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## Universe Exploration and Colonization

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### 1. Introduction

This chapter deals with exploration and colonization. This is done predominately from the prospective of the legal framework governing human activities in outer space. However, it also attempts to take a broader view of these topics, pulling in ethical, political, and historical understandings of the issues under discussion. Law is representative of the society that produces it therefore it is important to have that broader understanding, especially when trying to peer into the future. Space settlements and exploration are popular topics. They have long been popular among science fiction fans and ‘visionaries’ but as the commercial sector develops increasingly plausible capabilities for conducting mass space transportation many in the space community feel that the age of space settlement is upon us. This is not exactly unprecedented, and the journey to Mars will undoubtedly prove more difficult than many realise or are willing to accept.

Some of those difficulties will stem from governance challenges, and the existing legal framework for outer space activities. However, particularly with the topics this chapter explores the broader context needs to be understood. Neither the terms exploration and colonization nor the concepts behind them exist in an intellectual vacuum. The weight of the legacy of European imperialism cannot be ignored. Particularly as many discussions of a human future in outer space too closely mirror the arguments of European imperialists. This will be addressed initially but it is also an issue which will be woven throughout the chapter. The chapter will also look at the reach of space law, does the Outer Space Treaty<sup>1</sup> (OST) apply to the entire universe? Before looking at the concepts of use, exploration and settlement through the prism of the Outer Space Treaty. Finally, the chapter will discuss terraforming and its links to the concept of ‘Ecological Imperialism’. As a single chapter it can only serve as an introductory overview for many of these issues, but they are important aspect for anyone giving serious consideration to the future of humanity in outer space.

### 2. Trouble with Terminology: Exploration and Colonization

The first thing to address is the use of terminology. Despite the title of this chapter colonization is avoided in the body, settlement is used instead. To put it mildly, colonization is a

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<sup>1</sup>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)

‘problematic’ term and settlement, albeit not without issue of its own, is the generally preferred alternative. It is therefore less jarring than colonization. However, it is not the word *per se* that is the issue, but the history of its use and what that means. The problem with colonization is not the word but the mindset, the world view, the history. The problem is over 400 years of European colonialism, imperialism, death, and destruction and the ideology that drove it. That does not disappear simply by changing words used. Particularly as many, in what Daniel Deudney has termed the ‘space expansionist’ camp<sup>2</sup>, have embraced the colonialist worldview. This is particularly true of the leaders of this movement such as Robert Zubrin.<sup>3</sup> Granted, this is not necessarily surprising; imperialism and colonialism are part of the very foundations of Western society, and human activities in outer space are, in essence, part of the ‘imperial project.’ But, given the proclivity to declare the goal to be a *human* future in outer space, concrete action needs to be taken in order to ensure that it actually is a *human* future and not merely an extension of ‘the West’ into outer space. Neither the terms exploration and colonization nor the concepts behind them exist in an intellectual vacuum, and the weight of the legacy of European imperialism cannot be ignored. This chapter does not ignore that, it endeavours to discuss it and acknowledge it. It can only ever serve as an introduction but that is vitally needed.

Further the paradigm shift that is necessary is more than just changing words. A first step, but certainly not the only step, is recognizing that for many people, around the world, exploration and colonization is “not a thrilling adventure story; it’s non-fiction, and we are on the wrong side of the strange-looking ship that appears out of nowhere.”<sup>4</sup> The ‘colonial mindset’ is rife throughout the space community and it is beyond time that this was addressed. People are doing so but until ‘decolonize space’ becomes the mainstream mantra then there is no hope of truly making ‘space for all.’

### 3. The Infinite Reach of Space Law?

The Outer Space Treaty does not define ‘outer space.’ There is no specified lower or upper (outer) limit to its scope of application beyond ‘outer space.’ It does specify that outer space includes ‘the Moon and other celestial bodies.’ While there is scope for debate about where the boundary between air and space law rests (or whether it exists at all)<sup>5</sup> the outer most limit is a

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<sup>2</sup>Daniel Deudney, *Dark Skies: Space Expansionism, Planetary Geopolitics, and the End of Humanity* (OUP 2020), 6

<sup>3</sup>Zubrin fully embraces the Turnerian Frontier thesis and argues that the future of the United States relies on the establishment of a new frontier on Mars, while this view is suffused throughout his writing it is specifically laid out in his essay ‘The Significance of the Martian Frontier’ which serves as an epilogue to Robert Zubrin with Richard Wagner *The Case for Mars: The Plan to Settle The Red Planet and Why We Must* (Touchstone 1997)

<sup>4</sup>Nalo Hopkinson, ‘Introduction’ in Nalo Hopkinson and Uppinder Mehan (eds) *So Long Been Dreaming: Postcolonial Science Fiction and Fantasy* (Arsenal Pulp Press 2015), 7

<sup>5</sup>The Legal Subcommittee of the UN Committee on the Peaceful Uses of Outer Space has a standing working group dedicated to the ‘Definition and Delimitation of Outer Space’, the topic is, to put it mildly, ‘stalled’. The Working Group’s 2019 report (the most recent as of this writing) highlights the issue quite well: UNCOPUOS ‘Report of the Acting Chair of the Working Group on the Definition and Delimitation of Outer Space’ 5 April 2019 UN Doc A/AC.105/C.2/2019/DEF/L.1 Accessible at: [http://unoosa.org/res/oosadoc/data/documents/2019/aac\\_105c\\_2def/aac\\_105c\\_22019defl\\_1\\_0\\_html/AC105\\_C2\\_2019\\_DEF\\_L01E.pdf](http://unoosa.org/res/oosadoc/data/documents/2019/aac_105c_2def/aac_105c_22019defl_1_0_html/AC105_C2_2019_DEF_L01E.pdf)

different question. The Moon Agreement<sup>6</sup> does specify that it only applies to the solar system, although given the low number of ratifications that treaty has received<sup>7</sup>, its value as a ‘subsequent agreement’ is somewhat limited. On the face of it the Outer Space Treaty applies to the entire universe, however, it is important to recall that the Outer Space Treaty is a treaty “governing the Activities of States in the Exploration and Use of Outer Space...” as well as the fact that, except where their principles are reflective of or have become customary international law, treaties only apply to those States which are parties to them. Further, while there are indeed some interesting questions about how international law would apply and relate to any extraterrestrial intelligences that may exist<sup>8</sup> it is somewhat absurd to argue that customary international law could apply to those beings, at least not without their consent to join the ‘international (interstellar?) community of States.’ The Outer Space Treaty, and by extension, the body of space law that has emanated from it, applies to the activities of States and their (human) nationals in outer space. This is the scope of application. States are not claiming jurisdiction over outer space but rather the people conducting activities there. Unless an extraterrestrial intelligence was to become a national of a State Party of the Outer Space Treaty their activities would not fall within the scope of application of the Treaty (this also counters any claims about the ‘right’ of Earth states to ‘rule’ over the Moon or any of the celestial bodies, States are not governing the Moon rather the activities of their nationals *on* the Moon, and states have the right to legislate the behaviour of their nationals wherever they may be,<sup>9</sup> indeed Article VI of the Outer Space Treaty even requires it.) For the foreseeable future (say the next 200 or so years) this is a reasonable formula to take, however eventually the paradigm will undoubtedly need to change, as humans move further from the confines of Earth the logic and practicality of their subjection to Earth based jurisdictions will diminish.<sup>10</sup> Therefore, while the Outer Space Treaty applies to the activities of State Parties and their nationals seemingly anywhere in the universe, practically and logically it only applies to this solar system. With the exception of a brief consideration of ethical issues relating to ‘world ships’, this chapter will remain focused on activities in this solar system.

#### 4. Use

The second freedom laid out in Article I OST is the freedom of use. No clear definition of use is provided by the treaty itself and it is not immediately clear whether ‘commercial operations’ can fit within it. Several delegates to the UN Committee on the Peaceful Uses of Outer Space (UNCOPUOS) which drafted the Outer Space Treaty did raise the issue that the definition of ‘use’ was unclear.<sup>11</sup> The French delegate specifically queried whether ‘use’ included

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<sup>6</sup>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)

<sup>7</sup>The Moon Agreement has 18 ratifications, the Outer Space Treaty has 109 - UNCOPUOS ‘Status of International Agreements Relating to Activities in Outer Space as at 1 January 2019’ (1 April 2019) UN Doc A/AC.105/C.2/2019/CRP.3

<sup>8</sup>‘Metalaw’ in Andrew G. Haley, *Space Law and Government* (Appleton-Century-Crofts 1963), 394-423; ‘Potential Interaction with Advanced Forms of Non-Earth Life’ in Myres S. McDougal, Harold D. Lasswell, and Ivan A. Vlasic *Law and Public Order in Space* (Yale University Press 1963)

<sup>9</sup>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, 51

<sup>10</sup>Barring some unforeseeable fantastical development in space travel technology

<sup>11</sup>UNCOPUOS ‘Summary Record of the Fifty-Eighth Meeting’ (20 October 1966) UN DOC A/AC.105/C.2/SR.58,

‘exploitation’ or whether ‘use’ was simply limited to ‘use for exploration purposes’.<sup>12</sup> There was a general sense that the Outer Space Treaty should not be too prescriptive and that therefore terms like ‘use’ should be left open to allow scope for future development.<sup>13</sup> It is also worth bearing in mind that the Soviets had initially attempted to restrict activity in space to only State activities however they eventually conceded and a compromise was reached permitting non-State activities which resulted in Article VI of the Outer Space Treaty.<sup>14</sup> The negotiating history of the OST supports a broad interpretation of the term ‘use’ as found in Article I, and a definition which would include commercial operations.

Of course, that does not necessarily clarify the scope of the kinds of use. One of the main questions in space law has been whether or not the freedom of use covers space resource extraction and utilization (i.e., space mining). Article II raises issues here because while the act of removing space resources may be covered by the freedom of use, the prohibition on appropriation could be a problem. This has been the subject of some debate,<sup>15</sup> even before the United States enacted their space resources law in 2015.<sup>16</sup> The debate at UNCOPUOS and elsewhere has demonstrated a growing acceptance, at least by States, that the freedom of use does include the extraction and utilization of space resources, even if there is still debate about the mechanics of authorising such activities.<sup>17</sup>

However, as with any use it is vital to recall that it is subject to the caveat of being in the interest and for the benefit of all countries as well as being “the province of all mankind”. Granted, the implications of that are not entirely clear. First, it is important to note that ‘Province of all mankind’ is not synonymous with ‘common heritage of mankind’<sup>18</sup> as used in Law of the Sea Convention<sup>19</sup> or the Moon Agreement. Further, it applies to the *exploration and use* of outer space, the Moon and other celestial bodies not to outer space itself. Scholars have endeavoured to provide clarity on the meaning of these conditions to the freedoms expressed in Article I OST.

3;UNCOPUOS 'Summary Record of the Sixty-Third Meeting' (20 October 1966) UN DOC A/AC.105/C.2/SR.63 , 8

<sup>12</sup>A/AC.105/C.2/SR.63, *supra* n11, 8

<sup>13</sup>UNCOPUOS 'Summary Record of the Sixty-First Meeting' (20 October 1966) UN DOC A/AC.105/C.2/SR.61, 8; A/AC.105/C.2/SR.63, *supra* n11, 8, 11; UNCOPUOS 'Summary Record of the Sixty-Eighth Meeting' (21 October 1966) UN DOC A/AC.105/C.2/SR.68, 10

<sup>14</sup>UNCOPUOS 'Summary Record of the Sixty-Seventh Meeting' (21 October 1966) UN DOC A/AC.105/C.2/SR.67, 3

<sup>15</sup>Francis Lyall and Paul B. Larsen, *Space Law: A Treatise* (Ashgate 2009), 186; Fabio Tronchetti, ‘Legal Aspects of Space Resource Utilization’ in Frans von der Dunk and Fabio Tronchetti (eds), *Handbook of Space Law* (Edward Elgar 2015), 788-789; Stephan Hobe ‘Article 1’ in Stephan Hobe, Bernhard Schmidt-Tedd and Kai-Uwe Schrogl eds., *Cologne Commentary on Space Law*, vol 1 (1<sup>st</sup> edn, Carl Heymanns Verlag 2009), 33; Virgiliu Pop, *Who Owns the Moon? Extraterrestrial Aspects of Land and Mineral Resources Ownership* (Springer 2009), 78; Gennady M. Danilenko, ‘Outer Space and the Multilateral Treaty-Making Process’ (1989) 4 Berkley Tech. L.J. 217, 332

<sup>16</sup>US Commercial Space Launch Competitiveness Act, Public Law 114-90, 114<sup>th</sup> Congress, 25 November 2015, 51 U.S.C.

<sup>17</sup>Thomas Cheney, ‘Sovereignty, Jurisdiction, and Property in Outer Space: Space Resources, the Outer Space Treaty, and National Legislation’ (PhD Thesis, University of Northumbria at Newcastle 2020), 316-317

<sup>18</sup>Frans von der Dunk, ‘International Space Law’ in Frans von der Dunk and Fabio Tronchetti eds., *Handbook of Space Law* (Edward Elgar 2015), 57-58

<sup>19</sup>United Nations Convention on the Law of the Sea (adopted 10 December 1982, entered into force 16 November 1994) 1833 UNTS 397 (UNCLOS)

Stephan Hobe notes that the notion of the ‘province of all mankind’ is in line with the regulation of other areas of the ‘global commons’ like the high seas and the deep seabed. However, there is no common pattern in the regulation of the ‘global commons’ each area has its own distinct regime.<sup>20</sup> Christol argues that the concept of the ‘province of mankind’ principle was meant to bolster the ‘in the interests and for the benefit of all’ concept. He says that the drafters saw little difference between province and benefit, but that this had a nuance that ‘benefit’ lacked on its own.<sup>21</sup> Philip De Man has argued that the freedoms expressed in Article I are “qualified, *inter alia*, by the obligation to duly take into account the corresponding freedoms of other States.<sup>22</sup>” Dembling and Arons argue that the language in Article I OST was largely designed and intended to prevent a ‘first come, first served, approach to accessing celestial bodies and ensuring that the benefits of space were accessible to all States even if they were ‘latecomers.’<sup>23</sup>

In practice this aspect of Article I OST has not amounted to obligations on the part of space actors. For this reason, the ‘Space Benefits Declaration’ (UNGA Res 51/122)<sup>24</sup> was promulgated. The Space Benefits Declaration arose out of a desire by developing states to more precisely define the terms of Article I of the Outer Space Treaty. Debate exists as to the legal effect of these provisions of Article I of the Outer Space Treaty. Does it create merely moral obligations or is it legally binding? As Elena Carpanelli and Brendan Cohen have written, even if Article I does create legal obligations, the vagueness of the terms involved does still cause issues “one wonders, for instance, whether only the ‘exploration and use’ must be beneficial, or also the resources resulting from this activity.<sup>25</sup>” However, the vague nature of the provisions of the Declaration also substantially reduce its value as an authoritative means of interpretation of Article I of the Outer Space Treaty.<sup>26</sup> That said, there is value in the Declaration on Space Benefits as a reaffirmation of the principle that space activities are meant to be for the benefit of all humankind, and could have an impact on interpretation, by a court, of Article I of the Outer Space Treaty either as a ‘subsequent agreement’ or ‘subsequent state practice’ as defined by Article 31(3) VCLT.<sup>27</sup> Though perhaps the most significant impact of the Declaration on Space Benefits is to mark the end of the push by developing States for a more concrete expression of the principle that space is meant to be for the benefit of all humans. As Carpanelli and Cohen write “in this way, they abandoned the claim that outer space, as the ‘common heritage of mankind,’ demanded the sharing of economic benefits that come from outer space activities...” in return the space powers reaffirmed their commitment to using space for the benefit of all countries and while this is not a legal obligation it does carry a moral weight.<sup>28</sup> States must bear this in mind when considering how to use, and explore outer space.

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<sup>20</sup>Hobe ‘Article 1’, *supra* n 15, 27-29

<sup>21</sup>Carl Q. Christol *Space Law: Past, Present, and Future* (Kluwer Law and Taxation Publishers 1991), 70-71

<sup>22</sup>Philip De Man, ‘Rights Over Areas vs Resources in Outer Space: What’s the Use of Orbital Slots?’ (2012) 38 *Journal of Space Law* 39, 56

<sup>23</sup>Paul G. Dembling and Daniel M. Arons, ‘The Evolution of the Outer Space Treaty’ (1967) 33 *J. Air L. + Comm.* 419, 430

<sup>24</sup>UNGA Res 51/122 (13 December 1996) UN Doc A/RES/51/122

<sup>25</sup>Elena Carpanelli and Brendan Cohen, ‘A Legal Assessment of the 1996 Declaration ‘on Space Benefits on the Occasion of its Fifteenth Anniversary’ (2012) 38 *Journal of Space Law* 1, 5

<sup>26</sup>*Ibid*, 30

<sup>27</sup>*Ibid*, 19-23

<sup>28</sup>*Ibid*, 32

## 5. Exploration

Exploration is explicitly endorsed by Article I of the Outer Space Treaty. It is the “exploration and use” of outer space that States shall be free to conduct. Further, there is also a stipulation that there “shall be freedom of scientific investigation.” However, as Dane Kennedy writes “exploration, as it is commonly understood, is the product of a particular historical legacy. In English usage, exploration is a term that first came to refer to arduous journeys into unfamiliar territories in the mid- to late- eighteenth century...”<sup>29</sup> and continues to connote “a combination of scientific and technological achievement, state power, and national prestige” especially in space exploration.<sup>30</sup> That said, the meaning of the term in the context of the Outer Space Treaty is clear. Exploration means scientific investigation. As Hobe points out it is to be “distinguished from the actual use of outer space.”<sup>31</sup>

As for the conduct of exploration the main concern lies in Article IX OST. This stipulates that States should avoid the ‘harmful contamination’ of other celestial bodies, and Earth, as well as avoid ‘harmful interference’ with the activities of other States. In the event of potential ‘harmful interference’ States are supposed to consult with the relevant States in order to avoid such interference (the most common example of this is the International Telecommunication Union’s regulations regarding the use of radio-frequency spectrum). What constitutes ‘harmful contamination’ is not specified by the treaty, but the concerns are generally around biological and chemical contamination of celestial bodies as well as a lesser concern about the potential ‘backwards’ contamination of Earth in the event of sample return missions. The non-binding COSPAR<sup>32</sup> Planetary Protection Policy<sup>33</sup> is generally considered the ‘gold standard’ among the scientific community for avoiding ‘harmful contamination.’ It categorizes celestial bodies and mission types based on a risk assessment framework and specifies appropriate measures. There are growing concerns about how this framework will be applied to non-scientific and non-government space missions beyond Earth orbit,<sup>34</sup> however the most recent NASA planetary protection policy does specify that the United States considers the NASA policy implementing the US’ obligations under Article IX OST<sup>35</sup> which should indicate that any private mission authorised by the United States would be expected to adhere to the NASA policy.

## 6. Settlement

Space settlements are permitted under international space law. As has been discussed, the

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<sup>29</sup>Dane Kennedy ‘Introduction: Reinterpreting Exploration’ in Dane Kennedy (eds) *Reinterpreting Exploration: The West in the World* (Oxford University Press 2014), 1

<sup>30</sup>*Ibid*, 2

<sup>31</sup>Hobe ‘Article 1’, *supra* n 15, 35

<sup>32</sup>Committee on Space Research

<sup>33</sup>COSPAR ‘Policy on Planetary Protection’ (2020) 208 *Space Research Today* 10. Accessed: [https://cosparhq.cnes.fr/assets/uploads/2020/07/PPPolicyJune-2020\\_Final\\_Web.pdf](https://cosparhq.cnes.fr/assets/uploads/2020/07/PPPolicyJune-2020_Final_Web.pdf)

<sup>34</sup>Thomas Cheney, Christopher Newman, Karen Olsson-Francis, Scott Steele, Victoria Pearson, and Simon Lee ‘Planetary Protection in the New Space Era: Science and Governance’ (2020) 7 *Frontier in Astronomy and Space Sciences* 1

<sup>35</sup>United States. NASA. *NASA Interim Directive: Planetary Protection Categorization for Robotic Crewed Missions to the Earth’s Moon*. NID 8715.128. 2020. Accessed July 10, 2020. Available at: [https://nodis3.gsfc.nasa.gov/OPD\\_docs/NID\\_8715\\_128\\_.pdf](https://nodis3.gsfc.nasa.gov/OPD_docs/NID_8715_128_.pdf)

freedom of use in Article I is broad, sufficiently so to allow this. Further, stations, installations, and outposts are specifically mentioned in the Outer Space Treaty in Article XII. There is no reason to suppose that this would preclude permanent habitation of such facilities. That said Article II OST does pose some issues.

## 6.1 Non-appropriation

The non-appropriation principle, in Article II OST, prohibits claims to territory by States and this prohibition also extends to private actors by virtue of Article VI OST which makes States responsible for the activities of their nationals (natural or legal persons) and requires them to authorize and supervise those activities.<sup>36</sup> However, the object and purpose of Article II OST is to prevent a ‘scramble for space’ akin to the European scramble for overseas colonies,<sup>37</sup> not prohibit human expansion beyond Earth. The key about Article II is that it bans ‘national appropriation’ not activity. It means that an activity cannot be used as a means of ‘national appropriation’ which does not inherently ban that activity. The concept of ‘use’ in Article II needs to be considered in conjunction with that in Article I.<sup>38</sup> It does not necessarily mean that ‘use’ is prohibited but rather that use cannot be used as a basis for a claim of ‘national appropriation.’ Facilities are allowed but they cannot be used as a basis to exclude others from the area. Activities are protected from ‘harmful interference’ but that is assessed on a consultative basis with the other relevant States rather than a unilateral determination. In short, Article II OST needs to be taken in context of Article I OST; use of space is allowed but use of space does not and cannot generate ‘sovereign’ rights regardless of duration.<sup>39</sup>

There should also be consideration of the nature of these facilities. The realities of the space environment means that any human habitation in outer space or on a celestial body will be a ‘space object’. While there is no clear definition of ‘space object’ provided by the space treaties it is possible to identify a working definition which can be approximated as a ‘human made object launched into outer space’. ‘Therefore, the station, installation, outpost or settlement could be said to simply be the space object so there is no need to claim ‘territory’ on the Moon or any other celestial body. The space object will occupy a location on a celestial body but that will not necessarily amount to appropriation so long as the claim to jurisdiction and control is over the space object and not the ‘ground’ it rests on. This is of course not without issue, de facto appropriation does not become acceptable just because it lacks a formal declaration, but that is a nuance States will have to work out.

## 6.2 Jurisdiction

These facilities will also have jurisdictional issues, especially if established by multinational groups and contain multinational populations. Space objects are subject to the ‘jurisdiction

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<sup>36</sup>Tronchetti ‘Legal Aspects of Space Resource Utilization’, *supra* n15, 780; Steven Freeland and Ram Jakhu ‘Article II’ in Stephan Hobe, Bernhard Schmidt-Tedd and Kai-Uwe Schrogl (eds) *Cologne Commentary on Space Law*, vol 1 (1<sup>st</sup> edn Carl Heymanns Verlag 2009), 58

<sup>37</sup>Freeland and Jakhu ‘Article II’, *supra* n36, 49

<sup>38</sup>*Ibid*, 53

<sup>39</sup>Ram S. Jakhu, Joseph N. Pelton, Yaw Otu Mankata Nyampong *Space Mining and its Regulation* (Springer 2017), 121-122

and control' of the State they are registered to.<sup>40</sup> Further, States have an obligation to 'authorize and continually supervise' the activities of their nationals in outer space.<sup>41</sup> However, it is not clear how this applies to those not responsible for the conduct of 'activities,' or even what constitutes an 'activity.' A person who chooses to make outer space their permanent home could find their national government's obligation to 'authorize and continually supervise' their activities somewhat invasive. Even if the obligations under the Outer Space Treaty only applies to the State of registry and the State of nationality of the operators of the space station rather than all of its inhabitants then settlers may find that they still have not escaped the jurisdiction of their state of nationality as "every State has the right to regulate the conduct of its subjects wherever they may be."<sup>42</sup> These jurisdictions may clash. Exclusive jurisdiction is not necessarily applicable to space objects therefore this still means that there can be competing jurisdictions if the 'astronaut' or 'settler' is of a different nationality than the 'space object.' However, there are procedures for dealing with the exercise of civil and criminal jurisdiction already developed for astronauts, such as Article 22 of the ISS Agreement and the ISS code of conduct.<sup>43</sup> These will need to be developed further for space settlements.

### 6.3 State Creation

State creation is another complex aspect, particularly given the potential difficulties for meeting the 'territory' requirements in the unique environment of outer space. That said the definition of statehood is not necessarily ironclad: "it is sometimes said that statehood is a question of fact, meaning that it is not a question of law."<sup>44</sup> However international law does establish criteria for statehood.<sup>45</sup> The Montevideo Convention<sup>46</sup> is the usual point of reference and is considered to have codified existing customary international law. The Montevideo Convention says that States should have a permanent population, a defined territory, an established government, and the capacity to enter into relations with other States. However, this is not a tick box exercise and the reality of statehood relies on relations with other states as the examples of Kosovo and Palestine (among others) demonstrate. As far as actually creating new States is concerned, self-determination is often the strongest principle marshalled in favour of the creation of a new State. Self-determination as a means for creating new states grew from Articles 1 and 55 of the UN Charter and the right to self-determination has taken on a role as an important obligation.<sup>47</sup>

While Article II OST does create issues particularly around the concept of territory for state creation, given the centrality of self-determination in modern international law and the anti-colonial focus of Article II OST it would be perverse for this to stand as a barrier to the

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<sup>40</sup>Outer Space Treaty, *supra* n1, Article VIII

<sup>41</sup>*Ibid*, Article VI

<sup>42</sup>Csabafi *The Concept of State Jurisdiction in International Space Law*, *supra* n9, 51

<sup>43</sup>Gabriella Catalano Sgrosso 'Legal Status, Rights and Obligations of the Crew in Space' (1998) 26 J. Space L. 163, 185-186

<sup>44</sup>James Crawford *Brownlie's Principles of Public International Law* (8<sup>th</sup> edn OUP 2012), 127

<sup>45</sup>*Ibid*, 127

<sup>46</sup>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

<sup>47</sup>Crawford *Brownlie's Principles*, *supra* n44, 141

effective exercise of a space based political community's self-determination to be independent of an Earth based State. Statehood will surely look somewhat different from the present terrestrial example, but the concept has never been static, and it would be counter-intuitive for the Outer Space Treaty to forever shackle human settlements in outer space to their terrestrial 'masters'.

#### 6.4 World Ships and Ethics of Space Settlement

While for the reasons outlined above this chapter largely ignores extrasolar exploration and settlement initiatives it is nevertheless worth considering the ethics of 'world ships' particularly as many of these issues pertain to artificial habitats that may be constructed in this solar system as well as potential settlements on planets such as Mars. This is especially true if future generations of off Earth humans become physically incapable of emigrating to Earth. While it is reasonable to assume some degradation in the 'quality of life' for those who choose to make their lives in outer space or on other worlds, that does not grant carte blanche for the creation of dystopian societies. If a reasonable standard of living is not possible, and perhaps more importantly if the needs of a space society would preclude fundamental human freedoms particularly reproductive freedom and respect for gender identity and sexual orientation then it is not an endeavour worth pursuing. As James Schwartz has written "Human settlement in space, whether interstellar or interplanetary, should only take place for good reasons, never with haste or false urgency, and with adequate preparation and consideration for the well-being of future generations of settlers. Anything less would be negligence on an astronomical scale."<sup>48</sup>

#### 7. Terraforming and Ecological Imperialism

Any discussion of the future of humans in outer space always involves a discussion of terraforming. Terraforming is a variant of geo-engineering which is about transforming the environment of other planets into environments which are suitable for human life. The usual target for this discussion is Mars, however, particularly in science fiction, other possibilities are discussed, such as extra-solar planets. While artificial habitats in outer space are not strictly speaking terraforming, they are nevertheless a form of 'geo-engineering.' In line with the broader approach taken in this chapter, I will discuss how terraforming, and the framing of it among the space 'community' fits closely with 'Ecological Imperialism' which was a dominant theme in European imperialism.

Terraforming is the process of transforming a planet's environment so that it is habitable by Earth life (specifically humans). This involves modifying "a planet's climate, atmosphere, topology, and ecology."<sup>49</sup> It is conceptually related to geo-engineering, indeed the only real distinction is that geo-engineering is about transforming the Earth and Terraforming is about transforming other planets.<sup>50</sup> While terraforming originated in science fiction<sup>51</sup> (Arthur C. Clarke's 1951 *The*

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<sup>48</sup>James S.J. Schwartz 'Worldship Ethics: Obligations to the Crew' (2018) 71 *JBIS* 53, 63

<sup>49</sup>Chris Pak *Terraforming: Ecopolitical Transformations and Environmentalism in Science Fiction* (Liverpool University Press 2016), 1

<sup>50</sup>Although there is an irony that both terra and geo mean Earth albeit in Latin and Greek respectively

<sup>51</sup>Angus Stevenson and Maurice Waite eds. *Concise Oxford English Dictionary* (12<sup>th</sup> edn. OUP 2011), 1489

*Sands of Mars*<sup>52</sup> is one of the earliest depictions of terraforming Mars) space advocates such as Robert Zubrin argue that humans should terraform and settle Mars for real.<sup>53</sup> These proponents often utilize the Turnerian Frontier narrative that the ‘challenge’ of ‘developing’ a frontier is necessary for the development of (American) society.<sup>54</sup> Zubrin explicitly embraces this argument, describing the ‘Martian frontier’ as a potential “engine of progress”.<sup>55</sup> Terraforming arguments also often mirror the ‘Ecological Imperialism’ narratives described by Crosby<sup>56</sup> and Ross<sup>57</sup> in which the use of science and technology to master nature and bring ‘unproductive spaces’ into ‘use’ represents a pinnacle of achievement.

The term ‘Ecological Imperialism’ was coined by Alfred Crosby to describe the ecological aspect of European imperialism. Crosby argues that these transformations were key to the success of European colonization and uses the term ‘Neo-Europes’ to describe those areas in the temperate zones that have roughly ‘European’ climates and therefore enabled European crops and livestock to flourish (or at least be economically viable.)<sup>58</sup> Crosby traces ecological imperialism back to the Portuguese and Spanish settlement of the Azores and other islands of the Eastern Atlantic. These first efforts at ‘Europeanizing’ were done to provide food for mariners and so they seeded these islands with livestock like pigs.<sup>59</sup> Crosby argues that what he calls a ‘portmanteau biota’, a “scaled down, simplified version of the biota of Western Europe”, was crucial to the success of European colonization.<sup>60</sup>

Others have built upon and expanded Crosby’s work. Corey Ross broadens the view and argues that the European imperialism has been a central feature of global environmental history. Ross argues that European imperialism needs to be regarded “not so much as a social project with ecological consequences, but as a socio-ecological project (or better: a series of projects) in and of itself.”<sup>61</sup> At the heart of this project “was an attempt to transform forests, savannahs, rivers, coastal plains, *into productive and legible spaces...*”<sup>62</sup> (emphasis not in original) which enabled European countries to tap into “resource subsidies” and “ghost acres” of their overseas colonies. This allowed them to overcome “the ecological limits that their own territories placed on economic growth and commercial activity.”<sup>63</sup> Indeed, tapping into earlier ideas espoused by the likes of John Locke there was a sense that Europeans had a duty to exert a mastery over nature, and to turn ‘underutilized’, ‘empty,’ or ‘defective’ areas of the Earth into ‘productive’ resource bearing territories. This has not dissipated with formal decolonization. Partly because experts in

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<sup>52</sup>Arthur C. Clarke *The Sands of Mars* (Gollancz 2019) (originally published by the Rocket Publishing Company 1951)

<sup>53</sup>Zubrin and Wagner *The Case for Mars*, *supra* n3, 218, 247-249; Buzz Aldrin and Lenard David *Mission to Mars: My Vision for Space Exploration* (National Geographic 2015), 182

<sup>54</sup>See, Frederick Jackson Turner *The Significance of the Frontier in American History* (originally presented to the American Historical Association in 1893, this author has used the Penguin 2008 paperback)

<sup>55</sup>Zubrin and Wagner *The Case for Mars*, *supra* n3, 1

<sup>56</sup>Alfred W. Crosby *Ecological Imperialism* (2<sup>nd</sup> edn. CUP 2018)

<sup>57</sup>Corey Ross *Ecology and Power in the Age of Empire: Europe and the Transformation of the Tropical World* (OUP 2019)

<sup>58</sup>Crosby *Ecological Imperialism*, *supra* n56, 6-7

<sup>59</sup>*Ibid*, 73

<sup>60</sup>*Ibid*, 89

<sup>61</sup>Ross *Ecology and Power in the Age of Empire*, *supra* n57, 4

<sup>62</sup>*Ibid*, 3

<sup>63</sup>*Ibid*, 2

postcolonial States, under pressure from international institutions, have internalized the “gospel of efficiency”<sup>64</sup> but also because Western countries are still relying on these “resources subsidies” and “ghost acres”<sup>65</sup> to ‘break free of the constraints of nature’ and fuel an unsustainable consumer driven way of life based on a promise of infinite growth.<sup>66</sup>

As with most questions in space law, the question of whether terraforming is legal largely hinges on the interpretation of Articles I and II of the Outer Space Treaty. If we take a broad approach to the freedom of use, which is, as discussed, a sensible approach, then terraforming would reasonably be seen to fall within the scope of ‘use’ in Article I OST. Further, transforming a planet like Mars into a ‘productive’ territory arguably falls into the category of being ‘in the interests of all countries and for the benefit of all [human]kind’ particularly as the international system does generally presume development,<sup>67</sup> the concerns expressed above notwithstanding. However, the non-appropriation principle does present a barrier. To dramatically transform a planetary environment by virtue of terraforming would be a fairly substantial act of appropriation. Therefore no one State could presume the authority to undertake or authorise such an activity. Article IX and the stipulation that States should avoid the ‘harmful contamination’ of other celestial bodies may also present a challenge for any terraforming activity. While there may be reasonable debate over whether terraforming would constitute ‘harmful’ contamination the process would undoubtedly involve the introduction of organisms such as genetically engineered algae in violation of the planetary protection principles generally seen as the implementation of Article IX OST.<sup>68</sup> This also raises ethical issues beyond those already discussed as the transformation of a planetary environment through terraforming would destroy much of the scientific value of that environment, further, it may destroy any life which may exist on that world. Therefore, even if one accepts arguments that humans should (and can) terraform a planet the question of when will always be a key question.<sup>69</sup>

## 8. Conclusion

The Outer Space Treaty dates from 1967 and is primarily focused on a limited scope of human activities in outer space. However, as its full title says it is a Treaty of Principles and as such it lays a foundation for the space governance regime. As discussed, some of those principles, such as use are fairly broad and can be reasonably interpreted to cover a fairly wide range of activities. This does not mean there are not limitations, but those limitations need to be understood in the light of the ‘object and purpose’ of the treaty. This provides scope for space mining, space settlement and even eventually space states. Granted the regime will have to evolve and the details of how exactly to govern these activities will need to be determined but they are compatible with the Outer Space Treaty. The broader issues, beyond the purely legal questions, highlighted by this chapter are the moral, ethical, and philosophical ones. What should space be

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<sup>64</sup>Gregory T. Cushman *Guano and the Opening of the Pacific World: A Global Ecological History* (CUP 2014), 140

<sup>65</sup>Ross *Ecology and Power in the Age of Empire*, *supra* n57, 1; Naomi Klein, *This Changes Everything* (Penguin 2014), 48-49, 58

<sup>66</sup>Klein, *This Changes Everything*, *supra* n65, 48-49, 56-58, 79-83

<sup>67</sup>UNGA Res 1803; Sangwani Patrick Ng’ambi (2015) ‘Permanent Sovereignty Over Natural Resources and the Sanctity of Contracts, From the Angle of *Lucrum Cessans*’ 12 *Loyola University Chicago International Law Review* 153), 154

<sup>68</sup>Cheney et al ‘Planetary Protection’, *supra* n34, 3-4

<sup>69</sup>See, generally: James S.J. Schwartz, *The Value of Science in Space Exploration* (OUP 2020)

'used' for? Who should use space? How do we ensure that that use is equitable and does indeed benefit all humankind? How do we prioritize the search for life and the desire to colonize Mars, or mining for resources? Who is 'we'? These are not legal questions, but they are core to any meaningful discussion of space governance, certainly if we are talking about exploration and 'colonization' of outer space.