

Space Settlement Governance: An Overview of Legal and Policy Issues

Final Summary

for the

Mohammed Bin Rashid
Global Space Settlement Challenge



Centre for a Spacefaring Civilization

+44 (0) 7561864231 info@spacefaringcivilization.space www.spacefaringcivilization.space

Centre for a Spacefaring Civilization Ltd
Registered Office Address: 14 Waltham Road Gillingham Kent ME8 6XQ
Company Limited by Guarantee Registered in England and Wales (Company No: 11084036)

Web: Spacefaringcivilization.space
Twitter: @spacefaringciv

Released under a Creative Commons Attribution, Non-Commercial, No Derivatives 4.0
International Licence - <https://creativecommons.org/licenses/by-nc-nd/4.0/>

Written by
Thomas Cheney
Email: tcheney@spacefaringcivilization.space
Twitter: @thomcheney

This project received seed funding from the Dubai Future Foundation through Guaana.com
open research platform

About the Centre for a Spacefaring Civilization

The Centre for a Spacefaring Civilization is an independent think tank and research centre focused on space law and policy, specifically those issues that need to be addressed in order for humanity to become a spacefaring civilization. We take a holistic and multidisciplinary view of the field and promote the sustainable and equitable development of space, keeping in mind the interests of all nations and peoples. We are headquartered in the United Kingdom but are virtually operated and globally focused. The Centre for a Spacefaring Civilization aims to be a credible and objective source of leadership and information on space law and policy topics. We take a global, long term, and multidisciplinary approach to these issues and seek to forge relations based on mutual respect, trust, and transparency.

Our Mission

To further, advance and aid the legal and policy debates on those issues that need to be addressed and discussed in order to facilitate the development of humanity as a spacefaring civilization. In pursuit of this the Centre for a Spacefaring Civilization will work with governments, industry, academia, nongovernmental, intergovernmental, and international organizations, our supporters, and globally minded citizens to ensure the secure, sustainable, and peaceful development of space in the interests, and for the benefit of all of humanity.

Our Vision

To create and promote the legal, and policy developments needed in order to facilitate humanity's transformation into a spacefaring civilization.

Table of Contents

Abbreviations	4
Executive Summary	5
Main findings	5
Outputs	8
Obstacles and Changes	9
Impact and Implementation	9
Conclusion and Next Steps	10
Bibliography	11

Abbreviations

IAC – International Astronautical Congress

ISS – International Space Station

OST – Outer Space Treaty

UAE – United Arab Emirates

UK – United Kingdom of Great Britain and Northern Ireland

UNCOPUOS – United Nations Committee on the Peaceful Uses of Outer Space

UNGA – United Nations General Assembly

UNOOSA – United Nations Office of Outer Space Affairs

USA – United States of America

Executive Summary

This project examined the legal, policy, and governance issues involved in establishing, maintaining, and growing space settlements whether in outer space or on the Moon or any other celestial body. The project examined the existing legal framework, and how it may need to adapt and evolve, with specific examination of concepts such as those of ‘space object’, and ‘astronaut’ which are inadequately defined in the space treaties and may not even be appropriate for space settlements. This was done with the view to preserving as much of the existing space law framework as possible and with respect for the principles of freedom of use and exploration, and the non-appropriation principle codified in Articles I, and II of Outer Space Treaty¹ respectively. This project looked at existing space law, historical and other relevant analogous models. It also involved taking a multi- and inter- disciplinary approach undertaking a legal, political, historical, and ethical analysis of the governance of human societies on Earth and in outer space.

This project serves as an initial survey to a broader body of work on space settlements, which will be continued by the Centre for a Spacefaring Civilization for the foreseeable future. The topic of space settlements is growing in importance and interest, particularly with the increased attention to the ‘Moon Village’ concept and the development of the United States’ Deep Space Gateway, additional impetus is provided by such endeavours as the UAE’s Mars 2117 project and, of course, Elon Musk’s continually expressed desire to ‘colonize’ Mars. Space settlement will not be possible without consideration of governance issues. Humans are complex, social and political beings, and without understanding these issues space settlement is not viable. Therefore, further work on these issues is urged, and the Centre for a Spacefaring Civilization will endeavour to develop this project further.

This project made no attempt to define ‘space settlement’, terms such as ‘station’, ‘installation’, ‘outpost’, and ‘settlement’ are used interchangeably and are meant to refer to long duration facilities of any size, duration, and purpose. This project is meant as a general survey of the issues that need to be addressed rather than a specific examination of any one proposal.

Main Findings

The key main finding of this project is that stations, installations, outposts and settlements are indeed permitted under international space law. That is not to say that there are not potential issues or hurdles, but the space treaties allow for such endeavours, within constraints. This is not only true owing to a broad application of the freedom of use of outer space codified in Article I of the Outer Space Treaty but made clear by Article XII OST:

All stations, installations, equipment and space vehicles on the Moon and other celestial bodies shall be open to representatives of other States Parties to the Treaty on a basis of reciprocity.

While it is true that there is no definition provided for either ‘station’ or ‘installation’ this suggests a broader interpretation of the terms rather than a narrower, more restrictive one. In short, the drafters of the Outer Space Treaty could have specified what they meant by “stations,

¹Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies (adopted 27 January 1967, entered into force 10 October 1967) 610 UNTS 205 (Outer Space Treaty/OST)

installations, equipment and space vehicles” but they chose not to. This coupled with the broad ‘freedom of use’ in Article I of the Outer Space Treaty means that stations, installations, outposts and settlements are, generally speaking, permitted. Furthermore, despite the ‘failure’ of the Moon Agreement² to achieve widespread acceptance, it is still worth considering that the Moon Agreement contains provisions regarding ‘stations’ and ‘installations’ on the Moon and other celestial bodies in six of its articles (8-12 and 15). This further supports the interpretation that the Outer Space Treaty allows for such activities.

However, as mentioned, that is not to say that there are not potential hurdles to outposts, stations, installations or settlements, in outer space, on the Moon, or other celestial bodies. The most significant specific obstacle is the prohibition, codified in Article II OST, on the national appropriation of outer space, the Moon or other celestial bodies “by claim of sovereignty, by means of use or occupation, or by any other means.” While the full implications of this prohibition are, as yet, unclear, it is clear that this means that one cannot claim territory on a celestial body. There may be additional issues for plans to use in situ resources, like using lunar regolith for construction of the European Space Agency’s proposed Moon Village, although recent developments with regards to space resources owing to the recently enacted laws in the United States³ and Luxembourg⁴, as well as the work of The Hague Space Resources Governance Working Group⁵, and discussions at the Legal Subcommittee of the United Nations Committee on the Peaceful Uses of Outer Space (UNCOPUOS)⁶ suggest that there is a growing acceptance of the idea that use of space resources for such purposes does not, per se, constitute appropriation. Though the establishment of permanent installations on a portion of the surface of a celestial body may be considered appropriation, especially if, as some are proposing, one claims an ‘exclusion’ or ‘safety zone’ around the outpost, installation or settlement, particularly as the right to exclude is one of the key components of the ‘bundle’ of property rights and directly conflicts with the freedom of access principle codified in Article I OST.

One potential ‘solution’ that this project has identified is the use of the ‘space object concept.’ While there is no clear definition of ‘space object’ provided by the space treaties it is possible to identify a working definition from establish practice, which can be approximated as a ‘human made object launched into outer space’. ‘Space objects’ cover a wide range of things from the smallest nanosats to segments of the International Space Station (which is considered

²Agreement Governing the Activities of States on the Moon and Other Celestial Bodies (adopted 18 December 1979, entered into force 11 July 1984) 1363 UNTS 3 (Moon Agreement)

³US Commercial Space Launch Competitiveness Act, Public Law 114-90, 114th Congress, 25 November 2015, 51 U.S.C, Title IV

⁴Loi du 20 juillet 2017 sur l’exploration et l’utilisation des ressources de l’espace - (Law of 20 July 2017 on the exploration and use of space resources) Doc. parl. 7093; Sess. Ord. 2016-2017 - <http://data.legilux.public.lu/file/eli-etat-leg-loi-2017-07-20-a674-jo-fr-pdf.pdf>

⁵The Hague Space Resources Governance Working Group (2017) ‘Draft Building Blocks for the Development of an International Framework on Space Resource Activities’ Accessed at: <https://www.universiteitleiden.nl/binaries/content/assets/rechtsgeleerdheid/instituut-voor-publiekrecht/lucht--en-ruimterecht/space-resources/draft-building-blocks.pdf>

⁶UNCOPUOS, Report of the Legal Subcommittee on its fifty-fifth session, held in Vienna from 4 to 15 April 2016, UN Doc A/AC.105/1113; UNCOPUOS, Report of the Legal Subcommittee on its fifty-sixth session, held in Vienna from 27 March to 7 April 2017, UN Doc A/AC.105/1122; UNCOPUOS, Report of the Legal Subcommittee on its fifty-seventh session, held in Vienna from 9-20 April 2018, UN Doc A/AC.105/1177

an assemblage of space objects rather than a single space object in and of itself.) Given that any station, outpost, installation, or settlement will have to exist within a sealed pressurised environment (like the ISS) they will therefore be constructed out of space objects. Therefore, the station, installation, outpost, or settlement could be said to simply be the space object therefore there is not necessarily any need to claim ‘territory’ on the Moon or any other celestial body. The concerns prompting requests for ‘exclusion’ or ‘safety’ zones could be dealt with under the provisions in Article IX of the Outer Space Treaty requiring an avoidance of ‘harmful interference’ with the activities of other States Parties, as well as the liability regime elaborated in Article VII OST and the Liability Convention⁷.

This approach is not without problems of its own, not least of which the fact that the concept of space object relies on an object having been ‘launched’ into outer space from Earth and therefore may not apply to objects constructed in outer space particularly if they are constructed from material derived from the Moon or other celestial bodies. However, it is worth noting that Article VIII OST states that:

ownership of objects launched into outer space, **including objects landed or constructed on a celestial body**, and of their component parts, is not affected by their presence in outer space or on a celestial body or by their return to the Earth. (authors emphasis)

Indicating that objects constructed on celestial bodies would still fall within the definition of a ‘space object’, however this still leaves objects ‘in space’ in a potential state of ‘legal limbo’. There are further definitional issues that the international community needs to address, one such is the term ‘astronaut’. Again, there is no clear definition of the term ‘astronaut’ provided by the space treaties, and indeed the term ‘personnel of spacecraft’ is used instead in several places. This is relevant for a few reasons, first the space treaties contain provisions regarding the rescue and return of astronauts (Article V OST and the Rescue Agreement⁸) as well as endowing them with the status of ‘envoys of mankind’. However, none of the rescue or return provisions are far from deviating from the general principles of humanity which would require the rendering of assistance to those in distress anyway, nor does the status ‘envoy of mankind’ have much in the way of effect, it certainly does not convey diplomatic status on ‘astronauts’. Regardless, there is value in the conversation about how we wish to consider those who will make space their ‘home’.

An additional finding of this project is the need to consider multijurisdictional issues that will arise given the inevitable international nature of any such space station, installation, outpost or settlement. There are a few ways that jurisdictions can overlap. First is ‘territorial’ or ‘quasi-territorial’, this manifests itself as the ‘owners’ of space objects have jurisdiction over their space object, this is not necessarily an issue for single State projects such as Tiangong or Mir but is an issue on the International Space Station as one can move from Russian, American, ‘European’, and Japanese segments within a matter of minutes. This is a potential problem as States also have jurisdiction over their nationals in outer space on a personal (i.e. non-

⁷Convention on International Liability for Damage Caused by Space Objects (adopted 29 March 1972, entered into force 1 September 1972) 961 UNTS 187 (Liability Convention)

⁸Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space (adopted 22 April 1968, entered into force 3 December 1968) 672 UNTS 119 (Rescue Agreement)

territorial) basis so a Russian in an American section could be subject to both the jurisdiction of Russia and the United States. Article 22 of the ISS Agreement⁹ provides a mechanism for dealing with any such conflicts however it has never been tested and is lacking in its clarification.

A further major finding was looking further ahead to the future and considering the process of 'state creation' in outer space. There are several issues regarding state creation in outer space, including the non-appropriation principle already mentioned, however one of the key issues is defining 'territory.' As mentioned, the non-appropriation principle precludes claiming 'territory' per se on the Moon or other celestial bodies however there may be a solution in the 'space object' by using that as 'territory' rather than the bit of celestial body it sits on. That said, there is a general prohibition on using 'artificial' constructs (islands) as 'territory', this was codified in the United Nations Convention on the Law of the Sea¹⁰. However, there may be a possibility of creating a 'special rule' just for use in the unique environment of outer space.

There are also numerous governance, and even societal and sociological issues, that need to be examined in greater detail. There will need to be consideration of the differing needs based on size, location and purpose (a research base vs mining camp, for example). Antarctica will serve as an excellent model and analogue, especially given that it is likely that the developments in outer space will closely mirror those on that continent. This ties in with the general overall finding of the project, which is that legal, policy, governance, social science and humanities studies need to be given greater attention, funding and support if space settlements are to be viable. After all while life support systems, energy production and other engineering and scientific challenges are important it is important to remember that a settlement is literally nothing without people, and there's more to people than oxygen, water and food.

Outputs

So far there have been two outputs from this project, a paper entitled, 'Moon Villages, Mars Cities and Space Nations: State and Nation Creation in Outer Space' which was presented at the University of Glasgow's Law Postgraduate Conference and an interactive presentation entitled 'Developing and Adapting Space Law to Govern Long Term and Permanent Human Settlement of Outer Space, the Moon and Other Celestial Bodies' which was presented as part of the International Institute of Space Law's 61st Colloquium on the Law of Outer Space during the International Astronautical Congress in Bremen, Germany. There are plans for further presentations based on developments from this project at the IACs in 2019 and 2020 as outlined in the further work section of this final summary. There is also a research paper which is currently looking for a place for publication and plans for shorter briefing and policy papers which will be released under the auspices of the Centre for a Spacefaring Civilization in due course. Finally, as, again, mentioned elsewhere in this final summary we are looking at producing a multiauthor, multidisciplinary volume covering a range of issues relating to space settlement governance.

⁹Agreement 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 (adopted 29 January 1998, entered into force 29 January 1998) TIAS 12927 (ISS Agreement)

¹⁰United Nations Convention on the Law of the Sea (adopted 10 December 1982, entered into force 16 November 1994) 1833 UNTS 397 (UNCLOS)

Obstacles and Changes

The main obstacle was simply the breadth and depth of the topic. This was especially problematic given that we were considering generic proposals. However, this highlights great opportunity for future research, especially as there has been limited consideration of the issues specifically relating to the governance of space settlements by the space law and policy community. This needs to be remedied given the increasing number of proposals for space settlements, outposts and bases that are being made by governments, space agencies and independently funded visionaries. However, this did mean that this project formed more of a general survey of the topic that was initially intended, that said, that does of course have significant value for the topic and the field as it highlights the key issues that need further investigation and study.

As for changes of direction, there was less consideration of the sociological aspects than was initially intended, and this was mainly a product of availability of research partners capable of carrying out this research and the time available for the project. However, this will be a key area for further study as the work that was done under the project has highlighted the need to understand how humans operate with governance structures and physical systems particularly in remote and hostile locations in order to better understand how to construct effective governance structures for outer space settlements, outposts and bases.

While the project itself has not experienced a change of direction, there will be one undertaken for the immediate follow up work to be done, this will involve looking more closely at specific proposals and existing facilities like the International Space Station, the Deep Space Gateway, the Moon Village and the Mars 2117 project.

Impact and Implementation

The most obvious and immediate potential impact is the ability to influence decision making regarding the Deep Space Gateway, Moon Village and Mars 2117, as well as private sector endeavours such as those proposed by SpaceX's Elon Musk. This project and subsequent work will contribute to a much needed and underexplored debate on the governance structure for space settlements. Beyond direct implementation by decision makers and policy actors, we will be looking to publish a multi-author volume covering a range of topics relating to space settlements and continue to present the existing findings and future findings at key conferences and events as well as relevant open access journals. This project has and will continue to inform and influence the ongoing debate and discussion regarding the nature of governance of space settlements, which as has been highlighted in this summary, is of vital importance to the success of any such endeavour.

Conclusion and Next Steps

The main conclusion from this product is that the space settlement will not be possible without consideration of legal policy and governance issues. Humans are complex, social and political beings, and without understanding these issues space settlement is not viable. Therefore, further work on these issues is urged, and the Centre for a Spacefaring Civilization will endeavour to develop this work further.

This further work will involve the conduction of a sociological examination of the nature of remote societies and outposts, Antarctic research bases in particular, this will involve expanding the existing project team to include sociological researchers. Additionally, we will aim to conduct research from a political science perspective which would encompass decision-making, governance structures, policy making and implementation in remote locations. This work could then connect with the above-mentioned sociological research.

However, the immediate further work will involve a specific, deeper, examination of the legal and policy frameworks behind the Deep Space Gateway and the Moon Village, the intention would be to present these findings at the International Astronautical Congress in Washington D.C. in October 2019. In conjunction with this would be an examination of the same issues but looking at the UAE's Mars 2117 project but with the aim of presenting that project at IAC 2020 in Dubai. There are initial plans to present a multiauthor, multidisciplinary volume on space settlement governance.

Bibliography

Treaties

- 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 (adopted 29 January 1998, entered into force 29 January 1998) TIAS 12927 (ISS Agreement)
- Agreement Governing the Activities of States on the Moon and Other Celestial Bodies (adopted 18 December 1979, entered into force 11 July 1984) 1363 UNTS 3 (Moon Agreement/MA)
- Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space (adopted 22 April 1968, entered into force 3 December 1968) 672 UNTS 119 (Rescue Agreement)
- Convention on International Liability for Damage Caused by Space Objects (adopted 29 March 1972, entered into force 1 September 1972) 961 UNTS 187 (Liability Convention)
- Convention on Registration of Objects Launched into Outer Space (adopted 14 January 1975, entered into force 15 September 1976) 1023 UNTS 15 (Registration Convention)
- Montevideo Convention on the Rights and Duties of States (adopted 26 December 1933, entered into force 26 December 1934) 165 LNTS 19; 49 Stat 3097
- Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies (adopted 27 January 1967, entered into force 10 October 1967) 610 UNTS 205 (Outer Space Treaty/OST)
- United Nations Convention on the Law of the Sea (adopted 10 December 1982, entered into force 16 November 1994) 1833 UNTS 397 (UNCLOS)

Legislation

- Commercial Space Launch Amendments Act, Public Law 108–492, 108th Congress, 23 December 2004, 49 U.S.C. §70101 (United States)
- Loi du 20 juillet 2017 sur l’exploration et l’utilisation des ressources de l’espace - (Law of 20 July 2017 on the exploration and use of space resources) Doc. parl. 7093; Sess. Ord. 2016-2017 - <http://data.legilux.public.lu/file/eli-etat-leg-loi-2017-07-20-a674-jo-fr-pdf.pdf> (Luxembourg)
- Outer Space Act 1986, Chapter 38 (United Kingdom)
- Space Activities Act 1998* (Cth) (Australia)
- US Commercial Space Launch Competitiveness Act, Public Law 114-90, 114th Congress, 25 November 2015, 51 U.S.C, Title IV (United States)

UN Documents and Resolutions

- UNCOPUOS ‘Status of International Agreements Relating to Activities in Outer Space as at 1 January 2018’ (9 April 2018) UN Doc A/AC.105/C.2/2018/CRP.3
- UNOOSA, ‘Accession by Venezuela (Bolivarian Republic of) to the Agreement Governing the Activities of States on the Moon and Other Celestial Bodies’ (3 November 2016) UN Doc C.N.829.2016.TREATIES-XXIV.2 (Depositary Notification)
- UNCOPUOS, Report of the Legal Subcommittee on its fifty-fifth session, held in Vienna from 4 to 15 April 2016, UN Doc A/AC.105/1113

UNCOPUOS, Report of the Legal Subcommittee on its fifty-sixth session, held in Vienna from 27 March to 7 April 2017, UN Doc A/AC.105/1122

UNCOPUOS, Report of the Legal Subcommittee on its fifty-seventh session, held in Vienna from 9-20 April 2018, UN Doc A/AC.105/1177

UNGA Res 1721 (20 December 1961) UN Doc A/RES/1721 (XVI)

Articles

‘Elon Musk Unveils Plan to Build City on Mars ‘in our lifetimes’’ *Sky News* (28 September 2016) <https://news.sky.com/story/elon-musk-unveils-plan-to-build-city-on-mars-in-our-lifetimes-10596540>

P.J. Blount, ‘Renovating Space: The Future of International Space Law’ (2012) 40 *Denv. J. Intl’l L & Pol’y* 515

PJ Blount and Christian J Robison (2016) ‘One Small Step: The Impact of the U.S. Commercial Space Launch Competitiveness Act of 2015 on the Exploitation of Resources in Outer Space’ 18 *North Carolina Journal of Law and Technology* 160

Laurence Cawley, ‘The Off-shore Fort ‘State’ of Sealand Marks 50 Years’ *BBC News* (2 September 2017) <http://www.bbc.co.uk/news/uk-england-suffolk-41135081>

Gennady M. Danilenko (2016) ‘International Law-making for Outer Space’ 37 *Space Policy* 179

Nicola Davis, ‘Will You Become A Citizen of Asgardia, the first nation state in space?’ *The Guardian* (12 October 2016) <https://www.theguardian.com/science/2016/oct/12/will-you-become-a-citizen-of-asgardia-the-first-nation-state-in-space>

Paul G. Dembling and Daniel M. Arons (1966) ‘The United Nations Celestial Bodies Convention’ 33 *J. Air L. & Com.* 535

Paul G. Dembling and Daniel M. Arons (1967) ‘The Evolution of the Outer Space Treaty’ 33 *J. Air L. & Com.* 419

Loren Grush, ‘Elon Musk Teases Pictures of a SpaceX Moon Base and Martian City’ *The Verge* (28 September 2017) <https://www.theverge.com/2017/9/28/16382716/spacex-elon-musk-moon-base-alpha-mars-colonization-interplanetary-transport-system>

Paul B. Larsen ‘Asteroid Legal Regime: Time for a Change?’ (2014) 39 *J. Space L.* 275

Ricky J. Lee ‘Article II of the Outer Space Treaty: Prohibition of State Sovereignty, Private Property Rights or Both?’ (2004) 11 *Aust. Int’l L. J.* 128

Michael Listner, ‘Iridium 33 and Cosmos 2251 three years later: where are we now?’ *The Space Review* (13 February 2012) <http://www.thespacereview.com/article/2023/1>

Christopher J. Newman (2016) ‘Exploring the Problems of Criminal Justice in Space’ 2 *Room 8* <https://room.eu.com/article/exploring-the-problems-of-criminal-justice-in-space>

Christopher J. Newman, ‘Seeking Tranquillity: Embedding Sustainability in Lunar Exploration Policy’ (2015) 33 *Space Policy* 29

Ian Sample, ‘Is a Moon Village the Next Step for Space Exploration? ESA’s Chief Thinks So’ *The Guardian* (23 September 2016) <https://www.theguardian.com/science/2016/sep/23/is-a-moon-village-the-next-step-for-space-exploration-esas-chief-thinks-so>

Gabriella Catalano Sgrosso (1998) ‘Legal Status, Rights and Obligations of the Crew in Space’ 26 *J. Space L.* 163

James S.J. Schwartz ‘Worldship Ethics: Obligations to the Crew’ (2018) 71 *Journal of the British Interplanetary Society* 53

James Titcomb ‘Mars City: Human Missions to Space Colony Will Start in 2024, Elon Musk Says’ *The Telegraph* (29 September 2017)

<https://www.telegraph.co.uk/technology/2017/09/29/mars-city-human-missions-space-colony-will-start-2024-elon-musk/>

Vladlen S. Vereshchetin and Gennady M. Danilenko (1985) 'Custom as a Source of International Law of Outer Space' 19 J. Space L. 22

Brian Weeden, '2009 Iridium-Cosmos Collision' Secure World Foundation (10 November 2010)

https://swfound.org/media/6575/swf_iridium_cosmos_collision_fact_sheet_updated_2012.pdf

Books

Carl Q. Christol *Space Law: Past, Present, and Future* (Kluwer Law and Taxation Publishers 1991)

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

James Crawford *The Creation of States in International Law* (2nd edn, Oxford University Press 2006)

Imre Anthony Csabafi *The Concept of State Jurisdiction in International Space Law: A Study in the Progressive Development of Space Law in the United Nations* (Martinus Nijhoff 1971)

I.H.Ph. Diederiks-Verschoor and V. Kopal, *An Introduction to Space Law* (3rd edn, Kluwer Law International, 2008)

Malcolm D Evans (eds) *International Law* (4th edn, Oxford University Press 2014)

- Matthew Craven, 'Statehood, Self-Determination, and Recognition'

Thomas Gangale *The Development of Outer Space: Sovereignty and Property Rights in International Space Law* (Praeger, 2009)

Kevin Gray and Susan Francis Gray, *Land Law* (7th edn, Oxford University Press 2011)

Andrew Haley *Space Law and Government* (Appleton-Century-Crofts 1963)

Albert A. Harrison *Spacefaring: The Human Dimension* (University of California Press 2001)

Stephan Hobe, Bernhard Schmidt-Tedd and Kai-Uwe Schrogl eds., *Cologne Commentary on Space Law*, vol 1 (1st edn, Carl Heymanns Verlag, 2009)

- Stephan Hobe, 'Historical Background'

- Stephan Hobe 'Article 1'

- Steven Freeland and Ram Jakhu 'Article II'

Stephan Hobe, Bernhard Schmidt-Tedd, Kai-Uwe Schrogl and Peter Stubbe (eds.), *Cologne Commentary on Space Law*, vol 2 (1st edn, Carl Heymanns Verlag 2013)

- Irmgard Marboe, Julia Neumann, Kai-Uwe Schrogl, 'The 1968 Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space'

Ram S Jakhu, Joseph N. Pelton, Yaw Otu Mankata Nyampong, *Space Mining and its Regulation* (Springer 2017)

Christopher D. Johnson (eds.) *Handbook for New Actors in Space* (Secure World Foundation 2017)

- Tanja Masson-Zwaan, 'The International Framework for Space Activities'

Gabriel Lafferranderie, and Sergio Marchisio (eds.), *The Astronauts and Rescue Agreement: Lessons Learned* (European Centre for Space Law 2011)

- Jacques Arnould, 'Does the Concept of 'Envoys of Mankind Have a Future?'

- Stephan Hobe, 'Space Tourism as a Challenge to the Astronaut Concept'

- E. Jason Steptoe, 'Astronaut Rescue and Return in an era of planetary exploration: 'Envoys of Mankind', 'space flight participants' and celestial settlers'

- Ricky J. Lee *Law and Regulation of Commercial Mining of Minerals in Outer Space* (Springer 2012)
- Francis Lyall and Paul B. Larsen *Space Law: A Treatise* (Ashgate 2009)
- Irmgard Marboe (eds), *Soft Law in Outer Space: The Function of Non-binding Norms in International Space Law* (Boehlau Verlag 2012)
- Steven Freeland, 'The Role of 'Soft Law' in Public International Law and its Relevance to the International Legal Regulation of Outer Space'
- Gerard K. O'Neill *The High Frontier: Human Colonies in Space* (William Morrow and Company 1977)
- Virgiliu Pop *Who Owns the Moon? Extraterrestrial Aspects of Land and Mineral Resources Ownership* (Springer 2009)
- Ganesh Sitaraman *The Counterinsurgent's Constitution: Law in the Age of Small Wars* (Oxford University Press 2013)
- Yoshifumi Tanaka *The International Law of the Sea* (2nd Edn. Cambridge University Press 2015)
- Frans von der Dunk and Fabio Tronchetti eds. *Handbook of Space Law* (Edward Elgar 2015)
- Irmgard Marboe 'National Space Law'
 - Fabio Tronchetti 'Legal Aspects of Space Resource Utilization'

Dictionaries

Concise Oxford English Dictionary (12th edn, 2011)

Other

The Hague Space Resources Governance Working Group (2017) 'Draft Building Blocks for the Development of an International Framework on Space Resource Activities' <https://www.universiteitleiden.nl/binaries/content/assets/rechtsgeleerdheid/instituut-voor-publiekrecht/lucht--en-ruimterecht/space-resources/draft-building-blocks.pdf>