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## Book Review: Space Law: A Treatise (Second Edition)

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**BOOK REVIEW: *SPACE LAW: A TREATISE*  
(SECOND EDITION)**

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**B**Y THE TIME THIS REVIEW appears in print, perhaps a third edition of this excellent treatise on space law will be needed. The first edition<sup>1</sup> was issued in 2009 and was reviewed by this author in the *Journal of Air Law and Commerce*.<sup>2</sup> The second edition (Treatise)<sup>3</sup> was published in 2018 and is the subject matter of this review. However, this review of the Treatise may end up being a rather unconventional book review.

The second edition follows the same general scheme as the first edition.<sup>4</sup> It is comprised of eighteen chapters, thousands of footnotes, and references to topics in what could be sub-chapters within the eighteen chapters.<sup>5</sup> There are many cross-references on the same topic, from one chapter to another, which makes for difficult reading at times, as the reader is asked to refer to previous or subsequent chapters.

Lyall and Larsen, eminent scholars of space law, stated in the first edition that their purpose in writing this book was

to provide a reference book, a research tool; as such, it should belong in the library of persons or institutions involved in space activities, particularly those who would benefit from knowing that

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<sup>1</sup> FRANCIS LYALL & PAUL B. LARSEN, *SPACE LAW: A TREATISE* (2009) [hereinafter LYALL & LARSEN (1st ed.)].

<sup>2</sup> Sylvia Ospina, *Francis Lyall and Paul B. Larsen: Space Law: A Treatise*, 76 J. AIR L. & COM. 501 (2011).

<sup>3</sup> FRANCIS LYALL & PAUL B. LARSEN, *SPACE LAW: A TREATISE* (2d ed., Routledge 2018) [hereinafter LYALL & LARSEN (2d ed.)].

<sup>4</sup> Ospina, *supra* note 2, at 501.

<sup>5</sup> LYALL & LARSEN (2d ed.), *supra* note 3.

space law is a growing and dynamic field that needs to be taken into account when planning any and all space activities.<sup>6</sup>

This Treatise remains timely, but a third edition would cover and include more recent activities in space. Some of these will be noted below.

The authors have updated the second edition with many of the space activities that have taken place since 2009, notably the increased involvement of the private sector and the commercialization of space activities.<sup>7</sup> But between the publication of the second edition in 2018 and the present (2020), even more changes have occurred in the realm of space activities and legislation. Several advances include SpaceX's successful reuse of launch vehicles,<sup>8</sup> and more companies, in addition to Virgin Galactic, aim to enhance space tourism, although they have yet to fly paying passengers to low Earth orbit or suborbital regions.<sup>9</sup> Still, other companies aim to fly humans to the Moon, and NASA has contracted with Boeing and SpaceX to manufacture a space capsule capable of reaching the Moon.<sup>10</sup> Some of these projects—aimed at reaching the International Space Station and possibly the Moon—are viewed as “stepping stones” to eventually reach Mars.<sup>11</sup> Technology has advanced in the last few years, but more progress is needed before launching humans to the Moon again, let alone to Mars. Chapter 7 of the Treatise, “The Moon, Asteroids and Other Celestial Bodies,” offers a

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<sup>6</sup> Ospina, *supra* note 2, at 501 (citing LYALL & LARSEN (1st ed.), *supra* note 1, at vii).

<sup>7</sup> See, e.g., LYALL & LARSEN (2d ed.), *supra* note 3, at 413–15.

<sup>8</sup> Ryan Whitwam, *NASA Will Allow SpaceX to Reuse Rockets and Capsules for Astronaut Launches*, EXTREME TECH (June 18, 2020), <https://www.extremetech.com/extreme/311887-nasa-will-allow-spacex-to-reuse-rockets-and-capsules-for-astronaut-launches> [<https://perma.cc/P8R4-23KT>].

<sup>9</sup> Jim Clash, *Virgin Galactic Announces New Reservations for Future Astronauts*, FORBES (Feb. 26, 2020), <https://www.forbes.com/sites/jimclash/2020/02/26/virgin-galactic-announces-new-pricing-structure-for-future-astronauts/#1bcb04485d58> [<https://perma.cc/T4C5-RKU8>].

<sup>10</sup> Justin Bachman, *Elon Musk Rips Boeing's \$90-Million Space Trips as Cost Tops SpaceX's*, BUS. STANDARD (Nov. 16, 2019), [https://www.business-standard.com/article/international/elon-musk-rips-boeing-s-90-million-space-trips-as-cost-tops-spacex-s-119111601342\\_1.html](https://www.business-standard.com/article/international/elon-musk-rips-boeing-s-90-million-space-trips-as-cost-tops-spacex-s-119111601342_1.html) [<https://perma.cc/D87Y-UDY3>].

<sup>11</sup> Jonathan O'Callaghan, *Elon Musk Tells SpaceX To Focus On Mars-Bound Starship Spacecraft Dramatically and Immediately*, FORBES (June 8, 2020), <https://www.forbes.com/sites/jonathanocallaghan/2020/06/08/elon-musk-tells-spacex-to-focus-on-mars-bound-starship-spacecraft-dramatically-and-immediately/> [<https://perma.cc/DG5J-WSHL>].

good exposition of the Moon Agreement<sup>12</sup> and its growing importance in view of current initiatives to go back to the Moon and to mine asteroids.<sup>13</sup> Are the authors offering hints that the Moon Agreement should be ratified by the advanced space powers, such as the United States, Russia, and China?

At the legal and regulatory level, some progress has been made, with many countries having enacted national space laws and established national space agencies.<sup>14</sup> Chapter 15 of the Treatise goes into detail on some national space legislation, country by country: Australia,<sup>15</sup> China,<sup>16</sup> India,<sup>17</sup> Russia,<sup>18</sup> the United Kingdom,<sup>19</sup> and the United States.<sup>20</sup> Very little mention is made of national legislation in other countries, such as Japan or France.<sup>21</sup>

Legal and technological advances have also brought into question the need to update or improve on definitions found in the space treaties. Among other advances, the authors discuss (1) “astronaut,” in view of private space flight participants;<sup>22</sup> (2) “registration” of space objects; (3) taking into account ownership of a space object;<sup>23</sup> and (4) “launching state,” in light of private parties’ involvement.<sup>24</sup> In brief, the authors suggest the need to update existing treaties or draft new ones.<sup>25</sup>

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<sup>12</sup> Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, *opened for signature* Dec. 18, 1979, 1363 U.N.T.S. 3 [hereinafter Moon Agreement].

<sup>13</sup> See, e.g., LYALL & LARSEN (2d ed.), *supra* note 3, at 168, 177, 183.

<sup>14</sup> The United Nations Office for Outer Space Affairs (UNOOSA) website provides a list of national legislation. *National Space Law Collection*, U.N. OFF. FOR OUTER SPACE AFFAIRS, <https://www.unoosa.org/oosa/en/ourwork/spacelaw/nationalspacelaw/index.html> [<https://perma.cc/6U2A-L2AQ>]. Wikipedia provides a list of national space agencies. *List of Government Space Agencies*, WIKIPEDIA (last edited May 19, 2020), [https://en.wikipedia.org/wiki/List\\_of\\_government\\_space\\_agencies](https://en.wikipedia.org/wiki/List_of_government_space_agencies) [<https://perma.cc/RQ79-8ERX>].

<sup>15</sup> LYALL & LARSEN (2d ed.), *supra* note 3, at 419–23.

<sup>16</sup> *Id.* at 423–27.

<sup>17</sup> *Id.* at 427–29.

<sup>18</sup> *Id.* at 430–32.

<sup>19</sup> *Id.* at 432–37.

<sup>20</sup> *Id.* at 437–43.

<sup>21</sup> *Id.* at 413–45. While not covered in great detail, Japan’s intent to implement its own obligations under the Outer Space Treaty is mentioned briefly. *Id.* at 432 n.135.

<sup>22</sup> *Id.* at 118–19.

<sup>23</sup> *Id.* at 78–89.

<sup>24</sup> *Id.* at 86.

<sup>25</sup> See, e.g., *id.* at 78–89, 118–19.

The concept of “soft law”<sup>26</sup> receives a fair amount of attention, and the authors contend that over the past years, certain policies and aspects of space activities have become “customary international law,” even though no national law may yet exist regarding that particular space activity.<sup>27</sup> Further, they maintain that even if States are not signatories to certain space treaties, customary international law will prevail,<sup>28</sup> since the authors conclude that the fundamental principles of the Outer Space Treaty<sup>29</sup> are now “customary international law.”<sup>30</sup> As seems to be usual, the law, including international law, finds itself lagging behind technological advances and enterprises, especially those financed by the private sector.

One issue that has been the subject of many hours and meetings is the question of the delimitation/demarcation of air space from outer space, and the topic is expounded upon in the second edition of the Treatise in several different chapters.<sup>31</sup> This issue has been discussed at the United Nations Committee on the Peaceful Uses of Outer Space (UNCOPUOS) sessions, as well as at the International Telecommunication Union (ITU) World Radio Conferences (WRCs), notably during WRC 2012.<sup>32</sup> Even though there is no clear delimitation at present, when space tourism takes off (intentional pun), it may have to be resolved, if for no other reason than to attribute responsibility to a State in the event of an accident or damage to spacecraft and to people. Would an update of the 1972 Liability Convention<sup>33</sup> be necessary to take into account the growing role private, commercial entities are playing in space activities? And to take into account the growing space debris and dangers they pose to existing and planned satellite systems?

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<sup>26</sup> *Id.* at 45–48, 355–56.

<sup>27</sup> *See, e.g.*, 63–73.

<sup>28</sup> *Id.* at 64–65.

<sup>29</sup> Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, *opened for signature* Jan. 27, 1967, 18 U.S.T. 2410, 610 U.N.T.S. 205 [hereinafter Outer Space Treaty].

<sup>30</sup> LYALL & LARSEN (2d ed.), *supra* note 3, at 70–73.

<sup>31</sup> *See, e.g., id.* at 135–62.

<sup>32</sup> Comm. on the Peaceful Uses of Outer Space (COPUOS), Rep. of the Secretariat, Historical Summary on the Consideration of the Question on the Definition and Delimitation of Outer Space, U.N. Doc. A/AC.105/769/Add.1 (2020).

<sup>33</sup> Convention on the International Liability for Damage Caused by Space Objects, Mar. 29, 1972, 24 U.S.T. 2389, 961 U.N.T.S. 187.

As to updating legislation to include new space activities, the United States took a major step in 2015 with the enactment of a law allowing for the mining of asteroids.<sup>34</sup> A similar law was enacted in Luxembourg in 2017, allowing private commercial enterprises to collect and keep the products of their space mining.<sup>35</sup>

Although scientists claim that asteroids and the Moon contain many valuable mineral resources, the biggest hurdle the companies wanting to engage in space mining face is the cost of getting to the asteroid(s), and bringing back to Earth the fruit of their activities.<sup>36</sup> Lyall and Larsen refer to both U.S. and Luxembourg legislation that promotes asteroid mining by private parties, but also mention that these activities are in an embryonic stage, and how they will evolve over time is open to question—and financing.<sup>37</sup> They make further comments on these laws in the last chapter of the book.<sup>38</sup>

Major changes have taken place in the satellite communications sector in the last few years, increasing the importance of the ITU in regulating access to space, to orbits and the associated radiofrequencies. One company, O3b (established in 2007), aimed at providing satellite communications to the “other [three] billion” inhabitants that do not have access to the internet or other modern means of communications.<sup>39</sup> Another corporation, OneWeb, was set up in 2012, also with the goal of providing broadband high-speed communications to underserved areas and regions of the world.<sup>40</sup> Yet a third corporation, Starlink, was established by Elon Musk around 2015, with the

<sup>34</sup> See 51 U.S.C. § 51302.

<sup>35</sup> Jeff Foust, *Luxembourg Adopts Space Resources Law*, SPACENEWS (July 17, 2017), <https://spacenews.com/luxembourg-adopts-space-resources-law/> [https://perma.cc/K668-VNFF].

<sup>36</sup> Jeff Desjardins, *There’s Big Money to be Made in Asteroid Mining*, BUS. INSIDER (Nov. 3, 2016), <https://www.businessinsider.com/the-value-of-asteroid-mining-2016-11> [https://perma.cc/2SNU-YLY3].

<sup>37</sup> LYALL & LARSEN (2d ed.), *supra* note 3, at 183–86.

<sup>38</sup> *Id.* at 515.

<sup>39</sup> Peter Sayer, *Google Sells Stake in Satellite Internet Operator O3B Networks*, COMPUTERWORLD (July 4, 2016), <https://www.cio.com/article/3090572/google-sells-stake-in-satellite-internet-operator-o3b-networks.html> [https://perma.cc/L3D6-82JY].

<sup>40</sup> Sam Nussey, *A Space Odyssey: Britain Rockets into Unknown with OneWeb*, REUTERS (July 9, 2020), <https://www.reuters.com/article/us-oneweb-britain-insight/a-space-odyssey-britain-rockets-into-unknown-with-oneweb-idUSKBN24A1T0> [https://perma.cc/SFK5-BNNU].

aim of having a seamless internet broadband network in space, connecting to everywhere on Earth.<sup>41</sup>

These are only three of the new satellite companies aiming to provide seamless communications via satellite. The difference between these newcomers and existing systems such as Iridium is the number of satellites they will deploy or have deployed to achieve their goal. Iridium has sixty-six satellites in orbit<sup>42</sup> while O3b, in partnership with Luxembourg-based SES, has close to seventy in orbit.<sup>43</sup> Prior to filing Chapter 11 bankruptcy, OneWeb aimed to have 600 to 900 spacecraft in orbit.<sup>44</sup> Starlink has been authorized by the U.S. Federal Communications Commission (FCC) to launch at least 12,000 satellites.<sup>45</sup> It has already launched nearly 540 satellites<sup>46</sup> and caused consternation among radio astronomers due to the light that is reflected off the satellites.<sup>47</sup> This may be an ongoing issue, despite assurances from Musk that he has adjusted the satellites to lower the interfering reflection.<sup>48</sup>

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<sup>41</sup> Mike Wall, *Why SpaceX's Starlink Satellites Caught Astronomers Off Guard*, SPACE.COM (Jan. 10, 2020), <https://www.space.com/spacex-starlink-satellites-megaconstellation-surprise-astronomers.html> [<https://perma.cc/SMV5-KAQG>].

<sup>42</sup> Dave Mosher, *Elon Musk Says the Biggest Challenge of SpaceX's Starlink Internet Project Is Not Satellites, But Rather 'UFO on A Stick' Devices Users Will Need to Get Online*, BUS. INSIDER (June 5, 2020), <https://www.businessinsider.in/tech/news/elon-musk-says-the-biggest-challenge-of-spacexs-starlink-internet-project-is-not-satellites-but-rather-ufo-on-a-stick-devices-users-will-need-to-get-online/article-show/76218476.cms> [<https://perma.cc/JNR4-LTWA>].

<sup>43</sup> Caleb Henry, *SES Details LEO Constellation and Expanded MEO Constellation to FCC*, SPACENEWS (May 29, 2020), <https://spacenews.com/ses-details-leo-constellation-and-expanded-meo-constellation-to-fcc/> [<https://perma.cc/3WR3-L7BE>].

<sup>44</sup> Caleb Henry, *After Bankruptcy, OneWeb's Supply Chain Looking For New Ways to Keep Busy*, SPACENEWS (Apr. 20, 2020), <https://spacenews.com/after-bankruptcy-onewebs-supply-chain-looking-for-new-ways-to-keep-busy/> [<https://perma.cc/2HFB-LDZB>].

<sup>45</sup> Scott Desmit, *Look! It's A Bird, It's A Plane, It's . . . Elon Musk's Starlink; Satellite String Visible Early Thursday Morning*, DAILY NEWS (June 19, 2020), [https://www.thedailynewsonline.com/top\\_story/look-it-s-a-bird-it-s-a-plane-it-s-elon-musk-s-starlink/article\\_618d5376-70d0-5def-b1f2-1cc86546f10e.html](https://www.thedailynewsonline.com/top_story/look-it-s-a-bird-it-s-a-plane-it-s-elon-musk-s-starlink/article_618d5376-70d0-5def-b1f2-1cc86546f10e.html) [<https://perma.cc/QXH9-T9EK>].

<sup>46</sup> Caleb Henry, *SpaceX Launches 58 Starlink Satellites, Three Planet SkySats on Falcon 9*, SPACENEWS (June 13, 2020), <https://spacenews.com/spacex-launches-58-starlink-satellites-three-planet-skysats-on-falcon-9/> [<https://perma.cc/8HBH-5Y5K>].

<sup>47</sup> Roland Lehoucq & François Graner, *Elon Musk is Polluting the Skies with SpaceX's Thousands of Satellites*, MARKETWATCH (Jan. 6, 2020), <https://www.marketwatch.com/story/elon-musk-is-polluting-the-skies-with-spacexs-thousands-of-satellites-2020-05-27> [<https://perma.cc/94BJ-DLJ9>].

<sup>48</sup> *Id.*

These new satellite systems, or mega-constellations, may be authorized by their respective administrations, but have they taken into account the impact they have or will have on the outer space environment, such as increasing the amount of space debris and the possibility of satellite collisions that will impact their operations and service provision? Lyall and Larsen suggest in both editions that there is a need for a global agency that could handle the proliferation of satellite systems, launches, space debris, and to manage space traffic.<sup>49</sup> The authors elaborate on this subject in Chapter 8, where they suggest the establishment of a “World Communication Commission.”<sup>50</sup> They have written on the efforts to minimize space debris but realize that these efforts are hampered by the cost of cleaning up the outer space environment.<sup>51</sup> Cost is only one impediment, however. Lack of viable technology is another, and a third is the issue of ownership of space debris. While some of the space debris can be identified as belonging to a particular State or operator, the small particles may be more difficult to identify, but they are nevertheless as dangerous as large pieces of rockets or spent satellites.<sup>52</sup>

The threat posed by space debris is discussed in several parts of the Treatise, and the authors posit that the Liability Convention needs to be revisited and updated to deal more effectively with space debris.<sup>53</sup> Even though liability has a long history in international law according to Lyall and Larsen, it is a concept that needs to be refined as it applies to space law and space activities.<sup>54</sup> While debris on Earth may be traceable to its source, debris in space is more difficult to track and imputing liability is also more difficult.<sup>55</sup>

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<sup>49</sup> LYALL & LARSEN (2d ed.), *supra* note 3, at 268–70; Ospina, *supra* note 2, at 507–08 (citing LYALL & LARSEN (1st ed.), *supra* note 1, at 306–07).

<sup>50</sup> LYALL & LARSEN (2d ed.), *supra* note 3, at 225.

<sup>51</sup> *Id.* at 275–79.

<sup>52</sup> *Id.* at 271–72.

<sup>53</sup> *Id.* at 87–90, 97–98. The Treatise authors’ suggested revisions include “a proper time-table within which notifications to UNOOSA should be made.” *Id.* at 87.

<sup>54</sup> *Id.* at 95.

<sup>55</sup> *Id.* at 87–90 (revisions should be made to “strengthen the identification of a space object under [Liability] Convention Art. V by requiring that all the larger detachable solid parts of space objects should have identifiers, designators or an adequate registration number stamped or otherwise contained, embossed, or engraved on them”).

One major difference between the first and second editions of this Treatise is Chapter 8, which focuses on the ITU.<sup>56</sup> The authors go into much detail on the history of the ITU, the substance of many of the WRCs, the role of the ITU in managing all the satellite systems which are notified to this international entity, as well as what role the ITU should play in the implementation of the Cape Town Convention<sup>57</sup> Space Protocol.<sup>58</sup> The Space Protocol<sup>59</sup> deals with the financing and securing of interests in space assets, issues which seem to be more economic than technical and perhaps beyond the purview of the ITU.<sup>60</sup>

One question the author of this review posits is: what are the potential short- and long-term impacts of one entity, such as Starlink, having thousands of satellites in orbit? Will this mega-constellation prevent competitors from implementing their systems? Could Musk, the man behind Starlink, claim special rights to several orbits by virtue of having so many of his satellites in space and crowding out competitors? Should one entity like Starlink be allowed to dominate the orbits? Will Musk be able to coordinate the use of the frequencies and orbital positions with all systems planned or already in orbit, or will he “get his way” by dint of being the occupier of so many orbits and orbital positions, possibly rendering some of the ITU’s functions obsolete or certainly more difficult? Radio astronomers are making their case for protection against or from the light reflected off the Starlink satellites,<sup>61</sup> but it is too early to know whether their complaints will be acted upon by Starlink in a satisfactory manner.

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<sup>56</sup> *Id.* at 189–226.

<sup>57</sup> Convention on International Interests in Mobile Equipment and Protocol to Convention on International Interests in Mobile Equipment on Matters Specific to Aircraft Equipment, Nov. 16, 2001, S. Treaty Doc. No. 108–10, 2307 U.N.T.S. 285.

<sup>58</sup> *Id.* at 190–94, 208–09, 220.

<sup>59</sup> Protocol to the Convention on International Interests in Mobile Equipment on Matters Specific to Space Assets, *opened for signature* Mar. 9, 2012, <https://www.unidroit.org/instruments/security-interests/space-protocol> [<https://perma.cc/J9HW-RS5S>] (adopted during a diplomatic conference convened by Germany in Berlin from Feb. 27–Mar. 9, 2012).

<sup>60</sup> This issue is discussed in a later chapter, Chapter 14, with references to the ITU (Chapter 8) and the Outer Space Treaty. *See id.* at 392–404. It would seem that the ITU has enough problems trying to remain solvent without taking on a supervisory role for the Space Protocol. *Id.* at 197–99.

<sup>61</sup> Shannon Stirone, *Elon Musk’s Satellites Threaten to Disrupt the Night Sky for All of Us*, WASH. POST (June 5, 2019), <https://www.washingtonpost.com/outlook/2019/06/05/elon-musks-satellites-threaten-disrupt-night-sky-all-us/> [<https://perma.cc/7GJG-R27K>].

The authors have also expanded on the military use of outer space, a subject they address in Chapter 16.<sup>62</sup> They go into great detail on the Outer Space Treaty and what it permits or does not permit, and the similarities between the Antarctic Treaty and the Outer Space Treaty.<sup>63</sup> They also address the rise of commercial satellite use by the military sector and related issues, such as ownership of the spacecraft.<sup>64</sup> The creation of the U.S. Space Force as a new branch of the U.S. Armed Forces in December 2019<sup>65</sup> will give more prominence to the question of military use of outer space. But will the Space Force, currently under the Secretary of the U.S. Air Force, achieve more independence from the U.S. Air Force, or will it continue to rely on it for qualified personnel?

Another change between the first and second editions relates to the search for extraterrestrial intelligence (SETI).<sup>66</sup> Chapter 17 on SETI includes many references to the ITU's regulations, but the authors state that the ITU Radio Regulations (ITU-RR) provide little protection to radio astronomy, so that radio astronomers seem to get short shrift at the WRCs.<sup>67</sup> The authors also mention that plans to set up a telescope on the Moon have been considered for years<sup>68</sup> and would need to take into account the Moon Agreement, which to date has been ratified by very few States.<sup>69</sup> The telescope would also need to take into account harmful interference in radio emissions in the "shielded zone" of the Moon.<sup>70</sup>

In brief, this chapter on SETI goes into much detail regarding the history of SETI, the ITU, the Outer Space Treaty, and the Moon Agreement.<sup>71</sup> The footnotes are extensive, and not the easiest to read and understand, but worth the effort.

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<sup>62</sup> LYALL & LARSEN (2d ed.), *supra* note 3, at 447–482.

<sup>63</sup> *Id.* at 456–471, 462.

<sup>64</sup> *Id.* at 463, 466.

<sup>65</sup> Leonard David, *Trump Officially Establishes US Space Force with 2020 Defense Bill Signing*, SPACE.COM (Dec. 21, 2019), <https://www.space.com/trump-creates-space-force-2020-defense-bill.html> [<https://perma.cc/Q4WW-CNEZ>].

<sup>66</sup> LYALL & LARSEN (2d ed.), *supra* note 3, at 483–507; Ospina, *supra* note 2, at 519–20.

<sup>67</sup> LYALL & LARSEN (2d ed.), *supra* note 3, at 495–97.

<sup>68</sup> *Id.* at 497.

<sup>69</sup> *Id.*

<sup>70</sup> *Id.*

<sup>71</sup> *Id.* at 484–85, 494–95, 497.

The last chapter of the Treatise is entitled “The Future.”<sup>72</sup> In this chapter, the authors pose some very interesting questions and problems regarding the growing participation of the private sector in space activities, the role of international agreements and ultimately, of international law, both as it relates to terrestrial and outer space activities.<sup>73</sup> They maintain that “the use of space could be made more clearly congruent with the international public interest rather than narrow national interests.”<sup>74</sup>

The authors go into much detail regarding some of the topics covered in the previous chapters, such as the problems with space debris: they suggest that a new legally binding instrument would be useful to impose clear obligations and standards.<sup>75</sup> Another concern is the proliferation of satellites of all sizes in different orbits, leading them to conclude that space traffic management is becoming a necessity.<sup>76</sup> They also go into detail regarding asteroid mining by private commercial parties, and what kind of “property rights” these entities could claim.<sup>77</sup> They seem to imply that the passage of the U.S. Asteroid Act in 2015 and the Luxembourg Law of 2017 were too hasty and do not take into account one of the basic tenets of space law, namely that these resources should be for the benefit of all mankind.<sup>78</sup> They advocate giving the ITU-RR more authority and power to ensure that the radiofrequency spectrum is used efficiently and in conformity with the ITU-RR, and in accordance with the ITU’s Constitution, Art. 44.2, which notes that the radio frequencies and associated orbits (not only the geostationary-satellite orbit) are “limited natural resources.”<sup>79</sup> One suggestion that would be welcome by many Administrations, but not by private parties, is instituting fees for the use of outer space and the radio frequencies.<sup>80</sup>

Another area of concern is the unrestrained “military use of outer space.”<sup>81</sup> Several countries, such as the United States, Rus-

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<sup>72</sup> *Id.* at 509–23.

<sup>73</sup> *See, e.g., id.* at 514–15.

<sup>74</sup> *Id.* at 519.

<sup>75</sup> *Id.* at 514.

<sup>76</sup> *Id.* at 515.

<sup>77</sup> *Id.* at 515–16.

<sup>78</sup> *Id.* at 516; *see also* Outer Space Treaty, *supra* note 29, art. I; Moon Agreement, *supra* note 12, art. 11.

<sup>79</sup> *Id.* at 519 (quoting Constitution of the International Telecommunication Union (Geneva, 1992)), art. 44.2, 1996 B.T.S. 24.

<sup>80</sup> *Id.* at 520.

<sup>81</sup> LYALL & LARSEN (2d ed.), *supra* note 3, at 447–83.

sia, and China, have space forces, the newest one being the U.S. Space Force.<sup>82</sup> Chapter 16 is devoted to that topic,<sup>83</sup> but the new U.S. Space Force came into being only in December 2019.<sup>84</sup> Thus, a third edition of the Treatise will have to expand on this question.

The chapter on future of space law and of space activities poses many thought-provoking situations and questions.<sup>85</sup> The authors are able to capture some of these concerns and recommend some solutions. As they state in regard to SETI, “[it] raises the correlative question whether there is intelligent life on Earth.”<sup>86</sup> Let us hope that our intelligence will help us maintain the use of outer space primarily for peaceful purposes and for the benefit of all mankind, as stated in Article I of the Outer Space Treaty.<sup>87</sup> Further, as Lyall and Larsen state, “Law and morals must always interact for Law and Society to be healthy.”<sup>88</sup>

### CONCLUSION

Perhaps “Conclusion” is not the appropriate word with which to end a book review. In this instance, it is more accurate to call these comments “Conclusions,” those of the reviewer.

By and large, the second edition of *Space Law: A Treatise*, like its predecessor, is a readable book, with very extensive footnotes, and comments included in many of these. It is certainly a tome worthy of being on the shelf or desk of anyone interested in space law, its origins, and its current status. Space law is one of the most dynamic sectors of international law and is likely to continue evolving for many years to come.

Many important changes have taken place since its publication in 2018, and perhaps a third edition will include these. As noted above, the establishment of the U.S. Space Force as a sixth arm of the Department of Defense, and separate from the Air Force, is a significant change. The Space Force is still in an embryonic stage but will grow and become important in the next few years. Another major change is the launch of mega-

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<sup>82</sup> Leonard David, *Space Force: What Will the New Military Branch Actually Do?*, SPACE.COM (Feb. 9, 2020), <https://www.space.com/united-states-space-force-next-steps.html> [<https://perma.cc/7AZH-3RE7>].

<sup>83</sup> LYALL & LARSEN (2d ed.), *supra* note 3, at 447–83.

<sup>84</sup> David, *supra* note 82.

<sup>85</sup> LYALL & LARSEN (2d ed.), *supra* note 3, at 509–23.

<sup>86</sup> *Id.* at 523.

<sup>87</sup> Outer Space Treaty, *supra* note 29, art. I.

<sup>88</sup> LYALL & LARSEN (2d ed.), *supra* note 3, at 507.

constellations of satellites, and how these will affect the outer space environment, radio astronomy, and other sciences. Whether asteroid mining will become a reality, or whether and when space tourism will finally materialize, are open-ended propositions at this point in time.

One drawback to the second edition, in this reviewer's estimation, is the font size. Admittedly, the authors were able to save trees by using a smaller font and putting more information on each page as a result. But the small type, especially in the footnotes, makes it tiring to read this book for long stretches of time.

Another drawback this reviewer noted in both editions is the lack of references to writings by space law practitioners in the southern hemisphere. This Treatise is more Eurocentric than it needs to be, as many writings of space lawyers whose native language is not English are available in English. For example, the Proceedings of the International Institute of Space Law, the International Academy of Astronautics, the International Law Association, and various other international organizations are all in English and available to space law practitioners.

Despite these few shortcomings, the second edition of *Space Law: A Treatise* serves as much more than a basic book on the subject; it is an excellent reference book for the legal profession, as well as anyone interested in this fascinating—and still young—legal sector.