentions'.[98] The strongest restatement of an obligation to consider the environment cited by the authors comes from the 1996 *Legality of the Use by a State of Nuclear Weapons in Armed Conflict* Advisory Opinion by the International Court of Justice, where the majority clearly stated that

> [t]he existence of the general obligation of States to ensure that activities within their jurisdiction and control respect the environment of other States or of areas beyond national control is now part of the corpus of International Law relating to the environment.[99]

It is from this well-substantiated base that the authors launch into the more detailed transfer of environmental protections into outer space and the obligation to prevent contamination, congestion, and destruction of the environment. The authors do not stop here though; they quickly expand into the implications of geoengineering,[100] contamination of the earth by extraterritorial elements,[101] and pollution of orbit by debris.[102] It is orbital pollution and debris that have the most immediate implications for space activities and this is why the authors delve into the most detail about this, exploring the current space traffic management arrangements (as this generally includes the tracking of active satellites *and* debris/defunct orbital equipment), voluntary debris mitigation guidelines, and the implications of each.

The space environment is not an element of significant focus for many and historically it has been ignored. Reflecting on both the nuances of long-standing international law and the need to protect the space environment, the authors have truly embraced the importance of this developing area of law.

D *What Do We Use Space For?*

The bulk of the book is taken up by a discussion of what outer space is actually used for: service provision. In three chapters, the authors discuss satellite communication and direct broadcasting, navigation systems, and remote sensing, with each going

96 *Trail Smelter (United States v Canada) (Awards)* (1941) 3 1905 RIAA.

97 *Corfu Channel Case (United Kingdom v Albania)* [1949] ICJ Rep 4.

98 Lyall and Larsen, above n 10, 247.

99 Ibid 249; *Legality of the Use by a State of Nuclear Weapons in Armed Conflict (Advisory Opinion)* [1996] ICJ Rep 226, 241–2 [29].

100 Lyall and Larsen, above n 10, 258.

101 Ibid 252.

102 Ibid 264.

into great detail about not only the law relevant to each of those areas, but the bodies that have shaped the law and industries as they stand.

Drawing on state practice, international law, domestic law, and other persuasive instruments that exist, these central chapters explore the policy, administrative, and legal complications related to the daily and ordinary uses of outer space, the uses that are mostly overlooked by the ordinary person and will not be considered here in great detail due to the significant depth the authors consider the issues in.

IV Modern Space: Exploitation For Advantage

A *Commercialisation and Commercial Law*

Launches of commercial payloads are almost a weekly occurrence now — companies such as American SpaceX and United Launch Alliance consistently aim for increased launch frequency from their North American bases, while the French-based Ariane-Space, Indian ISRO, and New Zealand-based Rocket Lab add to the consistency of the launch industry.[103] Although it is easy to marvel at the technological capability behind these endeavours, it is important to remember the presence of significant legal barriers. Just as nations are faced with highly restrictive international obligations, these companies must navigate complex domestic regulatory regimes while trying to remain profitable. It is easy to forget that rockets are incredibly expensive, making it difficult to break into the space industry without significant financial backing. Lyall and Larsen explore the issues that face commercial operators in remarkable detail in chapters 14 and 15, touching on the little considered issues of commercial financing and trade restrictions, and domestic laws that contemplate space respectively.

1 *Finance in Space?*

Funding is the grand equaliser of the commercial space industry. No matter the company structure, technology involved or innovative approach to launching, there is a significant cost involved in reaching orbit, generally in the tens of millions of dollars for contracting a large payload launch[104] and the hundreds of millions (if not billions) of dollars to be able to develop rocket technology.[105] The authors recognise this, and in a chapter that could have been incredibly dry, they comprehensively

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103 Avery Thompson, 'SpaceX Wants to Launch 30 Rockets in 2018', *Popular Mechanics* (online), 23 November 2017 <https://www.popularmechanics.com/space/rockets/a13858802/spacex-wants-to-double-its-number-of-launches-in-2018/>; Rocket Lab, *Rocket Lab 'Its Business Time' Launch Window to Open 20 April 2018 NZT* (3 April 2018) <https://www.rocketlabusa.com/news/updates/rocket-lab-to-launch-first-commercial-mission-this-month/>.

104 SpaceX, *Capabilities and Services* <http://www.spacex.com/about/capabilities>.

105 NASA Associate Deputy Administrator for Policy, 'Falcon 9 Launch Vehicle NAFCOM Cost Estimates' (August 2011) 2 <https://www.nasa.gov/pdf/586023main_8-3-11_NAFCOM.pdf>.

cover the restrictions and primary international instruments that regulate financing of space activities and objects.

The authors introduce this part by recognising the importance of domestic law, that the law of where a company is incorporated, where they operate, or where they contract will always be of paramount significance and influence their ability to raise funds and conduct space activities.[106]

When considering finance, the authors tackle, in a relatively concise manner, two main approaches; registration of security interests in space objects (or a company's holdings) and capital raises, with the majority of the chapter considering the former due to the more solidified private international law in the area. As foreshadowed above, domestic law is not to be ignored, with the authors recognising its importance and the capability to register interests in company property in a large number of jurisdictions. Although the authors focus mainly on the United States Uniform Commercial Code, while briefly stopping by the more convoluted approach in Europe, the approach to describing the regimes makes it easy for any informed reader to draw analogies with their own domestic law.[107] For example, it is clear to see how the Australian *Personal Property Securities Act 2009* (Cth) can be used to allow companies to leverage the technology they are developing to raise funds.[108]

This is where the domestic analysis ceases and the authors move to private international law, specifically the *Cape Town Convention*.[109] This optional convention established a set of international rules and mechanisms as to how interests in rail, aviation, and space assets are to be registered so as to protect a debtor's rights when assets are moved between jurisdictions (or in the case of aviation and space assets, moved into regions outside of the jurisdiction of any state). The text of the Space Protocol to the Convention was agreed to in 2012 with a significant amount of pushback from the industry it sought to regulate.[110] From the outset, as the authors do, it is important to note that for the protocol to come into force it needs 10 ratifications but at the time of publication, the book recorded only four.[111]

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106 Lyall and Larsen, above n 10, 388.

107 Ibid 388–9.

108 *Personal Property Securities Act 2009* (Cth). For those unfamiliar with the Australian *Personal Property Securities Act*, it allows the registration of interests against property for a broad variety of tangible 'goods', 'including satellites and other space objects': s 10 (definition of 'goods').

109 *Cape Town Convention on International Interests in Mobile Equipment*, opened for signature 16 November 2001, 2307 UNTS 285 (entered into force 1 March 2006).

110 Lyall and Larsen, above n 10, 394; *Protocol to the Convention on International Interests in Mobile Equipment on Matters Specific to Space Assets*, opened for signature 9 March 2012 (not yet in force) <https://www.unidroit.org/english/conventions/mobile-equipment/spaceassets-protocol-e.pdf>.

111 Lyall and Larsen, above n 10, 393.

This Convention provides groundwork for the international equivalent of a domestic register of interests while attempting to overcome the complexities associated with international mobility. The book thoroughly engages with issues related to registration of interests in space objects, the administrative backing behind such a system, and the broader compatibility with public international law.

Despite this, the authors note the variability in the space industry by raising the concerns of nearly 100 concerned parties from across the world and the complaints they made in a joint letter to the administering body of the Convention in 2012.[112] It is here that the authors recognise the diversity of approaches in a commercial setting, that some companies will be capable of raising funds through shares, venture capital, or other investments that do not require security interests in space objects. The authors only cautiously look to why the space industry has rejected the Convention, acknowledging complaints as to the burden that may be imposed. What they do not do is extend their analysis beyond the primary evidence. While it is likely that many companies merely hold disdain for the scheme as it may hold them liable, internationally, for their debts, it is not an assertion that is made by the authors. Considering the reluctance of the industry to accept the *Cape Town Convention* the authors clearly, and accurately, assert that it is likely that not all who enter the space sector can do so without security and that this Convention, when entering a more mature phase, will no doubt become useful.

2 *Domestic Space Law*

Held until quite late in the book, Chapter 15 is titled 'Commercial activities and the implementation of space law'. On its face this is slightly misleading, with the chapter more dedicated to examples of domestic space law, very much in the vein of chapters in a multiplicity of other books in the market.[113] Where the authors have tried to expand upon the work of others is by including an introduction to the major obligations that need to be included in domestic instruments, much of which is explained in significant and intricate detail early within the book. What must be commended is the way in which the authors have intertwined practical examples, such as the on-orbit transfer of satellites between INTELSAT and New Skies NV,[114] in a way that draws on the much larger and more complex analysis and interpretation introduced earlier in the text.

Recognising this, the authors skilfully provide an overview of a topic that could easily span hundreds of pages; providing a basic overview and context for the domestic space law of Australia, China, India, Russia, the United Kingdom, and the United States. The approach is relatively simple, drawing on real world and practical examples from these jurisdictions and highlighting the unique points of policy and law that exist in each. This is a relatively concise approach when compared to volumes such as von der Dunk's *Handbook of Space Law* that discusses in excess of 15 nations' domestic space laws and policy.[115] When comparing the two though,

112 Ibid 394.

113 See, eg, von der Dunk, above n 5, 127.

114 Lyall and Larsen, above n 10, 417.

115 von der Dunk, above n 5, 127.

the detail is much more refined in the Lyall and Larsen volume, to the benefit of the casual reader and the more experienced space lawyer who needs an accurate, yet succinct, summary of major space laws internationally.

B *Militarisation*

A fact that is frequently forgotten when looking to the development of space activities is the inherent military character of its development. Whilst it would be misleading to say that outer space is completely 'militarised', it would be naïve to claim that all uses of orbit are commercial and possess a non-military purpose, a point the authors clearly articulate by saying that 'almost all space activities *can* have a military aspect'.[116] In many circles, outer space is referred to as the 'high ground',[117] a concept the authors link with Sun Tzu's *The Art of War* and the strategic advantages of occupying geographically higher positions in conflict.[118] The authors articulate the benefit of orbit strategically, stating that

> [a] country in possession of unique advanced space technology and with the will and means to use it for military purposes might achieve dominance over non-space-faring countries and otherwise impose its will.[119]

Recognising this, the military uses of outer space interact with all other uses. Reckless militarisation jeopardises not only the safety of humankind on earth, but also access to the space domain itself. It is from here that the authors turn their mind to the restrictions that exist in space law.

In an effective analysis, the authors draw on broader international law to inform the position of military activities in outer space. Many academics, when approaching the question of whether military activity in outer space is permitted, start with the principle articulated in article IV of the *Outer Space Treaty*, that space is only to be 'exclusively for peaceful purposes'.[120] Departing from this custom, the authors begin with their assessment of international law more broadly, providing the history and context of military activities in outer space, and space-specific international law restrictions before they reach the question of whether the use of 'peaceful purposes' prohibits any military activity in outer space. This is justified by the need to first appreciate 'the context of the technologies and actual use of space' before any decision as to the lawfulness of military activities in outer space is made.[121] Restricting the emphasis on the significance of the phrase, the authors adopt a practical and

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116 Lyall and Larsen, above n 10, 448 (emphasis added).

117 Dale Stephens, 'Increasing Militarization of Space and Normative Responses' in R Venkata Rao, V Gopalkrishnan and Kumar Abhijeet (eds), *Recent Developments in Space Law: Opportunities & Challenges* (Springer, 2017) 91, 93.

118 Lyall and Larsen, above n 10, 447.

119 Ibid.

120 *Outer Space Treaty* art IV.

121 Lyall and Larsen, above n 10, 468.

realistic approach to restating the law as it is, not as many other academics may wishfully interpret it to be.

Militarisation and military activities in outer space are discussed in a practical manner, linking the content with that already presented, using a building block approach. This chapter truly recognises the issues going forward by looking to the past actions of nations. In the current context of the private actor reigning supreme, it is recognised that space will not eternally be free of conflict and that the 'inter-dependence of military and commercial policies' may result in conflicting ideologies and eventual military engagements in the domain.[122]

C *SETI*

What is likely the most unique analyses of Lyall and Larsen's entire volume is their inclusion of the legal issues related to the search for extraterrestrial intelligence ('SETI'). Capitalising on what is now a clearly established approach of compounding areas of law to explore the legal issues in more depth, the authors consider the background of the search for extraterrestrial life, current scientific programs, and the interaction with international telecommunications law, the basic principles in the space treaties and the broader international law. Finally, they move into considering the documents that contemplate detection and first contact with extraterrestrial intelligence. So as not to spoil the content of the unique and engaging chapter, this review will not delve into the intricate detail, but merely remark that it has been constructed in an intuitive manner that exemplifies the positives of this book and its ability to progressively increase the complexity of the law considered, while ensuring it is conveyed in an accessible manner.

V Conclusion

As has been discussed throughout this review, space law is complicated and it faces many issues moving into the future. The second edition of *Space Law: A Treatise* does well to present the vast content of space law in a generally accessible and accurate manner, a difficult task when one acknowledges the vagaries of many components and the inconclusive nature of many doctrines, especially in the modern context. It clearly identifies many of the frequent practical issues with the law of outer space, while providing incredibly deep and intricate background to how the said law has been developed, while also acknowledging that many who write in this field are ignorant of the broader international law and contextual significance of the law of outer space.[123] In most instances, the law has been portrayed in a well-accepted manner, with conflicting views recognised. There are times where the authors falter, but this is insignificant when compared to the broader content of their book, one which achieves their aim of providing a 'fresco' of space law that is accessible by a broad range of individuals, no matter their background.

122 Ibid 476.

123 Ibid 510.