

Summer 1-1-2018

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### Recommended Citation

Marcus Schladebach, *Fifty Years of Space Law: Basic Decisions and Future Challenges*, 41 HASTINGS INT'L & COMP.L. Rev. 245 (2018).  
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# Fifty Years of Space Law: Basic Decisions and Future Challenges

BY MARCUS SCHLADEBACH\*

## Abstract

Space Law is often described as a collection of more or less amusing and unrealistic rules. For society, outer space is more of an imaginary sphere than a concrete space of Public International Law. That is why it is an ambitious project to explain that the international community of States has created a legal order for exploring and using outer space by concluding a binding international treaty. With a duration of 50 years, the Outer Space Treaty is in an advanced age. This special anniversary represents good reason to evaluate basic decisions and to predict future challenges of this modern part of Public International Law. The article explores the recent developments in Space Law and seeks to verify its status within International Law. Comparable to the Law of the Sea, Air Law, and currently Cyber Law, Space Law is the expectable international legal reaction to the fact that flights into outer space became possible, calling for a system of ordering. Together with the space-oriented fields of law mentioned above, Space Law is part of an emerging new *International Law of Spaces*.

## I. Introduction

On January 27, 2017, the fundamental legal basis for the exploration and use of outer space, the *Outer Space Treaty*,<sup>1</sup> celebrated its 50th Anniversary. The treaty was largely based on the Declaration of Legal

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1. G.A. Res. 2222 (XXI), Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (Dec. 19, 1966).

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Principles Governing the Activities of States in the Exploration and Use of Outer Space, which had been adopted by the General Assembly in its resolution 1962 (XVIII) in 1963,<sup>2</sup> but added a few new provisions. Under supervision of the United Nations [U.N.] the first two spaceflight nations, the United States [U.S.] and the former Soviet Union, had successfully negotiated this treaty, which was signed on January 27, 1967. It does not, however, represent the only legal document for the regulation of outer space affairs. Four additional conventions—the *Rescue of Astronauts of 1968*,<sup>3</sup> the *liability in cases of damages of 1972*,<sup>4</sup> the *registration of space objects of 1975*,<sup>5</sup> and (with special meaning for the Earth) the *Moon Treaty of 1979*<sup>6</sup>—complete the relevant legal order and create the legal field of “Space Law.” Space Law constitutes a special part of Public International Law, which is important not only for the spacefaring nations, but also for the Space industry worldwide. It should be noted that the four additional conventions only concretize certain articles of the *Outer Space Treaty*. This treaty, therefore, provides the basic framework for exploring and using outer space to date. Fifty years after the signature, it is time to recall its substantial achievements and identify future challenges.

## II. Basic Decisions

### 1. Negotiation and Conclusion

The first important point is the fact that the two spacefaring nations concluded the treaty at all. The period of the 1960s was not a period of friendship, peace, and good neighbourhood. A number of crises existed around the world and no one had the idea that the most urgent matter of the time was drafting and concluding a multilateral treaty for outer space. Unquestionably, the world's first space flights were undertaken in an

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2. G.A. Res. 1962 (XVIII), Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space (Dec. 13, 1963).

3. G.A. Res. 2345 (XXII), Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space (Dec. 19, 1967).

4. G.A. Res. 2777 (XXVI), Convention on International Liability for Damage Caused by Space Objects (Nov. 29, 1971).

5. G.A. Res. 3235 (XXIX), Convention on Registration of Objects Launched into Outer Space (Nov. 12, 1974).

6. G.A. Res. 34/68, Agreement Governing the Activities of States on the Moon and Other Celestial Bodies (Dec. 5, 1979).

unmanned form by Sputnik 1 on October 4, 1957,<sup>7</sup> and by Explorer 1 on February 1, 1958. Additionally, on April 12, 1961, Juri Gagarin had operated the first manned space flight. On May 5, 1961, Alan Shepard was the first American in outer space. These new technical developments forced the establishment of, at the minimum, basic rules for the exploration and use of outer space. However, were these reasons so strong that they demanded the conclusion of a treaty in such difficult political times? Indeed, contrary opinions on the status of Berlin, the Cuba Crisis, and the Vietnam War were all pushed aside for a while, and so, the drafting and the conclusion of the *Outer Space Treaty* in January 1967 became possible.

It is remarkable that a number of scholars have criticized the treaty, especially its wording.<sup>8</sup> They argued several points: the treaty repeats only the GA-Resolution of 1963; uses unclear wording; will never be realized; acts as an obvious instrument for political relaxation; aims on the psychological effects of mutual assurances; represents the reassuring proof of international cooperation; places the most minimal obligations; and is essentially a step backwards.<sup>9</sup> Other scholars have pointed out that the treaty provisions do not extend beyond preamble lyrics and determine the lowest common denominator.<sup>10</sup> They have additionally stated that the main reason for concluding this treaty was the States Parties' expectation that the treaty would never be applied.<sup>11</sup>

These scholars, however, had forgotten the historical context of the 1960s.<sup>12</sup> The difficult relations between the U.S. and the Soviet Union made only these careful provisions possible. The treaty had fixed the legal status of that time. In the following years, many other nations signed and ratified the treaty. In the summer of 2017, 105 States have ratified the *Outer Space Treaty*.<sup>13</sup> In retrospect, the very fact of concluding the *Outer Space Treaty*

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7. John Cobb Cooper, *The Russian Satellite – Legal and Political Problems*, 24 J. AIR L. & COM. 379 (1957).

8. For an overview on the critical positions, see Marcus Schladebach, *40 Jahre Weltraumvertrag. Rückblick und Ausblick*, 27 Neue Zeitschrift für Verwaltungsrecht 53 (2008).

9. See JAMES FAWCETT, *INTERNATIONAL LAW AND THE USES OF OUTER SPACE*, 25-27 (1968).

10. See Schladebach, *supra* note 8, at 54, footnote 15; Nicolas Mateesco Matte, *Outer Space Treaty*, in 3 *ENCYCLOPEDIA OF PUBLIC INTERNATIONAL LAW* 836, 838 (Bernhardt ed., 1997).

11. FAWCETT, *supra* note 9, at 25.

12. Schladebach, *supra* note 8, at 55.

13. Comm. on the Peaceful Uses of Outer Space, Rep. of the Legal Subcomm. on Its

was an historic achievement, which formed the legal order for outer space to date.

## 2. *Outer Space as Common Heritage of Mankind*

The second achievement of the *Outer Space Treaty* is the legal status of outer space as the “Common Heritage of Mankind.”<sup>14</sup> The term was originally introduced in the *Antarctic Treaty of 1959* and later during the creation of Space Law with the GA-Resolution of December 13, 1963. At first, the preamble of the *Antarctic Treaty* recognizes that “it is in the interest of all mankind that Antarctica shall continue forever to be used exclusively for peaceful purposes and shall not become the scene of object of international discord.”<sup>15</sup>

Transferring this new international term from the *Antarctic Treaty* to the arising idea of Space Law, the GA-Resolution of 1963 stated in its first rule: “The exploration and use of outer space shall be carried on for the benefit and in the interests of all mankind.” From there, the term found its way into the *Outer Space Treaty*. Art. I states that “the exploration and use of Outer Space shall be the province of all mankind.” With regard to the wording, the earlier legal acts deal with the term “interest” or “province of all mankind,” but the general term in the legal discussion and in the treaties of the 1970s and 1980s is “Common Heritage of Mankind.” These two terms have posed the question of whether there is a legal difference between them. Of course, some scholars have pointed out that the distinction between the concept of “province of all mankind” and “Common Heritage of Mankind” is important.<sup>16</sup> Under the first concept, States should be free to explore and use outer space as long as they do not harm other States. Although the exploration and use of Outer Space should be carried out for the benefit and in the interests of all States, the “province of all mankind” concept does not establish any obligation to share the benefits derived from outer space activities. By contrast, under the “Common Heritage of Mankind” concept,

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Fifty-Sixth Session, U.N. Doc. A/AC.105/C.2/2017/CRP.7, at 5-12 (Mar. 23, 2017).

14. FABIO TRONCHETTI, *THE EXPLOITATION OF NATURAL RESOURCES OF THE MOON AND OTHER CELESTIAL BODIES* 85 (2009); GBENGA ODUNTAN, *SOVEREIGNTY AND JURISDICTION IN THE AIRSPACE AND OUTER SPACE* 191 (2012); Rüdiger Wolfrum, *Common Heritage of Mankind*, in 2 *MAX PLANCK ENCYCLOPEDIA OF PUBLIC INTERNATIONAL LAW* 452 (Wolfrum ed., 2012).

15. *Antarctic Treaty*, Dec. 1, 1959, 402 UNTS 71; *see also* RICKY J. LEE, *LAW AND REGULATION OF COMMERCIAL MINING OF MINERALS IN OUTER SPACE* 204 (2012).

16. *See* TRONCHETTI, *supra* note 14, at 44-45.

the exploration and exploitation of a certain area and its resources should be carried out in accordance with the rules established by an international regime or authority. Successful explorers, users, and exploiters would be obliged to conform to that international regime and share the benefits derived from their exploitative activities.

However, there is no room for that understanding. The “Common Heritage of Mankind” principle is a legal principle that goes substantially back to the Antarctic regime. The former usage “interest of all mankind” (1959, 1963) and “province of all mankind” (1967) had expressed that substantial understanding, before in 1967, Arvid Pardo, Ambassador of Malta with the U.N., had used the term “Common Heritage of Mankind” for the first time concerning the Seabed in the Law of the Sea context.<sup>17</sup> This new term for an introduced principle was too new to already be used in the *Outer Space Treaty of 1967*. The treaty therefore still used the “old” term, but with the same substantial meaning. From that time, the international community then used the “new” term, “Common Heritage of Mankind,” as in Art. 11 sec. 1 *Moon Treaty (1979)* and in *UN Convention on the Law of the Sea (1982)*. These reasons exclude a legal difference between the two terms.<sup>18</sup>

Although attempts have been made to invoke this principle with respect to technology, cultural property, and the protection of the environment, the main impact of the common heritage principle remains the establishment of an international administration for areas open to the use of all States. A fully agreed definition of the term does not exist. However, it is possible to identify three common elements or, in other words, a “hard core” of such principle:

a) The main element of the Common Heritage status is the legal fact that no State shall claim or exercise sovereignty over any part of the area in question or its resources. No such claim or exercise shall be recognized. One can find this principle in Art. 137 and 89 UN Convention on the Law of the Sea,<sup>19</sup> in Art. II Outer Space Treaty and Art. 11 Moon Treaty. For example, the Moon Treaty states:

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17. TRONCHETTI, *supra* note 14, at 92; Malcolm D. Evans, *The Law of the Sea*, in INTERNATIONAL LAW 653 (Evans 2d ed., 2014); DONALD R. ROTHWELL ET AL., THE INTERNATIONAL LAW OF THE SEA 134 (2d ed. 2016).

18. *See also* ODUNTAN, *supra* note 14, at 205.

19. United Nations Convention on the Law of the Sea art. 89, 137, Dec. 10, 1982, 1833 U.N.T.S. 3.

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The exploration and use of the Moon shall be the province of all mankind and shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development. (Art. 4, sec. 1).

Neither the surface nor the subsurface of the Moon, nor any part thereof or natural resources in place, shall become property of any State, international intergovernmental or non-governmental organization, national organization or of any natural person. (Art. 11, sec. 3).

b) Secondly, the Common Heritage principle requires an international cooperation between the States involved. The principle does not forbid any use of the relevant area. However, this use is only allowed if all States act together, because it is a *common* heritage. The principle excludes the use by only one State, but allows the use by all States together. Of course, the lines between a forbidden single use and an allowed common use are fluid. From the obligations of exploring and using the area in a common way follow the duty to cooperate between the States. Whether an additional obligation exists to establish an international management system is still an open question. There are good reasons for this view, especially with regard to other international institutions, like the International Seabed Authority<sup>20</sup> and the International Telecommunication Union.<sup>21</sup> A management system for outer space or for the high seas does not exist and is not fixed into the relevant treaties. On the other hand, Art. 11 sec. 5 through 7 foresees “establish[ing] an international regime, including appropriate procedures” through the *Moon Treaty*. Yet, these provisions concerning the Seabed and the Moon are not enough to assume that spaces with the legal status of “common heritage of mankind” generally include the obligation to establish an international management system. Thus, one can identify at least an obligation of cooperation as a second element of the common heritage principle.

c) Thirdly, the use of international common goods for peaceful purposes has always been a very important aspect of the common heritage principle.

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20. INTERNATIONAL SEABED AUTHORITY, <https://www.isa.org.jm> (last visited Mar. 4, 2018).

21. INTERNATIONAL TELECOMMUNICATION UNION, <https://www.itu.int> (last visited Mar. 4, 2018).

This obligation is set forth in the international treaties referred to above. One may argue that this element constitutes a principle of its own, unrelated to the common heritage principle. In general, however, the peaceful use is in any case a core element of this principle and the peaceful purpose has been strongly underlined in the following treaty rules:

“The moon and other celestial bodies shall be used by all States Parties to the Treaty exclusively for peaceful purposes” (Art. IV, sec. 2 Outer Space Treaty).

“The moon shall be used by all States Parties exclusively for peaceful purposes” (Art. 3, sec. 1 Moon Treaty).

With regard to these general elements of the common heritage principle,<sup>22</sup> one can conclude that Space Law is a clear and instructive example of how this principle has been implemented into Public International Law.

### *3. Non-Appropriation Rule*

The third achievement is the Non-Appropriation rule in Art. II. The rule is related to the common heritage principle and helps to realize it. One could argue that there is no need for the Non-Appropriation rule, because from the common heritage principle already follows the prohibition of acquiring properties on celestial bodies. This interpretation would be too narrow. Art. II concretizes a special part of the common heritage principle stated in Art. I: the question of sovereignty. Art. II of the treaty regulates:

“Outer space, including the moon and other celestial bodies, is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means.”

#### a) Three Critical Events

Three events make this article a highly discussed norm in the last decades. The first remarkable action concerning Art. II is connected to the U.S. citizen, Dennis Hope. Since 1996, he has sold properties on the Moon. In 1980, he went to the U.S Governmental Office for claim registries, the San Francisco County Seat, and claimed – in compliance with the general procedures for private real property – the ownership for the Moon and all

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22. See also TRONCHETTI, *supra* note 14, at 89.

other planets, except Earth and Sun.<sup>23</sup> He based his claim on the *Homestead Act of 1862*.<sup>24</sup> This Act provided that any adult citizen, or person intending to become a citizen, who headed a family could qualify for a grant of 160 acres of public land by paying a small registration fee and living on the land continuously for five years. If the settler was willing to pay \$1.25 an acre, he could obtain the land after only six months' residence. The Agency registered Hope as the landowner of all claimed celestial bodies without any discussion of the legality of this claim. In November 1980, Hope founded a company called "Lunar Embassy"<sup>25</sup> and sent a "Declaration of Ownership" to inform the U.N. as well as the U.S. government and the Soviet Union government and requested any possible objections. Since he received no responses from these institutions, in 1996, he started to sell land plots on the Moon. He said, many "very important persons" like doctors, teachers, politicians, and other persons have already bought such properties. Although the price of such property, around \$30 for a certificate, is quite low, he identified as a millionaire. Indeed, the price is too low to start serious discussion on the legality of the claim, but as a business for the masses, Hope will earn big profits. In Hope's perspective, Art. II of the Treaty does not provide a legal limit for his business. He argues, the wording only prohibits "national appropriation," but does not include a prohibition of an appropriation by "private" persons.

The second activity was undertaken by a Spanish woman Maria Angeles Duran Lopez, living in Vigo, Spain.<sup>26</sup> In 2010, she remembered Dennis Hope and the fact that the Sun is still not registered for private ownership. Lopez went to the local properties registration agency to claim the Sun as her property and received a certificate of her ownership. Then, in 2013, she started an auction procedure on eBay and tried to sell parts of the Sun with a starting offer of 1 Euro per square metre. Based on a deep social motivation, she wanted to share the expected profit with the following percentages: 50% for the Spanish government, 20% for the Spanish pension

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23. See also TRONCHETTI, *supra* note 14, at 89.

24. See VIRGILIU POP, WHO OWNS THE MOON? 104 (2009); WULF VON KRIES ET AL., GRUNDZUGE DES RAUMFAHRTRECHTS 18 (2002).

25. LUNAR EMBASSY, [www.lunarembassy.com](http://www.lunarembassy.com) (last visited Mar. 4, 2018).

26. See Caitlin Dewey, *The curious case of the woman suing eBay over ownership of the sun*, WASH. POST (June 4, 2015), [https://www.washingtonpost.com/news/the-intersect/wp/2015/06/04/the-curious-case-of-the-woman-suing-ebay-over-ownership-of-the-sun/?utm\\_term=.f9c8a1c4943b](https://www.washingtonpost.com/news/the-intersect/wp/2015/06/04/the-curious-case-of-the-woman-suing-ebay-over-ownership-of-the-sun/?utm_term=.f9c8a1c4943b); Christopher Hooton, *'eBay vs woman who claims ownership of the Sun' is actually going to court*, INDEPENDENT (June 4, 2015), <https://www.independent.co.uk/news/world/europe/ebay-vs-woman-who-claims-ownership-of-the-sun-is-actually-going-to-court-10296417.html>.

fund, 10% for research, 10% for the fight against poverty and hunger in the world, and the remaining 10% for herself. A few days later, eBay deleted the offer in accordance with its internal rules. In 2014, Lopez started a lawsuit against eBay and claimed 10.000 Euro compensation. In June 2015, a Spanish court in Madrid agreed to hear the case, deciding that it does have jurisdiction over this legal question. But in fact, the reason for the lawsuit was eBay's blocking procedure and so the court only has to decide the contract law question of whether eBay has broken its own selling rules by deleting Lopez's offer. Finally, the court will not decide on the legality of the claim concerning Lopez's ownership of the sun. The final sentence of the court is unknown.

The third case reflects the new ambitions of the Space Policy of the U.S. On November 25, 2015, the former U.S. President, Barack Obama, signed the *Space Launch Competitiveness Act*,<sup>27</sup> which includes in Part IV a remarkable rule: every U.S. Citizen should be entitled to claim natural resources founded during an U.S. Space Mission.<sup>28</sup>

#### b) Evaluation

All three cases open the discussion of whether the Non-Appropriation rule of Art. II is applicable to the cases or not. There are a number of arguments that Art. II also includes a prohibition of private appropriation. The three main arguments are: Art. I provides free access for everyone to Outer Space, the moon and other celestial bodies. If one accepts the legality of private appropriation under Art. II, then the common heritage principle and the free access by all persons would be violated. If Art. II prohibits "national" appropriation, then it must logically prohibit "private" ones as well. The third argument deals with the intention of a State itself. There should not be an opportunity for a State to change its legal status from "national" to a private law status to claim property rights as a "private" legal person. To prevent an "escape of a State into private law," Art. II has to be interpreted in a broad sense: it includes a prohibition for both, national and

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27. U.S. Commercial Space Launch Competitiveness Act, Pub. L. No. 114-90, 129 STAT. 704 (Nov. 25, 2015).

28. For a strong critique, see Fabio Tronchetti, *Title IV – Space Resource Exploration and Utilization of the US Commercial Space Launch Competitiveness Act: A Legal and Political Assessment*, 41 AIR & SPACE LAW 143 (2016); see also Stephan Hobe, *The International Institute of Space Law adopts Position Paper on Space Resource Mining*, 65 Zeitschrift für Luft- und Weltraumrecht 204 (2016).

private appropriation.<sup>29</sup>

Notably, this major opinion regarding Art. II partly remains silent regarding the existing contrary arguments. But, unquestionably, a serious academic debate must consider the opposing side. First, the wording of Art. II only refers to “national” appropriation, allowing for a stricter textual interpretation. Further, there are apparent changes in the relevant articles of the *Outer Space Treaty* on the one hand and the *Moon Treaty* on the other hand. While Art. II of the *Outer Space Treaty* uses the word “national,” Art. 11, sec. 3 of the *Moon Treaty* explicitly includes “any natural person.” In accordance with this clear extension of the relevant addressed group, Art. II of the *Outer Space Treaty* limits its application on “national” institutions insofar a legal gap exists. Otherwise, there would not be a reason to extend the wording in the *Moon Treaty* to “natural persons.” Nonetheless, better reasons call for a wide interpretation and the major opinion that there is no legal gap in Art. II. All three cases mentioned above violate the Non-Appropriation rule of Art. II and all claims are illegal.

#### 4. Prohibition of Militarization

Another important achievement is the prohibition of militarization of outer space according to Art. IV.<sup>30</sup> State parties to the Treaty undertake not to place in orbit around the Earth any objects carrying nuclear weapons or any other kinds of weapons of mass destruction, install such weapons on celestial bodies, or station such weapons in outer space in any other manner. All State parties to the Treaty shall use the moon and other celestial bodies exclusively for peaceful purposes. The establishment of military bases and installations, the testing of any type of weapons, and the conduct of military manoeuvres on celestial bodies shall be forbidden. There is one interesting exception in Art. IV, Sec. II: The use of military personnel or equipment for scientific research or for any other peaceful purposes shall not be prohibited.

A closer look at the exact wording of Art. IV reveals smaller gaps. Although the idea of militarization of outer space has been shown in masses of movies in cinema or television series like “Star Wars” and others, fortunately there is no practical realization of these imaginations. Critical programs like the “Strategic Defense Initiative” (SDI) of U.S. President

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29. See POP, *supra* note 24, at 62; TRONCHETTI, *supra* note 14, at 217; SGROSSO, *supra* note 23, at 62; VON KRIES ET AL., *supra* note 24, at 18; Schladebach, *supra* note 8, at 55; Schladebach, *Einführung in das Weltraumrecht*, 48 *Juristische Schulung* 217, 219 (2008).

30. See SGROSSO, *supra* note 23, at 68; VON KRIES ET AL., *supra* note 24, at 253; Schladebach, *supra* note 8, at 56; Schladebach, *supra* note 29, at 219-20.

Ronald Reagan in the early 1980s stayed in an early planning status.<sup>31</sup> This year, the world is regularly looking to the Asian state, North Korea, where the government is conducting monthly testing of new rockets and informs the world via television about the so-called successful tests. This dangerous behavior strictly leads to the legal question of whether North Korea is a State party to the *Outer Space Treaty* and has to follow the rules mentioned above. The answer is surprising: in 2009, North Korea signed and ratified the *Outer Space Treaty* and the additional conventions, except the *Moon Treaty*.<sup>32</sup> Of course, the main legal instruments of Public International Law to prevent dangers from North Korea's ballistic missile tests are sanctioned by the U.N. Security Council.<sup>33</sup> The missile tests also violate the provisions of Space Law and create a serious challenge for Art. IV *Outer Space Treaty*.

### 5. *Rescue of Astronauts*

This next chapter deals with Art. V in a humanity context: the rescue of astronauts in cases of an emergency. According to Art. V, State parties to the Treaty shall regard astronauts as envoys of mankind in Outer Space and shall render to them all possible assistance in the event of accident, distress, or emergency landing on the territory of another State party or on the high seas. When astronauts make such a landing, they shall be safely and promptly returned to the State of registry of their space vehicle. These provisions of humanity are fixed in more detail in the additional *Rescue Agreement of 1968*.<sup>34</sup>

One of the legal questions of Art. V is the term "envoys of mankind." Various scholars have discussed whether this term creates a special legal status of astronauts.<sup>35</sup> Their proposals include a governmental status or a

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31. See Michael G. Gallagher, *Legal Aspects of the Strategic Defense Initiative*, 111 *MILITARY LAW REVIEW* 11 (1986); George Bernhardt et al., *Star Wars versus Star Laws: Does SDI Conform to Outer Space Law?*, 15 *JOURNAL OF LEGISLATION* 251 (1989).

32. See Committee on the Peaceful Uses of Outer Space, *supra* note 13, at 6.

33. See Press Release, Security Council, Security Council Press Statement on Democratic People's Republic of Korea's Ballistic Missile Launch, UN's Press Release SC/12831-DC/3705 (May 22, 2017).

34. See United Nations, *supra* note 3.

35. See HORST BITTLINGER, *HOHEITSGEWALT UND KONTROLLE IM WELTRAUM* 102 (1988); Horst Bittlinger, *Menschen im Weltall*, in *HANDBUCH DES WELTRAUMRECHTS* 205, 216 (Karl-Heinz Böckstiegel ed., 1991); SGROSSO, *supra* note 23, at 306; Schladebach, *supra* note 29, at 221.

status as a diplomat connected with certain immunity rights. Other scholars have spoken on the status of a “world citizen,” but without a clear reasoning on legal rights of such a world citizen. Finally, the debate ended with the result that the term “envoys of mankind” represents no special legal status of astronauts.<sup>36</sup>

The legal discussion on the status and the rescue of an astronaut requires a clear definition of the term “astronaut.” This represents the second legal question concerning Art. V. The major opinion defines “astronaut” as every person onboard of a spaceship.<sup>37</sup> On the other side, one can find that the term “astronaut” encompasses only persons aboard of a spaceship who have a certain technical function for the concrete Space mission.<sup>38</sup> The difference between the two positions is remarkable: private space travelers, sick astronauts and—only in theory—blind passengers do not operate technical activities onboard.<sup>39</sup> Therefore, according to the second opinion, the duty to rescue does not include these persons. It is problematic that there should not be an obligation to rescue Space travelers and sick astronauts. As mentioned before, the major opinion defines the term “astronaut” in a wider sense. Of course, this argument is the right one. It follows the ideas of humanity considered in the preamble of the *Rescue Agreement of 1968*. This method should be introduced as a new form of legal interpretation: the “interpretation of humanity.” The typical canon of interpretation methods,<sup>40</sup> founded in general by Friedrich Carl von Savigny in 1840,<sup>41</sup> should be enlarged by this new method.

## 6. Positioning of Satellites

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36. See HORST BITTLINGER, HOHEITSGEWALT UND KONTROLLE IM WELTRAUM 102 (1988); Horst Bittlinger, *Menschen im Weltall*, in HANDBUCH DES WELTRAUMRECHTS 205, 216 (Karl-Heinz Böckstiegel ed., 1991); SGROSSO, *supra* note 23, at 306; Schladebach, *supra* note 29, at 221.

37. See Bittlinger, *supra* note 35, at 205, 210; BIN CHENG, STUDIES IN INTERNATIONAL SPACE LAW 458 (1997); Schladebach, *supra* note 29, at 221.

38. See Stephen Gorove, *Interpreting Salient Provisions of the Agreement on the Rescue of Astronauts, the Return of Astronauts, and the Return of Objects Launched into Outer Space*, IISL-Proc. 93 (1968); Arthur Dula, *Regulation of Private Commercial Space Activities*, IISL-Proc. 25, 36 (1981).

39. See E.R.C. VAN BOGAERT, ASPECTS OF SPACE LAW 157 (1986); Schladebach, *supra* note 29, at 221.

40. The classic interpretation methods are: text, system, history and telos.

41. FRIEDRICH CARL VON SAVIGNY, SYSTEM DES HEUTIGEN ROMISCHEN Rechts 213-214 (1840).

### a) Satellites as Economic Use

The States are especially interested in the economic use of outer space. This motivation is justified by Art. I, which deals with the use of outer space. “Use” in that sense means at first “economic use.” One of the possible options to use Outer Space economically is the positioning of satellites for different purposes: communication (broadcasting, telecommunication, and internet); weather and natural disaster forecast; and navigation of transport, military aspects, and the like. It is obvious that almost every State wants to be present in outer space and wants to install and use modern communication technology by satellites. This economic-based interest leads directly to the legal questions of which States are entitled to put a satellite in an outer space orbit: is entitlement limited to only high-technology States, e.g. the U.S., Russia, Japan, France, or does entitlement extend to other States that do not have the technical and financial possibilities to place a satellite for their own purposes into outer space?<sup>42</sup>

### b) Procedure before the ITU

Every State, which wants to place a satellite in an outer space orbit, has to submit an order to the International Telecommunication Union (ITU) in Geneva. The ITU checks the order mainly with regard to technical aspects. If there is no contradiction with other orders for that specific frequency position, then the State gets the place. The general principle for those allocation decisions is “first come, first serve.”<sup>43</sup> In the past, the industrial countries made—on the basis of their economic and scientific power—many orders and received frequencies and the corresponding orbit positions. This development regarding the number of orders by industrial countries brought the developing countries in a defensive corner. As a result, the limited access to space became a highly discussed problem in the late 1970s.<sup>44</sup> While industrialized countries tried to use their technical knowledge to install many

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42. See Marcus Schladebach, *Der Weltraum als internationale Wirtschaftsarena. Koturen eines exterritorialen Wirtschaftsrechts*, in INTERNATIONALE DIMENSIONEN DES WIRTSCHAFTSRECHTS AUS SICHT VERSCHIEDENER RECHTSDISZIPLINEN UND RECHTSORDNUNGEN 11 (Kathrin Binder/Florian Eichel ed. 2013).

43. VON KRIES ET AL., *supra* note 24, at 157; SGROSSO, *supra* note 23, at 430; ISABELLA DIEDERICKS-VERSCHOOR ET AL., AN INTRODUCTION TO SPACE LAW, 64 (3d ed. 2008).

44. See STEPHEN GOROVE, DEVELOPMENTS IN SPACE LAW 46 (1991); Schladebach, *supra* note 42.

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satellites in space orbits to modernize the communication structures worldwide, the larger number of developing countries criticized this new "Race to Space." They felt excluded from the new technical and economic possibilities and claimed a fair procedure of allocation. Some States had even declared that the increasing number of communication satellites leads to an "imperialism of culture," because a group of industrialized countries wants to influence certain States' governmental systems with news and messages by satellites.

In this context, the chosen orbit plays a special role for placing a satellite. There are lower orbits between 200 and 5,500 km (LEO), medium orbits between 10,000 and 20,000 km (MEO), and highly elliptical orbits between 1000 km and 40,000 km.<sup>45</sup> However, the most interesting orbit is the Geostationary Orbit (GSO) at a height of around 36,000 km.<sup>46</sup> On this orbit, an installed satellite follows synchronal a point on Earth around the equator region. Related to this territorial place on Earth the satellite seems to be stationary in Space. For broadcasting purposes this position is very efficient and attractive: with only three satellites, a State is able to create an information network around the earth. At the end of the 1970s, the developing countries strongly advocated for a fair and equitable procedure to place satellites in outer space, especially in GSO. For this reason, the Space Law community searched for options to transfer these understandable interests into legal provisions.

### c) Legal Solution of the Allocation Conflict

This intention was not easy to realize. The *Outer Space Treaty* does not provide a suitable provision, which could have been modified to implement a distribution concept. Moreover, there was no political initiative to create a new legal norm concerning the placing of satellites, which is why the States have chosen the way to change relevant regulations of the ITU. It is the main international forum for the distribution of radio frequencies. Although it is questionable whether the International Telecommunication Law is the right place to decide conflicts on satellite positions in Outer Space, the Space Law community dealt with ITU law initially for the Geostationary Orbit in the late 1970s. In the mid-1980s, the State Parties changed the ITU Constitution to declare that all orbits in Outer Space represent "limited natural

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45. SGROSSO, *supra* note 23, at 31.

46. GOROVE, *supra* note 44, at 36; *see also*, DIEDERICKS-VERSCHOOR ET AL., *supra* note 43, at 64; *see also*, Schladebach, *supra* note 29, at 218-19.

resources”:<sup>47</sup>

In using frequency bands for radio services, Member States shall bear in mind that radio frequencies and any associated orbits, including the geostationary-satellite orbit, are limited natural resources and that they must be used rationally, efficiently and economically, in conformity with the provisions of the Radio Regulations, so that countries or groups of countries may have equitable access to those orbits and frequencies, taking into account the special needs of the developing countries and the geographical situation of particular countries. (Art. 44, sec. II).

The legal consequence of this special legal status of an orbit is that every State party of the ITU Constitution has the right to claim at least one position on every orbit. Regardless of a State’s economic, financial or scientific power to place a satellite on a certain orbit, at least one position must be reserved for future activities by the State. This distribution procedure can be evaluated as fair, even if industrialized countries are placing additional satellites on orbits. The provisions of the ITU are in accordance with Art. I of the *Outer Space Treaty*, stating that, “using Outer Space is in the interests of all countries, irrespective of their degree of economic or scientific development.” Even the poorest countries in Central Africa have a reservation for one satellite position in outer space on every orbit.

#### d) Paper Satellites

The phenomenon of “Paper Satellites” may be a silly aspect at superficial glance, but on closer inspection is a serious problem of Space Law. Starting with the Pacific State of Tonga, a number of developing countries around the equator region have applied for geostationary orbit positions, although they do not have the smallest possibility to construct a satellite and to place it in a suitable orbit.<sup>48</sup> The ITU, which only has less efficient legal instruments to divide between realistic and unrealistic applications, has regularly allocated the ordered orbit positions.<sup>49</sup> Afterwards, these states started to lease the orbit positions for high amounts to interested states. For instance, Tonga had ordered 16 GSO positions,

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47. SGROSSO, *supra* note 23, at 430; *see also*, Schladebach, *supra* note 29, at 219.

48. Don Riddick, *Why does Tonga own Outer Space?*, 19 AIR AND SPACE LAW 15 (1994).

49. VON KRIES ET AL., *supra* note 24, at 69.

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received six and leased a single position for \$2 Million.<sup>50</sup> Ordering such “Paper Satellites” might be a violation of the applying ITU rules. Though these acts do not contradict explicitly written rules, it is an abuse of the first-come, first-served principle. Additionally, if a state leases orbit positions for its own economic purposes, the state acts like an owner that gives rights to interested leasers. This commercialization of orbit positions is an appropriation of parts of outer space and consequently violates the Non-appropriation rule of Art. II *Outer Space Treaty*. To avoid “Paper Satellites,” which reduce the total volume of available positions, the States Parties of the ITU should create new provisions

### 7. Other Basic Achievements

There are a number of other basic achievements of the *Outer Space Treaty*. Art. VI declares the admission of non-state actors in outer space. Although activities by non-state actors were beyond unrealistic in 1967, the treaty was made for future times and provides the conditions for such private space missions. Rules on liability for accidents in space in Art. VII and (very modern for the 1960s) rules on environmental protection in Art. IX are further core aspects of this truly sustainable treaty.

### 8. The Beginning and the End of Outer Space

As described before, the *Outer Space Treaty* regulates a number of important basic aspects and contains fundamental achievements for a reasonable and peaceful use of outer space. Yet, there are also unresolved questions of Space Law. One question is the exact applicability of Space Law, especially the geographic lines of outer space. Space Law forms a separate legal order beyond national sovereignty, requiring appropriate determinations on the applicability of this law. Clearly, Space Law is applicable in outer space. Yet, there are no provisions on where outer space begins and where it ends. To be very clear: this is not a question of philosophy or metaphysics. It is an ordinary legal question to determine where the Space Law order is applicable.

#### a) The Beginning of Outer Space

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50. See Riddick, *supra* note 48, at 16.

The beginning of outer space is one of the most discussed questions in Air and Space Law.<sup>51</sup> The majority of the scholars state that outer space is the space directly above the airspace. While the airspace belongs to national sovereignty and is governed by national law, outer space belongs to mankind and is regulated by Space Law. Due to these totally different legal orders, there is a necessity for the clear delimitation of national airspace and international outer space. Additionally, every state wants to know its state borders. Lawsuits on state borders are the most important cases before the International Court of Justice. Nevertheless, there is a group of lawyers who permanently deny the necessity of such delimitation and proclaim the “No present need” theory. The aforementioned reasons, however, demonstrate a need to find a legal answer as to where outer space and the common Space Law order begins.<sup>52</sup>

There are approximately 35 opinions answering this legal question.<sup>53</sup> The leading argument uses knowledge from aerodynamics, discovered by the pioneer of aerodynamics: Theodor von Kármán, the founder of the world’s first institute of aerodynamics in Goettingen, Germany. In the 1950s he discovered that on the basis of aerodynamic, no aircraft could fly higher than 83 km. This line is called the “Kármán Line.” The major legal community adopted this discovery and transferred it as the “Kármán Primary Jurisdictional Line”<sup>54</sup> into the legal sphere. Most scholars subsequently conclude: when the airspace ends at a limit of 83 km, then outer space immediately begins at 83 km above the ground.

Other opinions follow such discovery, also based on serious facts of physics that no space object can fly on an orbit path lower than 100 km. While these scholars argue for a beginning of outer space at a limit of 100 km, they also accept that airspace ends at this point.

As everyone easily can see without checking a physics textbook, both

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51. See, e.g., ERNST FASAN, *WELTRAUMRECHT* 41 (1964); MANFRED A. DAUSES, *DIE GRENZE DES STAATSGEBIETES IM RAUM* (Schriften Zum Offentlichen Recht; Bd. 204 (1972)); ROBERT F.A. GOEDHART, *THE NEVER ENDING DISPUTE: DELIMITATION OF AIR SPACE AND OUTER SPACE* (Marietta Benko et al. eds., Vol 4 1996); DIEDERICKS-VERSCHOOR ET AL., *supra* note 43, at 15; SCHLADEBACH, *supra* note 29, at 218; SGROSSO, *supra* note 23, at 29; ODUNTAN, *supra* note 14, at 282.

52. See DAUSES, *supra* note 51, at 9; Alexandra Harris & Ray Harris, *The Need for Air Space and Outer Space Demarcation*, 22 *SPACE POLICY*, 3 (1996); MARCUS SCHLADEBACH, *LUFTHOHEIT: KONTINUITÄT UND WANDEL (JUS PUBLICUM)* (2014).

53. See SCHLADEBACH, *supra* note 52, at 168; ODUNTAN, *supra* note 14, at 282.

54. See, e.g., SCHLADEBACH, *supra* note 52, at 176-179; Schladebach, *supra* note 29, at 218; FASAN, *supra* note 51, at 73.

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legal positions must be wrong: outer space cannot begin at 83 km, because no space object can fly lower than 100 km. Additionally, airspace cannot end at 100 km, because no aircraft can fly on the effects of aerodynamics higher than 83 km. It is incomprehensible that no other scholar in Air Law and in Space Law has discovered this conflict. Since a German publication in 2014, this problem has cleared up.<sup>55</sup> Legal science cannot be smarter than natural sciences like physics. Both geographical limits are right for themselves: airspace must end at 83 km, and outer space must begin at 100 km. Outer space is not connected with airspace. There is an intermediate zone of 17 km.<sup>56</sup> Above this new created intermediate zone, outer space begins at a limit of 100 km. The legal status of that new zone is comparable with the “Exclusive Economic Zone” in the *Law of the Sea*. The territorial State should have special exclusive rights for the access to outer space. If this state wants to launch a space object, then access to outer space has to be free. A permission of another state is not necessary. If another state wants to use this zone for operating a space object, then the state has to take consideration on the interests of the territorial state. The legal order into the intermediate zone thus generally follows the rules of Art. 58 sec. I, III UNCLOS.

#### b) The End of Outer Space

The end of outer space has also not been determined. At least, the *Outer Space Treaty* refers to the “Moon and other celestial bodies.” This wording is quite unclear, because there is not an exact number of celestial bodies, a term that includes self-shining stars and planets. That is, the number of planets is changing, particularly after the former 9th planet, Pluto, had lost its status as a planet after a ridiculous decision in 2006 by the non-legitimized International Astronomical Union.

However, an indication results from Art. 1, sec. I of the *Moon Treaty*. It foresees the application of the Moon Treaty to not only the moon, but also other celestial bodies “within the solar system.” This is the only written point in Space Law to understand how Space Law itself defines its geographical application. Of course, as mentioned above, *the Moon Treaty* does not play an important role, because no space-faring nation has ratified this treaty. However, the *Moon Treaty* has determined a certain State consensus of the 1970s, which at least could be used to answer the question on the outer limits

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55. SCHLADEBACH, *supra* note 52, at 176.

56. *Id.*

of outer space. Taking into account that this border is more or less clear, there are good legal reasons to assume that our solar system is the outer limit for the application of Space Law in general and for the *Outer Space Treaty* in particular.

### III. Future Challenges

There are a number of future challenges in Space Law. This article presents five important aspects, which currently dominate the legal discussions on Space Law: (1) The International Space Station; (2) the exploitation of natural resources on the Moon; (3) the reduction of space debris; (4) the legal framework of space tourism; and (5) the national legislation in Space Law.

#### *1. International Space Station*

The International Space Station is a project of 5 partners: the U.S., Russia, Japan, Canada and Europe. Europe acts through the European Space Agency (ESA). There is also a formal cooperation with Brazil. After the political change in Eastern Europe in 1989, it was the former U.S. President Bill Clinton, who invited Russia to a new common space station in 1993. Russians had vast experiences in this field, because from 1986 to 2001 they had successfully operated the Space Station "Mir." In the late 1980s, the U.S. had also planned its own space station at first with the name "Freedom," then as "Alpha." At the beginning of the 1990s, with the open minded Russian President Jelzin, there was a political opportunity for a long lasting partnership in outer space. With regard to the legal fundament of this new project, the U.S. used its former draft agreement of 1988 for its own station, "Freedom," and modified it for new partners, especially for Russia. The legal basis for the ISS is now the ISS Agreement of January 29, 1998.<sup>57</sup>

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57. Agreement Concerning Cooperation on the Civil International Space Station, March 27, 2001, T.I.A.S. No. 12927; see also Rochus Moenter, *The International Space Station: Legal Framework and Current Status*, 64 J. AIR L. & COM. 1033 (1999); Karl-Friedrich Nagel, *Das neue Regierungsübereinkommen über die Internationale Raumstation*, 47 Zeitschrift für Luft- und Weltraumrecht 143 (1998), with text of the agreement at 149; SGROSSO, *supra* note

The cooperation on the ISS is an ongoing success. The international community should recognize that the station is one of the few international projects where the U.S. and Russia are working successfully together. Unfortunately, the ISS partners want to operate the station only until 2024.<sup>58</sup> Then, Russia wants to take its parts of the ISS to construct its own Russian Station. The conflict in the Ukraine and Crimea has forced such separating tendencies. This must be evaluated as negative development. If one keeps in mind that China is also working on its own space station, then the future of space stations tumbles back to the 1980s: no political, technical and scientific cooperation under the conditions of outer space. It is therefore an urgent task of the international community to check whether a sustained close cooperation with a common space station between the U.S. and Russia is possible.

## 2. *Exploitation of Natural Resources on the Moon*

### a) Searching for New Resources

A second challenge for Space Law is the legal debate on the exploitation of natural resources on the Moon and potentially other celestial bodies like Mars. In general, there is a discussion of resources shrinking on Earth.<sup>59</sup> Who is able to offer natural resources for around 8 billion human beings? The society has to think about new sources: for instance, the exploitation of the oceans and especially the deep sea.<sup>60</sup> Governed by the *Law of the Sea*, there are realistic plans for mining on the seabed to get Mangan nodules. In the Arctic, a number of states (the "Arctic Five") are going to use oil and gas.<sup>61</sup> Another possibility is the exploitation of resources on the Moon. In fact, the *Moon Treaty of 1979* not only represents the general legal basis of

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23, at 232; Schladebach, *supra* note 29, at 221/222; VON KRIES ET AL., *supra* note 24, at 219.

58. Marcus Schladebach, *Die Internationale Raumstation: Lost in Space?*, 62 *Zeitschrift für Luft- und Weltraumrecht* 709 (2013).

59. Marcus Schladebach, *Zur Renaissance des Rohstoffvölkerrechts*, in RECHT UND REALITÄT, FESTSCHRIFT FÜR CHRISTOPH VEDDER 593 (Stefan Lorenzmeier & Hans-Peter Folz eds., 2017).

60. Marcus Schladebach et al., *Aktuelle Herausforderungen im Seerecht*, 127 *Deutsches Verwaltungsblatt* 475 (2012); Tim Poisel, *Deep Seabed Mining: Implications of Seabed Disputes Chamber's Advisory Opinion*, 19 *AUSTRALIAN INT. LAW J.* 213 (2012).

61. See Alexander Proelß/Till Müller, *The Legal Regime of the Arctic Ocean*, 68 *Zeitschrift für ausländisches öffentliches Recht und Völkerrecht (ZaöRV)* 651 (2008); Rüdiger Wolfrum, *The Arctic in the Context of International Law*, 69 *ZaöRV* 533 (2009).

the Moon status,<sup>62</sup> but also includes a concept for mining on the Moon.<sup>63</sup> In accordance with Art. 11, sec. 1, the Moon and its natural resources are common heritage of mankind. Art. 11, sec. 4 provides that all States Parties have the right to explore and use the resources in accordance with the principle of nondiscrimination. Art. 11, sec. 5 to 7 calls for an international management system and a fair distribution plan.

#### b) New Deal with the Moon Treaty

The *Moon Treaty* entered into force on July 11, 1984, and has been ratified by only 16 States.<sup>64</sup> But the spacefaring nations are not party to this treaty, particularly because the legal concept of Moon mining is too strict and has socialist origins.<sup>65</sup> In the recent past, there are many initiatives to deal with this mining concept and to transfer it to the present.<sup>66</sup> A number of legal studies<sup>67</sup> have deeply analyzed how the ideas of the 1970s could be modified to maintain the natural resources as common heritage of mankind and to organize a fair access for all states, especially those states that are not able to operate spaceflights in the near future.

Of course, there are many perspectives that a realistic transport system to the Moon is still missing. This is correct for present times, albeit one can find serious research activities worldwide to invent a space elevator.<sup>68</sup>

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62. Agreement Governing the Activities of States on the Moon and Other Celestial Bodies of Dec. 5, 1979 (1363 UNTS 3, ILM 18 [1979], 1434).

63. See Ram Jakhu et al., *The 1979 Agreement Governing the Activities of States on the Moon and Other Celestial Bodies*, in COLOGNE COMMENTARY ON SPACE LAW VOL. II (Stephan Hobe, Bernhard Schmidt-Tedd, & Kai-Uwe Schrogl eds., 2013).

64. U.N. Treaty Collection, Status of Treaties, Ch. XXIV: Outer Space, Nr. 2.

65. VON KRIES ET AL., *supra* note 24, at 12.

66. See Ram Jakhu, *Twenty Years of the Moon Agreement: Space Law Challenges for Returning to the Moon*, 54 *Zeitschrift für Luft- und Weltraumrecht* 243 (2005); Stephan Hobe, *The Moon Agreement – Let's Use the Chance!*, 59 *Zeitschrift für Luft- und Weltraumrecht* 372 (2010); René Lefebvre, *Relaunching the Moon Agreement*, 41 *AIR & SPACE LAW* 41 (2016).

67. See POP, *supra* note 24; TRONCHETTI, *supra* note 14; LEE, *supra* note 15; SGROSSO, *supra* note 23, at 49.

68. See Cathy W. Swan et al., *Why we need a space elevator*, 22(2) *Space Policy* 86 (2006); Vernon Nase, *The Questionable Legality of the US Space Elevator Concept*, 55 *Zeitschrift für Luft- und Weltraumrecht* 118 (2006); Lubos Perek, *Between a celestial body and a spacecraft: Making the space elevator a success*, 23 *SPACE POLICY* 3 (2007).

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Germany has a leading role concerning this research.<sup>69</sup> The “European Space Elevator Challenge” at the Technical University Munich is an ambitious forum to present progress and strategies. Although those concepts are still at a starting point,<sup>70</sup> the strong interest of researchers will lead to practical solutions in the future for the transportation of natural resources from the Moon to the Earth.

### 3. *Reduction of Space Debris*

#### a) Definition

Space debris represents one of the greatest challenges in Space Law.<sup>71</sup> Fifty years of spaceflight have left many objects in outer space. Measures against the pollution of outer space from debris lead not only to legal questions but further mark a serious problem for mankind as a whole. It is surprising that discussion within the legal community has already been raging on the topic for a long time, considering the dangers connected to space debris can be immense. The legal results of this debate, if measured in conventions or recommendations, have been quite disappointing. The threats of space debris cannot be discounted as the frivolous forecasts or exaggerated science fiction theories of marginalized scientists. However, in the last few years, the discussion has increased. Although the impact of a meteorite near Tscheljabinsk, Russia did not represent a space debris affair in the technical meaning of the term, this incident elucidates that the dangers from outer space should not be underestimated.

Space debris consists of man-made space objects that stopped working and have no further function. In the recent past, the Committee on the Peaceful Uses of Outer Space (COPUOS), based in Vienna, Austria has dealt with the problem more intensively. In 1959, the U.N. General Assembly established COPUOS as a permanent body for discussing and regulating outer space affairs. It has two standing subcommittees, the Scientific and

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69. See, e.g., HANDELSBLATT, Aug. 14, 2016 (Ger.).

70. Dierk Spreen, *Die dritte Raumrevolution*, in *SOZIOLOGIE DER WELT-RAUMFAHRT* 89, 101 (Joachim Fischer & Dierk Spreen eds., 2014).

71. Marcus Schladebach, *Space Debris as a Legal Challenge*, 17 *MAX PLANCK YEARBOOK OF UN LAW* 61 (2013).

Technical Subcommittee and the Legal Subcommittee. Ten years ago the Committee composed a definition of space debris in its U.N. Space Debris Mitigation Guidelines of 2007:<sup>72</sup> “Space debris is defined as all man-made objects, including fragments and elements thereof, in Earth orbit or re-entering the atmosphere, that are non-functional.”

With regard to this definition, debris only includes particles that are the product of human activity, not those of natural origin. Asteroids and meteorites are consequently excluded from the concept of space debris. Man-made objects exist in different forms in outer space: old satellites, fragments of satellites, space stations and carrier rockets, and ruins of space object collisions encircle Earth and form an alarming ring around our planet. The largest proportion of these fragments is made up of small, even tiny, particles that arise from collision or explosions in outer space. Due to their small nature, such particles can only be recognized and registered with extreme difficulty. It is estimated that about 670,000 particles of a size more than 1 cm orbit Earth. Due to the latest developments in technology, it is possible to register particles of a size of 10 cm or more, of which there are approximately 29,000. The official registers of these objects are maintained at the United Nations and surprisingly at the Technical University of Braunschweig, in Germany. Other registers exist at NASA and ESA.

#### b) Dangers

Space debris can create dangers for outer space itself and for Earth. With regard to collisions in outer space, a number of incidents of collision between space debris and working space objects have been apparent in the preceding years. In this context, it should be noted that the International Space Station had already repeatedly carried out cost-intensive evasive maneuvers and the crew even had to evacuate due to space debris. Two examples illustrate the dramatic dangers for both astronauts and the ISS: on March 24, 2012, the six astronauts onboard the ISS had to evacuate in two rescue units because a large fragment of the Russian satellite Cosmos 2251 passed the ISS at a distance of only 23 km. This fragment was recognized too late for the ISS to undertake evasive maneuvers. On November 1, 2012,

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72. UN Office for Outer Space Affairs, *Space Debris Mitigation Guidelines of the Committee on the Peaceful Uses of Outer Space*, 2010. See also, UNGA Res. 62/217; Marietta Benkő/Kai-Uwe Schrogl, *The UN Committee on the Peaceful Uses of Outer Space: Adoption of the Resolution on Enhancing Registration Practice and of the UNCOPUOS Space Debris Mitigation Guidelines*, 57 *Zeitschrift für Luft- und Weltraumrecht* 335 (2008); SGROSSO, *supra* note 23, at 147.

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the ISS had to implement an evasive maneuver as space debris from the U.S. satellite Iridium 33 was on a direct collision course with it. The astronauts activated the engines of the transport vehicle Progress M-16M for around seven minutes and lifted the ISS into a higher orbit. For the ISS, the problem of space debris is of huge importance in general. As most man-made debris in outer space is found in the vicinity of space stations, it is only a matter of time before damage to a space station will lead to political and legal conflict.

Space debris also creates a danger for Earth because of the dissipated energy supply at the end of space objects' lives, they fall off onto a lower level. If they enter Earth's atmosphere, the largest proportion burns up. The parts not burned up fall onto land or into the sea. The first serious incident of this nature took place with the Russian satellite Cosmos 954 which worked on the basis of a nuclear power source. When the satellite re-entered the Earth's atmosphere on January 24, 1978 it scattered radioactive debris over northern Canada.

#### c) Proposal

A number of stakeholders claim that the removal of inactive satellites or other space debris would be too expensive. Satellite producers have stated that the production, transport to an orbit in outer space, and the use of a satellite are so cost-intensive that further investments cannot be financed seriously. Another reason for the lack of regulation concerning space debris is the fact that political pressure surrounding the problem is still quite weak. Obviously mankind needs more disasters caused by space debris to deal strictly with this topic. A responsible political body does not wait for such a disaster, but acts in a preventive manner. The counter arguments concerning the expected costs and the missing political pressure are not convincing. Consequently, in 2013, a proposal has been elaborated for a new Art. IX *Outer Space Treaty* with the following wording:<sup>73</sup>

(1) Every States Party is obliged to remove its Space objects that are no longer functional and other Space debris resulting from its former Space objects back to earth.

(2) Every States Party has to bear the costs of the removal itself. In case of a multinational Space object the costs of the removal have to be shared in accordance with the investments of the relevant State to the Space object.

#### 4. *Space Tourism*

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73. Schladebach, *supra* note 71, at 85.

### a) Understanding of the Term

Another issue, which has been intensively discussed in the recent past, is the legal framework of space tourism.<sup>74</sup> After the announcement by Sir Richard Branson and his enterprise “Virgin Galactic” to offer spaceflights for the general public for a ticket price of \$200,000, the Space Law community has started a debate on the legal background of such flights.<sup>75</sup> However, in a first step, one has to clearly determine the understanding of the term “space tourism.” In a general sense, the term “tourism” and the associated expectations are strongly connected to a safe and reliable everyday flight routine,<sup>76</sup> a more or less comfortable accommodation in a hotel or pension, and a safe return flight. These elements of tourism are not part of the recent understanding of space tourism. Although there are some ideas of building hotels on the Moon,<sup>77</sup> a real basis for a tourism business in that sense is more than unrealistic for the time being. Neither regular flights for the general public into outer space nor a comfortable accommodation in a Moon hotel is a real assumption for near future. Thus, the use of the term “space tourism” in its usual sense is an exaggerated academic debate without any serious facts and with it pure fiction.

### b) Suborbital Flights

The only reasonable approach to deal seriously with space flights is the identification of possible space flight options. It is therefore necessary to distinguish between flights to the ISS on one hand and suborbital flights on the other hand. During the first years of the operation of ISS, professional astronauts covered only three of six seats, the remaining three were empty. Since 2009, the ISS crew exists with six astronauts. Not for any spectacular reasons but to promote the financial fundament of the station, there was the possibility for a number of wealthy persons to fly to the ISS for around \$20 Million and to stay there for around 10 days. Dennis Tito, an American

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74. See SGROSSO, *supra* note 23, at 262-63.

75. Stephan Hobe, *Legal Aspects of Space Tourism*, 86 NEB. L. REV. 439 (2007); Stephan Hobe et al., *Space Tourism Activities – Emerging Challenges to Air and Space Law?*, 33 JOURNAL OF SPACE LAW 359 (2007); Marietta Benkö et al., *Space Tourism: Facts and Fiction*, 64 Zeitschrift für Luft- und Weltraumrecht 50 (2015).

76. Benkö et al., *supra* note 75, at 50.

77. SGROSSO, *supra* note 23, at 268-69.

businessman, was in 2001 the first private astronaut onboard the ISS. Tito was followed by Mark Shuttleworth (2002), Gregory Olsen (2005), Anousheh Ansari (2006), Charles Simonyi (2007 and 2009), Richard Garriot (2008) and Guy Laliberté (2009).<sup>78</sup> Because of the fact that spaceflights to the ISS are not possible anymore, the only option to deal with a small part of “space tourism” is the project by Richard Branson’s enterprise “Virgin Galactic.” Since a couple of years ago, he announced the beginning of suborbital flights into outer space with his “Space Ship II” from the Spaceport America in New Mexico.

Suborbital flights are parabolic flights, where passengers reach an altitude of approximately 100 km where they can experience zero gravity for a couple of minutes before they return to Earth.<sup>79</sup> Of course, this is not tourism, but more a spaceflight event. Until now, no such flight was operated. It is obvious that suborbital flights include a number of high risks. Health problems, panic reactions, technical difficulties or navigation errors make such space journeys an incalculable project. Considering these unsafe circumstances, it is remarkable that scholars intensively discuss the applicable legal framework.<sup>80</sup>

### c) Legal Framework

At present, there is no international legal framework concerning this issue. In general, the expectation to the legal order for spaceflights is at least the following: rules on legal nature and the content of the spaceflight contract, the liability towards space flight participants, and insurance questions.

The only State with a national space legislation concerning these aspects is the U.S. Special regulations exist at the federal level in Florida, New Mexico, and Virginia (all places with launching infrastructure).<sup>81</sup> Travelers must thereby *inter alia* be informed about the inherent dangers of their journey (e.g. death, injury, physical and psychological damage, economic losses). Furthermore, interested travelers must also be familiarized with the fact that many risks in spaceflight are still generally unknown. After having declared that they are fully aware of this situation

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78. The flight data concerning Mr. Richard Garriot are wrong. See SGROSSO, *supra* note 23, at 266-67.

79. Benkö et al., *supra* note 75, at 50.

80. See e.g., Hobe, *supra* note 75; Michael Chatzipanagiotis, *The Legal Status of Space Tourists in the Framework of Commercial Suborbital Flights* (2011).

81. Benkö et al., *supra* note 75, at 51-52.

through written informed consent, they are allowed to fly. Additionally, space travel must be qualified as “ultra-hazardous activity.” Such activity might be usually excluded from any insurance protection.<sup>82</sup> The same applies to private health and life insurance contracts. The risks of spaceflights will also not be insurable even in specially tailored insurance agreements. Another matter is the question of liability, where the U.S. regulation has been widely discussed.<sup>83</sup> Finally, there are environmental risks. As mentioned above, space debris near Earth constitutes a serious threat to every space mission. Which space traveler wants to collide with space debris? The provisions on spaceflights are more or less symbolic rules and the debate of the last years represents an academic discussion. The space community should keep in mind that many practical questions must be resolved before spaceflights for the general public become possible and reasonable.

##### 5. National Legislation on Space Law

The fifth point to be highlighted is the content of national acts on Space Law. Art. 6 of the *Outer Space Treaty* enables every state to release a national act to concretize the international obligations. The article especially refers to private space missions, which was for the year 1967 a modern idea.<sup>84</sup> If such a private space mission fails, then its home State is responsible for the caused damages. If a state introduces provisions on authorization and regularly controls private space missions, then the state can limit its liability for possible dangerous missions. It is reasonable and helpful to release national space acts,<sup>85</sup> not only for the state itself, but also worthwhile for the space industry. This cost-intensive industry sector is highly interested in legal certainty. Big financial investments into the space industry need reliable legal conditions and such a national act can offer legal certainty and predictability. While many spacefaring nations have its national space act,<sup>86</sup> it is remarkable that Germany as a big player in space industry is still refusing to create a national space act.<sup>87</sup> The German Space industry has to work on

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82. *Id.* at 52.

83. Hobe, *supra* note 75, at 448.

84. Schladebach, *supra* note 8, at 56.

85. See Schladebach, *Für ein nationales Weltraumgesetz*, 44 *Zeitschrift für Rechtspolitik* 173 (2011); VON KRIES ET AL., *supra* note 24, at 48.

86. See Schladebach, *supra* note 8, at 57; VON KRIES ET AL., *supra* note 24, at 52-53.

87. Schladebach, *supra* note 85, at 175.

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rocky ground.

## IV. Conclusion

### *1. Discoveries and Legal Reactions*

After mankind had found technical ways to send satellites and persons into outer space, the international legal order was requested to decide whether or not International Law should react to these new developments. The U.N., acting through the UNCOPUOS, decided to act. This development was quite similar to the discovery of the oceans hundreds of years ago: when ships were able to cross the oceans, the *Law of the Sea* quickly developed. These developments occur in form of customary law at first, but increasingly in written rules and with a number of recent challenges.<sup>88</sup> The technical discovery of airspace has led to International Air Law and, in recent times, the technical discovery of the internet has led to the newest branch: Cyber Law. In all these four spaces: oceans, airspace, outer space and cyber space, new technical developments have forced the creation of new fields of International Law more concretely: new International Law of Spaces.

### *2. Space Law as part of Public International Law*

The structure, the goals, and the instruments of the *Outer Space Treaty* as well as the connected conventions show the exact position of Space Law: Space Law is a special part of Public International Law like the well-established *Law of the Sea*, Environmental Law or Economic Law. However, there is one outstanding specialty of this field of law: it opens the mind for the fact that Earth is not the center of the universe, but only a small part of it. Earth is also a space object circling through the universe on more or less fixed paths. With this imagination, Space Law helps to measure the personal legal horizon in a new vertical dimension.

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88. Schladebach, *supra* note 60.