

# The State and the new space economy: enabling 21<sup>st</sup> century privateers or asserting international law?<sup>\*</sup>

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## SUMMARY

The new space economy

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What role for National Space Legislation?

Conclusions: preventing or enabling 21<sup>st</sup> century privateers?

Bibliography

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\* The present article is based on a conceptual framework first published in a previous work by the authors, following very closely. See, Reynaud, Kypraios (2019), pp. 149-168.

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## 1. The new space economy

Five decades after the success of the Apollo 11 mission, States no longer lead space exploration alone. The second decade of the 21<sup>st</sup> century is a time of acceleration where “the power of flows” vastly amplifies the power of a single individual, as well as the power of humans as a collective, to innovate and create<sup>1</sup>. This immense power is being effectively harnessed by a new generation of space visionaries, who are set to make the 21<sup>st</sup> century an era of “space barons”<sup>2</sup>. In this context, the term “New Space” has emerged “to describe radical new commercial space initiatives”<sup>3</sup> that are private sector-led and chiefly aimed at lowering barriers in the access to space and space-based technology, thereby paving the way for a “New Commercial Space” and a “New Space Economy”<sup>4</sup>.

Today’s global economy is largely dependent on space-based technology for day-to-day activities, to a degree of total dependency in relation to specific services (namely, the *downstream sector*). According to some estimates, the global space market is valued at between 250 to 350 billion US dollars, of which about a third corresponds to the development and manufacturing of satellites and launch vehicles – 56% coming from launch services and 11% from space-based technology services (such as telecommunications and navigation)<sup>5</sup>. Crucially, estimates are that by 2030 the private sector contribution to world space activity may vary between 35% to 40% of the total<sup>6</sup>.

Overall, recent technological advances lowering costs of platforms and access to space pose new legal challenges for the short-term. For example, technology currently under development has the potential of spurring a new service industry, allowing operators to abandon a logic of deactivation or relinquishment of space objects in favour of a recovery and in-orbit servicing model<sup>7</sup>. In addition, advances in small satellite technology hold the potential to foster the emergence of new business models<sup>8</sup>. Such steps in the consolidation of the new space economy will require the development of new domestic law in many fields, such as insurance law<sup>9</sup> or banking law<sup>10</sup>.

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1 FRIEDMAN (2016), p. 87.

2 DAVENPORT (2018).

3 PELTON (2016), p. 2.

4 *Ibid.*

5 ZHELEZNYAKOV and KORABLEV (2017), pp. 237-238.

6 *Id.*, p. 240. REYNAUD, KYPRAIOS (2019), pp. 151-153.

7 REYNAUD, KYPRAIOS (2019).

8 PELTON (2016).

9 BRÜNNER and SOUCEK (2011), pp. 910-948; DUNK and TRONCHETTI (2015), p. 67.

10 DUNK and TRONCHETTI (2015), pp. 874-911.

Public policies aimed at ambitious space projects – ensuring a continuous human presence on the Moon, colonizing Mars, or sending missions to Saturn’s moons – have been (and will increasingly have to be) balanced with other budgetary priorities and public perceptions. This is evident if one looks at the extremely high and constantly rising financial liabilities of States. Significantly, the total debt of governments worldwide is approximately 60 trillion US dollars, a considerable part of which corresponds to advanced spacefaring nations like the USA, China, India, the UK and France<sup>11</sup>. As societies increase their demands for state-led solutions to global problems – e.g., climate change – added pressure will be placed on national budgets, increasing the likelihood of State and overall divestment in space. This gap is set to be filled by private actors, who are now leading the research and development in very specific sectors of the new space economy<sup>12</sup>.

This tendency is already traceable. By way of illustration, in the past fifteen years NASA has retired the Space Shuttle and has forgone manned and cargo flights to the International Space Station (ISS). Significantly, the question of privatizing the ISS has been raised at the political level in the US, the rationale being to free public funding that could be redirected away from scientific research in-orbit and toward other projects (e.g., deep space exploration). It is no wonder that some authors consider that we are now in a “private astronautics”<sup>13</sup> phase<sup>14</sup>.

The march toward the afore-described “new space economy” spans six decades and can be divided in six phases<sup>15</sup>. The first two phases encompass (1) the mid-1950s, a period that pre-dated the launching of satellites and (2) a period starting in the 1960s and (3) lasting up to the 1970s when the competition between the USA and the USSR achieved its zenith. Then, until the mid-1980s the first expansion of cooperation in space took place, followed by a period starting in the mid-1980s and lasting until the mid-1990s when, in the wake of the collapse of the USSR, private actors gained increased access to launch capabilities. The fifth phase lasting until 2003 saw international cooperation for space exploration expanding significantly (the main example being the ISS project), as private companies strengthened their role in space activities with reference to new launching capabilities and specific activities such as space tourism. In 2019, we are at the heart of a sixth phase that is part of the “industry 4.0”<sup>16</sup>

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11 See The Economist, *The global debt clock*. Available at: [https://www.economist.com/content/global\\_debt\\_clock](https://www.economist.com/content/global_debt_clock). Last accessed: 1/11/2019.

12 PELTON (2016)

13 ZHELEZNYAKOV and KORABLEV (2017), p. 240.

14 REYNAUD, KYPRAIOS (2019), pp.151-153.

15 *Id.*, pp. 233-236. REYNAUD, KYPRAIOS (2019), p. 152 at 8.

16 FERREIRA, LOPES and SILVA (2018).

dynamics, where private sector investment in the space economy is characterized by long-term perspectives with return on investment perspectives spanning over a decade<sup>17</sup>.

The present paper, thus, hypothesizes that private actors will advance space exploration and space technology, to which space resources are essential. Faced with this reality States will typically take three sequential steps. A simple first step is establishing a national legal regime to regulate space activities by their nationals or from their territories, thus collecting revenue and not losing out on the economic momentum. A second step is to develop a conducive environment to space activities in their countries, thereby growing their economies by way of national space strategies and public policies. Finally, as competition with other States will increase, a third step would be necessary to maintain advantages: asserting their sovereignty by extending their jurisdictions, while at the same time asserting Earth-based control over private entities. This third step has several risks, the solution to which may only come from advancing current international space law.

As will be explained, the consolidation of the new space economy will entail a shift in paradigm: non-state actors (private entities) will be responsible for the highest percentage of investment in the world space economy, achieving dominance in key space activities – namely, human space flight, and commercial mining of space resources. The following section will focus on the second activity, and particularly on lunar commercial mining.

## 2. Commercial mining of space resources and the Moon

Mining raw materials in space was considered as a possibility for state-led space activities at least as far as 1979<sup>18</sup>. At present time, the rationale for – chiefly private – investment in technologies geared toward mining raw materials in space as a business model is somewhat challenging. That being said, all private sector investment will be guided by a simple three-step process: 1) identifying a recoverable resource; 2) developing the technology necessary to recover the resource; and 3) a client. On the one hand, there are predictions regarding difficulties in accessing and the depletion of certain raw materials on Earth<sup>19</sup>, as

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17 ZHELEZNYAKOV and KORABLEV (2017), p. 232.

18 “Owing to mounting interest on Capitol Hill, the Congressional Office of Technology Assessment (OTA) looked closely at this issue in 1979 and determined that «space colonization, once a field of visionaries and science fiction writers, now attracts scientists, who advocate the mining of the moon and asteroids for raw materials.»” – Spiller (2015), p. 183. See also Tronchetti (2009); Lee (2012).

19 MEINERT *et al.* (2016).

the development of the so-called green economy in the context of Industry 4.0 largely depends upon access to so-called *critical raw materials*<sup>20</sup>. Herein may reside a possible rationale, given that at present time a single State concentrates 70% of the supply side of the critical raw materials identified by the EU<sup>21</sup>. On the other hand, it seems improbable that commercial mining of space resources can be part of an economic model resting solely on Earth-based applications. Although according to some estimates an average asteroid may be worth 200 billion US dollars<sup>22</sup> and NASA has a mission – named *Psyche* – to study an asteroid valued in the quadrillions<sup>23</sup>, commercial mining of space resources as a *space activity* will require a value chain geared for space exploration and future space colonization.

Interestingly, the technology enabling the identification and the analysis of near-Earth objects (NEO)<sup>24</sup> is already in existence: in late 2018 a successful Japanese Space Agency (JAXA) mission proved the possibility of landing a man-made platform on an asteroid<sup>25</sup>. Nonetheless, the two private companies developing projects geared toward asteroid mining – Planetary Resources and Deep Space Industries – have ceased their activities.

Therefore, even though an argument could be made regarding the economic and technological viability of capturing and bringing a NEO closer to Earth orbit, the fact of the matter is that commercial mining of space resources will be feasible in the medium-term if the focus is on the celestial body that is nearest to Earth: the Moon.

The rationale of aiming for the Moon goes well beyond the closer distance: it is essential for the feasibility of the most ambitious space exploration projects – namely, Mars. Although there are projects with the aim of achieving a permanent human presence on the Moon, the main interest in connection with space mining is *space resource utilization* (SRU) with the objective of transforming proven lunar resources *in space*, thereby reducing costs and enabling new types of space activities. In other words, commercial mining on the Moon would be most viable if a value chain could be created whereby mined lunar resources could be, for example, transformed into spacecraft fuel. Here the discussion in scientific forums normally turns to the existence of water on the Moon, an assumption that still has some uncertainties. Other uses of the Moon encompass very rare and peculiar regions on the lunar surface such as the Peaks of Eternal Light

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20 World Bank (2017).

21 EU (2017).

22 JAKHU, PELTON and NYAMPONG (2016), p. 4.

23 FORBES (2017).

24 JAKHU, PELTON and NYAMPONG (2016), p. 4.

25 JAXA (2018).

(PEL), so called because they are permanently exposed to sunlight – thus, with obvious potential for producing energy with photovoltaic technology.

Complexity is, thus, present in a way reminiscent of the old *chicken and the egg* adage: can a technology be developed without ascertaining beforehand what the resource's extraction demands are? If answering this question is difficult, it is certain that, for the State, there is little rationale to invest in such endeavours.

Further to the technological capabilities, achieving the goal of *returning to the Moon* requires a legal framework to be in place that articulates current international space law with state-level legal regimes directed at licensing space activities. If, as we posit, the State is set to become an enabler of commercial mining of space resources and related activities, then two paths are possible: a) States lead efforts at international level to develop current space law, possibly toward a specifically crafted non-legally binding instrument; b) States act in self-interest eschewing international cooperation in favour of the enactment of national space legislation that – coupled with mining industry standards – will lead to a contested legal environment where non-state actors will compete. As we will demonstrate below, there is the risk of the Moon becoming like the 16<sup>th</sup> century's high seas, ushering in an era of resource competition among 21<sup>st</sup> century privateers<sup>26</sup>.

### 3. Space resource exploitation: between *lex lata* and *de lege ferenda*

The origins and development of international space law can be traced to the launch of the first satellite in 1957, thereby making this field of international law somewhat a product of the geopolitical circumstances of that time. The work of the United Nations Committee for the Peaceful Use of Outer Space (UN COPUOS) during the 1960s would eventually culminate in the core international law instruments that form the *Corpus Iuris Spatialis*<sup>27</sup> to date: starting in 1967 and over a period of twelve years, five major space law instruments were

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26 REYNAUD, KYPRIAOS (2019), p. 167.

27 *Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies* (10 October 1967); *Convention on International Liability for Damage Caused by Space Objects* (09 October 1973); *Convention on Registration of Objects Launched into Outer Space* (15 September 1976); *Convention on Early Notification of a Nuclear Accident* (27 October 1986); *Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency* (26 February 1987); *Principles on the Use of Nuclear Power Sources in Space* (AVRES/47/68, 14 December 1992). In addition, the *Convention of the International Telecommunication Union* (1992) and the *Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and Under Water* (1963).

created. In this light, space law is exceptional as a field of international law, given that its creation and development pre-date the emergence of a complex set of legal questions. In this regard space law is in stark contrast with other fields of international law such as the Law of the Sea, the codifying efforts of which culminated only in 1982.

At this point, another aspect referring to the development of international law *in toto* is of relevance. During the past thirty years, the crafting of legally binding international instruments has progressively given way to a preference for non-legally binding instruments. This general trend was mirrored in the development of international law on outer space. After the adoption of the five international space law treaties between 1967 and 1979, during the 1980s the progression of space law at the global level was marked by the adoption of principles established in UN General Assembly Resolutions<sup>28</sup>. More recently, States have become even more reliant on non-legally binding instruments, as space law has been advanced by means of recommendations and guidelines<sup>29</sup> – an example of which are the UN COPUOS *Space Debris Mitigation Guidelines* of 2007<sup>30</sup>.

Coming to the more specific issue of whether commercial mining of space resources is an activity compatible with existing international space law, there are different questions debated among authors and in scholarly writings<sup>31</sup>. A first point of contention pertains to ascertaining whether *mining* space resources – legally equivalent to their *exploitation* or *use* – is prohibited by the principle of non-appropriation enshrined in Article II of the Outer Space Treaty of 1967 read together with Article I thereof. Briefly, whereas Article I of OST 1967 establishes that outer space, the Moon and other celestial bodies “shall be free for exploration and use by all States”, Article II thereof explicitly foresees that “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”. Hence, if one equates *exploitation* with *appropriation*, an argument may be made that commercial mining of space resources is not possible under current international space law.

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28 *Principles Governing the Use by States of Artificial Earth Satellites for International Direct Television Broadcasting*, UNGA Resolution 37/92, 10 December 1982, UN Doc. A/AC.105/572/Rev.1, para. 39; *Principles Relating to Remote Sensing of the Earth from Outer Space*, UNGA Resolution 41/65, 3 December 1986, UN Doc. A/AC.105/572/Rev.1, para. 43; *Principles Relevant to the Use of Nuclear Power Sources in Outer Space*, UNGA Resolution 47/68, 14 December 1992, UN Doc. A/AC.105/572/Rev.1, para. 47; *Declaration on International Cooperation in the Exploration and Use of Outer Space for the Benefit and in the Interest of all States, Taking into Particular Account the Needs of Developing Countries*, UN Doc. 51/122, 13 December 1996.

29 UN (2017), § 35.

30 UN (2007), § 26.

31 JAKHU, PELTON and NYAMPONG (2016). REYNAUD, KYRAIOS (2019), pp. 155-156.

The abovementioned issue of appropriation certainly warrants a more detailed discussion. As a matter of fact, this question was raised in connection with the collection of lunar rock samples (subsequently broken-down and offered to other States) by US astronauts in the framework of the Apollo missions<sup>32</sup>. In this regard, the most balanced legal understanding is favourable to separating what are two different questions: a) appropriating celestial bodies; b) appropriating resources existing in celestial bodies (such as *lunar regolith*) – the latter not being clearly prohibited by the *Corpus Iuris Spatialis*. This is also the understanding of the International Institute for Space Law (IISL) position paper of 2015, which sets forth that “the use of space resources is permitted” absent a clear prohibition in the OST 1967<sup>33</sup>.

A second point of contention pertains specifically to mining space resources on the Moon, with the *vexata questio* among space authors here concerning the concept of *common heritage of mankind*<sup>34</sup>. Interestingly, the concept of “common heritage of mankind” enshrined in Article 11(1) of the Moon Agreement is often blurred with the notion of “province of all mankind” (Article I, OST 1967). Arguably, the essence for both the concept of *common heritage of mankind* and that of *province of all mankind* lies in the *common interest of mankind* stated in the Preamble of the OST. In fact, the *common interest of mankind* in outer space had already been recognized prior to the OST 1967 in historic UNGA Resolutions – namely, Resolution 1348(XIII) of 13 December 1958, Resolution 1472(XIV) of 12 December 1959, Resolution 1721(XVI) of 20 December 1961, Resolution 1962(XVIII) of 13 December 1963. Most recently, a reference can be found in UNGA Resolution 55/122 of 27 February 2001.

There are those space law scholars that consider the two concepts distinguishable from each other. Largely, the *province of all mankind* concept is considered as not establishing any State obligation to share the benefits derived from outer space activities, while the *common heritage of mankind* concept is seen as indicating that the *exploration* and *exploitation* of a certain space (or area) and its resources shall be carried out in accordance with the rules established by an international regime or authority.

On the one hand, Article 11(1) of the Moon Agreement establishes that “the moon and its natural resources are the common heritage of mankind”, while on the other hand the preamble of the OST 1967 refers to “the common interest of all mankind”<sup>35</sup>. On the other hand, attention should be given to Article 6(2) of the

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32 OGUNBANWO (1975), p. 212.

33 IISL (2015), p. 3.

34 Further on the relationship and implications of the two concepts for commercial activities in outer space, see GABRYNOWICZ (1992), p. 691. REYNAUD, KYPRAIOS (2019), pp. 155-156.

35 Lee (2012), pp. 203-272. See also JAKHU, PELTON and NYAMPONG (2016).



Moon Agreement, as it may be construed as allowing prospecting of resources on the Moon. Moreover, Article 11 in its entirety – its number 2 is similar in terms to Article II, OST 1967 – can be said to not be completely closed regarding the exploitation of lunar resources, given that it points to the establishment of “an international regime, including appropriate procedures, to govern the exploitation of the natural resources of the Moon”<sup>36</sup>. Further to both issues, one circumstance conditions the strength of the Moon Agreement: its low ratification rate<sup>37</sup>. Thus, one difficulty to the development on a non-legally binding instrument specifically tailored to space mining on the Moon is that States are divided in two groups with different – albeit not completely opposing – views. Crucially, the group of States that have ratified the Moon Agreement does not include spacefaring nations with a demonstrated strategic interest on the Moon – namely the USA and the People’s Republic of China.

Against this background, it is certainly worth noting that there is an increasing number of States – specifically within UN COPUOS – who have indeed expressed themselves in favour of the creation of an international legal regime aiming to regulate commercial space activities<sup>38</sup>. In assessing the issue of compatibility of commercial space mining with current international space law, two main arguments exist. Firstly, that the rationale of the regime of OST 1967 appears somewhat incompatible with a future where state-enabled private actors would be the sole competitors for resources on the Moon and other celestial bodies. Secondly, the argument may certainly be made that *space mining* as a purely commercial activity is irreconcilable with the concept of *common heritage of mankind*. Both arguments have historically been shared among States opposing a more flexible interpretation of current international space law by the *spacefaring nations*<sup>39</sup>.

Diverging somewhat from the debate among space law authors, States have furthered the debate in relation to the two points of contention in a more determined way. The UN COPUOUS Legal Subcommittee report for the fifty-sixth session (2017) registers a concern in connection with attempts by some States

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36 See *Moon Agreement*, Article 11(5).

37 The *Moon Agreement* has eighteen States Parties – namely, Armenia, Australia, Austria, Belgium, Chile, Kazakhstan, Kuwait, Lebanon, Mexico, Morocco, Netherlands, Pakistan, Peru, Philippines, Saudi Arabia, Turkey, Uruguay and Venezuela – and four Signatory States – namely, France, Guatemala, India and Romania. See [https://treaties.un.org/Pages/ViewDetails.aspx?src=IND&mtdsg\\_no=XXIV-2&chapter=24&-clang=\\_en#2](https://treaties.un.org/Pages/ViewDetails.aspx?src=IND&mtdsg_no=XXIV-2&chapter=24&-clang=_en#2). Importantly, out of these eighteen States that are parties to the treaty, seven have enacted national space laws (Australia, Austria, Belgium, Chile, Kazakhstan, Netherlands and Philippines), similar to France which is among the four States that have signed but not ratified it – see, <http://www.unoosa.org/oosa/en/ourwork/spacelaw/nationalspacelaw/index.html>. Last accessed: 30/10/2019.

38 UN (2018), § 246.

39 JAKHU and DEMPSEY (2017), p. 21; UN (2017), para. 29. REYNAUD, KYPRAIOS (2019), p. 157.

of circumventing the obligations stemming from the OST 1967, either by legitimizing legally controversial space resource exploitation activities undertaken by national non-state actors, or by creating “a register or a flag of convenience for private commercial entities interested in pursuing the exploitation of space resources”<sup>40</sup>. Furthermore, the 2017 report conveys the consensus among States regarding the shared understanding that article II OST 1967 prohibits any appropriation of the Moon or any celestial body, while registering a concern with the fact that some States have approved national space legislation in view of protecting private property rights over space resources mined from celestial bodies – *maxime* tantamount to a “claim of sovereignty or national appropriation”<sup>41</sup>. Nonetheless, the consensus seemed to emerge that all activities pursued orderly and non-abusively “and undertaken with the purpose of exploration of space [...] should be considered for the benefit and in the general interest of all countries”<sup>42</sup>.

In different terms, the UN COPUOS Legal Subcommittee fifty-seventh session report (2018)<sup>43</sup> registers the openness by a majority of States to the possibility of undertaking discussions regarding a legal framework applicable to the exploitation and/or utilization of space resources by non-state/private actors<sup>44</sup>. Crucially, specific calls were made for a multilateral approach to “detailed discussions on the exploitation and utilization of space resources by private entities”<sup>45</sup> in order to address very specific concerns stemming from the increased private sector engagement in space activities.

In the same vein, the UN COPUOS Legal Subcommittee report of 2019<sup>46</sup> corroborates this shift in state practice. Most interestingly, the consensus seems to exist on the acceptance of non-state/private actor engagement in space resource exploration and/or exploitation, with the main point of contention being the need for a new international legal framework<sup>47</sup>. Significantly, some States held the view that “commercial utilization” was consistent with current international space law, as the OST 1967 “did not broadly preclude such activities”<sup>48</sup>, while other States espoused the creation of an “ownership regime” for non/

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40 BRÜNNER and SOUCEK (2011), p 246. See also DROBNIG *et al.* (1990); CARLISLE (1981); United States. Congress. House. Committee on Armed Services. Special Oversight Panel on the Merchant Marine (2003).

41 UN (2017), §§ 240-241.

42 *Id.*, § 242.

43 UN (2018), § 246.

44 *Id.*, §§ 244-265.

45 *Id.*, §§ 244-245.

46 UN (2019).

47 *Id.*, §§ 242-248, 263.

48 *Id.*, § 245.

renewable space resources<sup>49</sup>. Additionally, a majority of States expressed favourable views to enhancing the Legal Subcommittee's work regarding exploration, exploitation and utilization of space resources<sup>50</sup>. Although different views were indeed set forth, States no longer shared the interrogations and hesitations regarding the commercialization of space resources registered in 2017. Pursuant to the unlocking of the debate in 2018, the discussions at the UN COPUOS Legal Subcommittee were re-centred to on the future perspectives for the development of international space law, clearly encompassing space resource utilization and exploitation for commercial purposes.

Hence, the following conclusion may be drawn: what remains a *vexata questio* among authors is understood by the States no longer as a question of *compatibility* but as a question of *articulation* with current international space law.

#### 4. What role for National Space Legislation?<sup>51</sup>

Although the legality of commercial mining of space resources can be said to have ceased to be a point of legal contention between States at the UN level, current international law on outer space only provides part of the legal framework required to engage in this space activity. In essence, Article VI of the OST 1967 provides that the “activities of non-governmental entities in outer space [...] shall require authorization and continuing supervision by the appropriate State Party to the Treaty”. Accordingly, national space legislation should emerge as a natural occurrence from the international law regime – specifically, the obligations enshrined in the OST 1967 – thus representing the continuity, the realization and the completion of the *Corpus Iuris Spatialis*<sup>52</sup>.

The enactment of national space legislation provides completion at the domestic level for the obligations imposed upon States by international legal instruments, thereby an interpretation. In addition, national space legislation has the potential of reflecting the changes the space sector is currently undergoing as the new space economy takes shape.

The number of States that have enacted national space legislation is trending upwards. Five decades ago, there were only two States – Norway<sup>53</sup> and the USA – whose domestic legal order contained national space legislation.

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49 *Id.*, § 247.

50 *Id.*, §§ 259-266.

51 This part follows very closely and develops an analysis previously undertaken by the authors. See REYNAUD, KYPRAIOS (2019), pp. 159-163.

52 DUNK (2011); FROELICH (2018).

53 See *Act on Launching Objects from Norwegian Territory in Outer Space* (Act n. 38 of 13 June 1969).

Surprisingly, until the end of 2000 only an additional four States had enacted national legislation regarding space matters: – namely, Sweden (1982), the UK (1986), South Africa (1993) and Australia (1998)<sup>54</sup>. Then this number increased starting in 2005-2008, and again recently in the past four years<sup>55</sup>. In 2019, Portugal became one of the latest countries to enact a complete national space legal regime, consisting of a national space law and the respective regulatory regime<sup>56</sup>.

When considering the enactment of national space legislation, there is guidance that may be resorted to such as the *Sofia Guidelines for a Model Law on National Space Legislation*<sup>57</sup>, or the Recommendations part of UNGA Resolution 68/74 of 11 December 2013<sup>58</sup>. However, a previous choice must be made between two possible legislative outcomes, as the national space legislation either becomes (a) the sum of all national legislation with an impact for space activities, or (b) a legal instrument that chiefly defines the existing rights and obligations regarding space activities carried out in a particular State or elsewhere by its nationals.

In wider terms, the potential is there for very interesting complementarities between the international law regime and domestic law<sup>59</sup>. A first objective for national space legislation is to create a national legal framework for the orderly development of space activities, thereby fulfilling an obligation for all State Parties stemming indirectly from the wording of Article VI OST 1967. A second goal will be the definition of the administrative competences in relation to the engagement in space activities by private actors, affording them an appropriate degree of legal certainty and protection. Lastly, a decisive goal relates to the potential of national space legislation to complete the international law regime itself.

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54 UK: *Outer Space Act* (1986); Sweden: *Lag (1982:963) om rymdverksamhet* (1982); South Africa: *Space Affairs Act (Statutes of the Republic of South Africa – Trade and Industry No. 84 of 1993)* (1993); Australia: *Space Activities Act No.123* (1998).

55 Belgium: *Loi du 17 septembre 2005 relative aux activités de lancement, d'opération de vol ou de guidage d'objets spatiaux* (2005); France: *Loi n° 2008-518 du 3 juin 2008 relative aux opérations spatiales* (2008); USA: *U.S. Commercial Space Launch Competitiveness Act, Space Resource Exploration and Utilization Act of 2015* (2015); and *American Space Commerce Free Enterprise Act of 2018* (2018); New Zealand: *Outer Space and High-altitude Activities Act of 2017* (2017); UK: *Space Industry Act of 2018* (2018); Luxembourg: *Loi du 20 juillet 2017 sur l'exploration et l'utilisation des ressources de l'espace* (2017).

56 Decree-Law no. 16/2019 of 22 January, published in the Official Journal of the Portuguese Republic, 1<sup>st</sup> series, no. 15 of 22 January 2019. This legislation is completed by the Regulation no. 697/2019 regarding the Access to and Engagement in Space Activities published in the Official Journal of the Portuguese Republic, 2<sup>nd</sup> series, no. 170 of 5 September 2019.

57 ILA (2012); UN (2013a).

58 UN (2013b).

59 DUNK (2011); FROELICH (2018).

In this regard, two legal questions should be referenced. A first question relates to the limits to State sovereignty over airspace, as the definition and delimitation of outer space is in itself a *vexata questio*<sup>60</sup>. On the one hand, the “spatialist”<sup>61</sup> doctrine is favourable to a clear delimitation of a frontier between airspace and outer space<sup>62</sup>. On the other hand, the so-called “functionalist”<sup>63</sup> doctrine assumes such task as nearly impossible and devalues the usefulness of establishing a delimitation, while questioning the existence of a scientific basis to define a natural vertical limit<sup>64</sup>. Some States try to answer the delimitation question in their respective national space legislation by choosing to vertically limit state jurisdiction. By way of illustration, Denmark’s space legislation of 2016 defines as “outer space” the “space above the altitude of 100 km above sea level”<sup>65</sup>. In other terms, the Portuguese space legislation adopts a functional approach to the question, as no specific definition was introduced<sup>66</sup>.

A second question refers to enshrining in national law the obligation to register space objects foreseen in the *Convention on Registration of Objects Launched into Outer Space* (14 January 1975)<sup>67</sup>. A main aspect is that Article II of the *Convention on Registration* does not establish a deadline for the fulfilment of the obligation to register an object, whereas Article IV thereof asserts that States have a duty to inform the UN Secretary-General “as soon as practicable”. Again, as an example the Danish space legislation establishes that final information regarding registration must be reported within a month after the object has been launched<sup>68</sup>, whereas the Portuguese law establishes a two-day deadline following the launch of the space object<sup>69</sup>.

Taking into consideration the complexities associated with space activities, an argument may be made that all national space legislation contributes to mitigating the specific risks for the State resulting from private entities’ actions (recalling Article VI OST 1967). Moreover, Article VIII of OST 1967 seems to enshrine an obligation of continuous supervision *vis-à-vis* the space object by the

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60 NETO (2015).

61 *Id.*, p. 32.

62 *Id.*, pp. 41-59.

63 *Id.*, p. 32.

64 *Id.*, pp. 32-34.

65 Part 2, 4, n.º 4, *Outer Space Act.*, Act no. 409 of 11 May 2016. Available at: <https://ufm.dk/en/legislation/prevaling-laws-and-regulations/outer-space>. Last accessed: 25/09/2019.

66 See Article 2 of Decree-Law no. 16/2019 of 22 January 2019.

67 *Convention on Registration of Objects Launched into Outer Space*, 14 January 1975, 1023 UNTS 15.

68 See Part 5, no. 9, 2, *Executive Order no. 552 of 31 May 2016 on requirements in connection with approval of activities in outer space*.

69 See Article 16(5) of Decree-Law no. 16/2019 of 22 January 2019.

registration State. Hence, the State where the space object is registered retains the jurisdiction and the control, an issue that gains relevance considering the private sector's dynamic – for example in cases where a space object is alienated to another company seated in another State.

Overall, national space legislation has the potential to be itself used as a stimulus for space activities. A State's space legislation establishing less-demanding requirements for the licensing of space activities can admissibly function as a powerful attraction for private entities, similar to a State's tax system. In time, this circumstance may conceivably lead to a highly competitive environment in the field of commercial mining of space resources.

## 5. Conclusions: preventing or enabling 21<sup>st</sup> century privateers?<sup>70</sup>

In the late 15<sup>th</sup> century, at a time when the world was divided in half by the Treaty of Alcáçovas (1479) and the Treaty of Tordesilhas (1494), the Papacy acted as the legitimizer of conquests and occupations. Disputes arising from the competition among colonizing powers for conquered territories were settled by the award of legal occupation titles, such as Pope Alexander VI's *Bula Inter Caetera* of 1493. From this practice the international custom of effective occupation would be born, a concept that in private law terms approximates that of *possession*.

In legal terms, States may be said to have a choice between expanding national legislation or advancing international law for outer space. Although theoretically these are not mutually excluding choices, they may not be the only two actual choices facing the State.

As the new space economy consolidates in the framework of Industry 4.0 dynamics, States will be required to retool their societies to stay competitive. The option to compete to attract private space companies in order to enhance their economies has already been taken by several countries, proof of which are the numbers relating to the enactment of national space legislation.

Problems are set to emerge as States take the next logical step: maintaining their competitive edge. Regarding outer space and the Moon, there is no Papacy or an international law regime such as the UNCLOS providing for a *de minimis* international legal framework for private entities' commercial activities like the commercial mining of space resources. Therefore, there is a legal margin for states to seek ways to remain competitive.

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70 This part follows very closely and expands the conclusions previously rehearsed by the authors. See, REYNAUD, KYPRIAOS (2019), pp. 165-167.

The State could then reinvent itself for the new space economy. As national space legislation is enacted enshrining different configurations, private entities will have a choice between different regulatory regimes. This is perhaps the main reason why some States at the UN COPUOS Legal Subcommittee warn against a *first come, first served* economic model in commercial mining of space resources<sup>71</sup>. Alternatively, a “flags of convenience” scenario may be envisaged, characterized by private entities being registered in States foreseeing the lowest regulatory requirements – thus, allowing for overall lower operational costs by comparison.

As explained above, besides the option of varying the regulatory burden in their respective national space legislations, States are already in effect competing by extending the limits of their national jurisdiction over space activities in a very specific way – that is, by inserting possession-related provisions regarding space resources. This could conceivably be taken to the next level as national space legislation begins equating *space mining of a celestial body for commercial purposes* to a *licensable private space activity* under domestic law.

In other words, the potential for disruption will stem from: a) the divergence between national space legislation regarding the definition of the obligations and the responsibilities of private entities; b) differences regarding administrative or regulatory powers at the State level in connection with the licensing of space activities; and c) States extending their national jurisdictions further by considering *space mining* as a proper space activity that may be subject to a national licensing mechanism. Absent consensual advances at the international level, assertions of national sovereignty have the risk of conceivably pushing reality beyond the aforementioned “flags of convenience” scenario typical of the maritime shipping industry: that is, the Moon and near-Earth orbit could become a contested space where State-enabled 21<sup>st</sup> century privateers will compete for resources and celestial body possessions. New types of services may then rapidly emerge destined to deliver the security the State will not be there to provide – namely, private military space companies.

As explained above, a few space law scholars have proposed detailed frameworks aimed at addressing this problem. Regarding legal developments concerning the return to the Moon, some authors propose that inspiration may be sought in the Law of the Sea<sup>72</sup>. In our view, an essential step may perhaps be to harness existing data relating to the Moon surface’s features with the objective of then crafting new legal concepts out of lunar morphological features, all in

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71 UN (2017), § 50.

72 TRONCHETTI (2009).

similar terms as geomorphological concepts were made part of the Law of the Sea in the UNCLOS 1982.

Perhaps the most added value would come from advancing an international legal framework specifically crafted for commercial lunar resource exploitation in the form of a non-legally binding instrument that could be scalable, coupled with an international licensing mechanism similar to those of Earth-based mining industry – thus having the merit of further spurring innovation by private entities – where, for example, temporary licenses could be issued.

Given that international space law is not static, the challenge lies in ascertaining what norms need reinterpretation and what issues require new legal frameworks. The risk of fragmentation is high, mainly due to the possibility that different legal interpretations of international law principles and concepts are given in national space legislation. Thus, the relationship between international space law and national space legislation needs to be considered: will the solutions for the new questions pertaining to the commercialization of space be sought at the international level or at the State level? If sought at the international level, will primacy be given to international legal instruments or non-legally binding instruments? Finally, will the solutions ever be successfully articulated with existing international space law – chiefly with the principles enshrined in OST 1967 – and to a degree that is acceptable to a wide majority of States? In seeking to provide elements to answer these questions, there are at least two dichotomies to consider. On the one hand, there is the opposition between the national level – a domestic law perspective, geared toward national policy objectives – and the international level – an international law perspective, sensitive to the aspirations of the international community. On the other hand, the ambition of reviving the *Corpus Iuris Spatialis* is opposed to state-level legislative action resulting in a gentle weakening of international law.

Specifically considering commercial mining of lunar resources, the concept of *common heritage of mankind* needs to be recalled. One of the challenges that should be addressed by a future legal regime on space resources utilization by means of space mining relates to the protection of so-called “lunar heritage sites” – e.g. the wreckage of the Soviet “Luna 2” spacecraft in *Mare Serenitatis* and the US Lunar Module “Eagle” used in Apollo 11 located in *Mare Tranquillitatis*, as well as artefacts or equipment such as the human boot prints left on the Moon by US astronauts during the Apollo missions – from the harmful effect of *in situ* private mining activities. Indeed, there have been proposals to extend the designations and protections of the UN World Heritage sites to historic lunar locations that represent significant advances in humankind’s space exploration. In our context, this relates to very likely future scenarios in which the landing of platforms on the Moon, or the actual mining of its surface, by private entities



would result in havoc on those sites; as it is the case with the 1969 catastrophic sandblasting of Surveyor III (that had landed on the Moon two years earlier) by Apollo 12's lunar lander, future commercial lunar missions may in fact damage such historically significant landing sites. This risk becomes even higher when combined with a probable high competition of private entities for prime *locations* to undertake their mining activities – many of which lie on the same areas where the early lunar expeditions took place.

By contrast with the Law of the Sea, international space law had the exceptional merit of by and large anticipating the full materialization of the reality it was made to discipline. At a time when innovation is propelled by an acceleration of flows at a global scale, the reassertion of control by the State may materialize in it assuming a central role as legitimizer and guarantor of private engagement in the new space economy.

As national sovereignty is asserted at the expense of common heritage of mankind, the choice to embark on complex legal discussions at the UN level is increasingly unenticing. In such a scenario, the international cooperation of the past may wither in favour of mere coordination in forums uncovered by international legal instruments with a view of agreeing new rules for the new space economy. In this light, the creation of a forum for space matters not covered by an international treaty assembling the USA, China, the Russian Federation, India – four countries with proven anti-satellite (ASAT) weapon capability – and France (a sort of *G5 for Space*), is a development that is increasingly less unimaginable.

By eschewing international cooperation toward developing current space law, and instead choosing to develop national space legislation and collect revenue, States will contribute to the reinvention of their role: from leaders into enablers, potentially ushering in an era of 21<sup>st</sup> century privateers.

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