

Back to the Future: Roman Law and Ownership of Objects Created on Celestial Bodies

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Abstract

This contribution analyses the gap left by Article VIII of the Outer Space Treaty in matters involving ownership of objects created on celestial bodies and suggests leveraging the Roman law principle of specification to bridge it. Article VIII provides a clear provision: “ownership of objects launched into outer space, including objects landed or constructed on a celestial body, and their component parts is not affected by their presence in outer space or on a celestial body ...”. Ownership of an object created in space is therefore possible as long as its ownership was established on Earth. Unfortunately, it leaves open the crucial question for space activities of ownership of objects made of local resources like lunar soil, which have legally no owner. In this case, the specification principle, which has broad application through most national (terrestrial) legal orders, can provide a regime of ownership by stating that created objects belong to the creator when created out of another’s article.

Keywords: extraterrestrial settlement, Moon colony, Mars colony, ownership, Roman law, principle of specification.

1. Introduction

The question of ownership of objects created on celestial bodies is one that necessarily arises when discussing the legal framework for future settlements on the Moon and Mars. One cannot imagine that future settlers will agree, or even have the capacity, to rely indefinitely on Earth importations to live on another planet. Hence, being able to create objects on celestial bodies will be key for sustainable human settlements in outer space.

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This is where legal and technological issues meet. Questions such as what type of object will be created, or who will create them and how, are not “just” scientific issues; answering them has legal consequences. Who will create them, and will the manufacturer be the owner? Will the “object” be movable or immovable? Will building materials used in construction be brought entirely, partially, or not at all from Earth? These questions all pertain in one way or another to the matter of ownership.

On Earth, such problems are solved by domestic law where each State has its own set of rules to define and establish ownership.¹ Domestic law identifies the owner of an object made out of materials belonging to different entities, specifies – or not – different rules between immovable and movable tangible objects, and includes provisions for intellectual property rights. In outer space, however, these rules are not applicable: as a *res communis*, outer space is an area beyond national jurisdiction.² It is therefore not possible for a State to impose its own domestic rules on property rights to other members of the international community.³ The only legal regime applicable is the one of international law.⁴ As *lex specialis*, it is necessary to turn to international space law in order to see whether it provides a common solution to identify the owner of an object constructed on the Moon or Mars.

There are two provisions in the Outer Space Treaty⁵ referring to property rights in outer space: Article II and Article VIII. Article II of the Outer Space Treaty has largely drawn the attention of current legal literature when discussing the issue at hand.⁶ It is particularly important when considering the legality of creating an immovable object, such as a lunar base, or of using “space resources” as a building material.⁷ However, supposing the question

1 John G Sprankling, *The International law of property* 1 (2014).

2 *Idem*, at 111.

3 On jurisdiction, see Bernhard Schmidt-Tedd & Stephan Mick, *Article VIII*, in *Cologne Commentary on Space Law* 157 (Stephan Hobe, Kai-Uwe Schrogl, & Bernhard Schmidt-Tedd eds., Carl Heymanns Verlag ed. 2009).

4 Sprankling, *supra* note 1, at 19; PJ Blount, *Outer Space and International Geography: Article II and the Shape of Global Order*, *New England Law Review* 97 (2019).

5 *Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies*, entered into force Oct. 10, 1967, 18 U.S.T. 2410, 610 U.N.T.S.

6 Eric Husby, *Sovereignty and property rights in outer space*, 3 *Journal of international law and practice* 359–372 (1994); Ricky J Lee, *Article II of the Outer Space Treaty Prohibition of State Sovereignty, Private Property Rights, or Both*, 11 *Australian international law journal* 128–142 (2004).

7 Steven Freeland & Ram Jakhu, *Article II, I* in *Cologne Commentary on Space Law* 42–44 (Stephan Hobe, Bernhard Schmidt-Tedd, & Kai-Uwe Schrogl eds., 2009); Stephen Gorove, *Limitations on freedom and use of outer space*, in *Proceedings of the Thirteenth Colloquium on the Law of Outer Space*, AIAA 1971, 74; *Position Paper on Space Resource Mining*, adopted by the Board of Directors of the

of the legality of creating immovable objects solved, the question of ownership would still be pending. In other words, despite the considerable attention paid to Article II, it skips a crucial issue: how can we determine the owner of an object created on a celestial body? This is why this contribution purposely leaves aside the questions raised by Article II and addresses the more precise problem of ownership. General considerations about legality do not void interrogations about the possibility to define legal standards of ownership in outer space; and to answer such interrogation, Article VIII provides an interesting basis.

For the sake of clarity, this contribution will not address matters of intellectual property but narrowly follow the question of “constructed” objects as mentioned in Article VIII of the Outer Space Treaty. In so doing, it cannot be forgotten that the scope of application of Article VIII is limited; the provision only considers cases where the object – or its components – has a legal link to Earth.⁸ With the *lex specialis* only partially addressing the question of ownership of objects created on celestial bodies, and in the absence of an “international property law”⁹, the contribution considers as particularly worthy of note the principles of accession to ownership as established under Roman law. These principles in general, and the principle of specification in particular, are widespread among nations and could provide a general framework to identify the owner of a newly created object in outer space.¹⁰

2. Article VIII of the Outer Space Treaty

Article VIII of the Outer Space Treaty affirms in its second sentence that: “Ownership of objects launched into outer space, including objects landed or constructed on a celestial body, and their component parts, is not affected by their presence in outer space or on a celestial body or by their return to the Earth.” Therefore, the provision expressly refers to cases where an object is created – *i.e.* “constructed” – on the Moon or Mars.

Since the Article includes in its scope the “component parts” of the object created in outer space, it therefore covers building materials used to construct said object.¹¹ However, the provision is restrictive in the sense that it only

International Institute of Space Law on 20 Dec. 2015, available at <https://iislweb.org/iisl-position-paper-on-space-resource-mining/> (accessed Sept. 25, 2020, as all other cited hereafter).

8 Sprankling, *supra* note 1, at 184.

9 *Idem*, at 3.

10 Michael P. Chatzipanagiotis, 3d Printing Using Material from Celestial Bodies: A Method to Circumvent the Non-Appropriation Principle? 4 (2016).

11 Laura Rut Skopowska, Is an object built in the outer space a ‘space object’ under the Liability Convention? Master Thesis. University of Luxembourg 40 (2017).

refers to objects and materials “launched into space”.¹² This can be explained by the purpose of Article VIII, Sentence 2 of the Outer Space Treaty: the provision is not designed to create specific ownership rights.¹³ Quite to the contrary, Article VIII only maintains, in outer space, ownership that has already been established on Earth, under domestic law.¹⁴ This is what the provision means by objects not being “affected by their presence in outer space or on a celestial body”. It follows that, under Article VIII of the Outer Space Treaty, the existence a legal link to Earth is decisive when determining who the owner of an object created on a celestial body is. Unless the object is registered per the terms of Article VIII, Sentence 1 – in which case jurisdiction and control fall to the State which is Party to the treaty –¹⁵ the applicable legal regime will be the one determined on the ground.¹⁶

Now, how does this situation play in the hypothesis of future space developments, namely in the case of settlements in outer space? Although future settlers will likely not depend on Earth, there are merits in considering a scenario where the manufactured object would be derived, in whole or in part, from terrestrial materials. In fact, the leading concept to create such objects is based on the use of 3D printing technology: a process which “transforms digital 3D objects into physical ones... by laying down successive layers of material”^{17,18} Those layers of material are customarily referred to as “ink”. Several experiments have already been conducted to assess the feasibility of the concept;¹⁹ in 2014, a 3D printer was sent to the ISS to test the impact of printing in zero gravity.²⁰ There is no difficulty in considering the 3D printer

12 Article VIII, Sentence 2 of the Outer Space Treaty.

13 Schmidt-Tedd & Mick, *supra* note 3, at 163.

14 *Idem*, at 164; Sprankling, *supra* note 1, at 184.

15 Article VIII, Sentence 1 of the Outer Space Treaty states that: “A State Party to the Treaty on whose registry an object launched into outer space is carried shall retain jurisdiction and control over such object, and over any personnel thereof, while in outer space or on a celestial body.”

16 Schmidt-Tedd & Mick, *supra* note 3, at 164.

17 Chatzipanagiotis, *supra* note 10, at 1.

18 Michael Johnson, *Solving the Challenges of Long Duration Space Flight with 3D Printing*, NASA (2019), http://www.nasa.gov/mission_pages/station/research/news/3d-printing-in-space-long-duration-spaceflight-applications.

19 See e.g. Clare Scott, *NASA’s First-Ever Fully 3D Printed Rocket Engine is 75% Complete*, 3DPrint.com (2015), <https://3dprint.com/111799/nasa-3d-printed-rocket-engine/>; ESA, *Building a lunar base with 3D printing* (2013); http://www.esa.int/Enabling_Support/Space_Engineering_Technology/Building_a_lunar_base_with_3D_printing; Alec, *NASA funded project RAMA could transform asteroids into mining spaceships with 3D printing by 2030*, 3ders.org (2016), <http://www.3ders.org/articles/20160608-nasa-funded-project-rama-could-transform-asteroids-into-mining-spaceships-with-3d-printing-by-2030-.html>.

20 Sarah Loff, *International Space Station’s 3-D Printer*, NASA (2014), <http://www.nasa.gov/content/international-space-station-s-3-d-printer>.

as material brought from Earth and used to construct a final object.²¹ As such, it falls under the scope of Article VIII of the Outer Space Treaty and its ownership will have an impact on the determination of the owner of the manufactured object. From there, and in the absence of registration of the final object, three scenarios are possible.²²

2.1. The 3D Printer and the “Ink” are Both Brought from Earth and Owned by a Single Entity

In this case, the printer and “ink” are both brought from Earth and owned by a single entity A in accordance with the relevant legal regime on Earth. Since the materials are brought from Earth, Article VIII of the Outer Space Treaty applies, and the ownership of the manufactured object is determined by terrestrial rules. As all the materials necessary to manufacture the object are owned by the same entity (“A”), A is the owner of the manufactured object.

2.2. The 3D printer and the “Ink” are Both Brought from Earth but Owned by Two Different Entities

In this case, the printer and the “ink” are both brought from Earth but owned by two different entities, respectively A and B. Since the materials are brought from Earth, Article VIII of the Outer Space Treaty also applies here. However, as there are different entities involved in the manufacturing, the ownership of the manufactured object is not as easily determined as in the first case. Ownership will depend on the content of the applicable law on Earth, which will vary from one individual State to another.²³

One potential solution would be to leave the two entities contractually agree on who the owner of the manufactured object will be.²⁴ Although it would grant great flexibility to the two entities, this solution would fall short in cases where no agreement could be reached. It would also not give certainty in the establishment of ownership, as it would operate on a case-by-case basis.

This is where a reference to the Roman law principle of specification could offer an elegant solution (*see* below Section 4.3) to determine who, between the manufacturer (“A”) and the owner of the “ink” (“B”), owns the manufactured object. It would have the benefit of providing an “universal” solution, regardless of the origin of the object.

21 Skopowska, *supra* note 11, at 44-45.

22 *See idem*, at 45-49.

23 Blount, *supra* note 4, at 105.

24 *Idem*, at 45.

2.3. The Object is Partially or Fully Manufactured Using Extra-Terrestrial Resources²⁵

In this case, the manufactured object is either:

- a) fully made of extraterrestrial resources or,
- b) the 3D printer was brought from Earth, but not the “ink”; for instance, a 3D printer using lunar regolith for “ink”.

In both instances, the presence of extraterrestrial material (partially) excludes the application of Article VIII of the Outer Space Treaty. The provision remains silent regarding the applicable law for the ownership of object made, entirely or partially, from extraterrestrial material.²⁶ As explained above,²⁷ Article VIII does not create ownership; it relies on pre-established ownership over an object. However, in the absence of a link to Earth, there is no pre-established regime that Article VIII of the Outer Space Treaty could refer too. Even in the case where a 3D printer is brought from Earth and its ownership established, the other half of the equation – that is the ink used to manufacture the object – would remain uncertain regarding its ownership under international space law. Who, then, should prevail between the manufacturer – *i.e.* the owner of the 3D printer – and the owner of the ink? Should it be the owner of the 3D printer because of its work? Or because the manufacturer’s ownership of the printer is recognized under the Outer Space Treaty? Could it be the owner of the ink because it provided the substance necessary to create the object? Article VIII of the Outer Space Treaty does not say. Thus, the answer as to whom owns the manufactured object must be found elsewhere.

3. Absence of an “International Law of Property”

In the absence of a satisfactory answer to the question under *lex specialis*, we would normally turn to *lex generalis* to solve the issue. However, as Sprankling²⁸ explains, there is no such thing as an “international law of property” in the sense of *jus commune*;²⁹ there is no universal set of rules governing ownership for all individuals. When discussing property rights in the context of a global common, “the only effective method to create or regulate these rights... is through international law.”³⁰

25 This section is based on the hypothesis that extraterrestrial resources can be owned. The author notes, however, that this matter is still being discussed, *see e.g. supra* note 7.

26 Sprankling, *supra* note 1, at 185.

27 *See* Section 2, page 2.

28 Sprankling, *supra* note 1.

29 *Idem*, at 1, 359.

30 *Idem*, at 19.

In the case of outer space, as it was previously noted, the closest international regime for ownership of objects created in outer space is the one provided by Article VIII of the Outer Space Treaty; but this is a regime that suffers from its own shortcoming when confronted to objects manufactured from extraterrestrial materials. Considering these severe limitations, the contribution suggests considering another largely recognized legal resource, Roman law, to determine the ownership of objects created on celestial bodies.

4. Accession to Ownership and Roman Law

4.1. The Role of Roman Law in Outer Space

At the peak of its expansion, Rome conquered and administered the majority of the then-known world, from Great Britain to Egypt and from Spain to Mesopotamia.³¹ As a consequence, it is not uncommon to find in both common-law and civil-law traditions traces of Roman law principles. This is especially true as regards to the matter of accession to ownership, even if³² exact legal effects vary across legal orders. For this reason, Roman law has the advantage of providing a general framework that is familiar to deciding entities. Furthermore, the need for a uniform set of rules governing the ownership of objects created on celestial bodies is rendered more complex by the outer space' qualification as a *res communis*. This means that the outer space is a common good of humanity, and hence cannot be appropriated as such. It poses the problem of "owning" something that cannot be, in principle, appropriated.

The mention itself of the legal concept of "*res communis*" indicates the relevance of Roman law for space law since this concept originates in the Roman classification of things.³³ Exposed in the *Digesta*, one of the four parts composing Emperor Justinian's *Corpus Iuris Civilis*,³⁴ the classification divides "things" in five categories, one of them being the *res communes omnium*.³⁵ This category encompasses things that "were not owned by anybody and were also incapable to have a *dominus*"³⁶. As demonstrated by Capurso,³⁷ the legal regime for outer space is built on similar pillars to the ones governing *res communes omnium* under Roman law: 1) freedom of

31 Jérôme Carcopino, *La vie quotidienne à Rome à l'apogée de l'Empire* (Réimpr. . ed. 1975).

32 Chatzipanagiotis, *supra* note 10, at 4.

33 Andrea Capurso, *The Non-Appropriation Principle: A Roman Interpretation* 8 (2018).

34 *Idem*, at 3.

35 *Ibid*.

36 *Ibid*.

37 Capurso, *supra* note 33.

access, 2) freedom of use and 3) prohibition to appropriate the area. We find these principles incorporated as core principles of the Outer Space Treaty, and clearly expressed in its Articles I and II.

The qualification of outer space as *res communis* is central in the current difficulty to establish clear rules governing ownership of objects created on celestial bodies. As stated in Section 1, outer space is an international area located beyond the national jurisdiction of States. Consequently, States cannot establish and enforce, on a celestial body, their own rules governing ownership. Considering the role Roman law plays in the definition of outer space's legal status as well as the reach of its heritage, it is legitimate to look into Roman law to find solutions to a problem arising from it.

4.2. Artificial Accession to Ownership

Roman law provides *inter alia* a method to acquire property through "artificial accession", that is, in a manner which is not based on a consensual agreement between potential owners.³⁸ In this situation, accession to ownership is the result of either "the owner's labor on or their improvement of an article, or by adding to or mixing with it something that they or another person owns".³⁹ According to Arnold,⁴⁰ there are three main methods through which a person may access ownership artificially: adjunction, confusion and specification.

- a) Adjunction, also referred to as "accession", occurs when two or more distinguishable elements are joined into one, and the final product can still be identified with only one of the preexisting elements. For instance, a foreign material used to improve a house.
- b) Confusion, by opposition to adjunction, occurs when two or more similar elements are intermixed to create a new product, and the preexisting elements cannot be distinguished. For instance, a person making wine out of his grapes and those belonging to a different owner.
- c) Specification occurs when a person, by their skills or labor, creates a new product out of another's material. For instance, making clothes out of fabric belonging to someone else.

This is the last method which offers the most pertinent reference when considering objects manufactured in space: we can indeed draw a parallel between making clothes out of someone else fabric and constructing an object out of someone else's resources, these resources being space resources, and therefore belonging to all as a "*res communis*".

38 Chatzipanagiotis, *supra* note 10, at 4; Earl C. Arnold, *The Law of Accession of Personal Property*, 22 Columbia Law Review 103 (1922).

39 Arnold, *ibid.*

40 *Ibid.*

4.3. The Principle of Specification

According to the principle of specification, the labor or skills used to manufacture the new object is the principal thing; the materials used for its realisation being its accessory.⁴¹ The rationale behind such a determination is that, in most cases, the new object has a greater economic value than the materials on their own. For instance, Michelangelo's *David* has more economic value than the marble he used. Thus, had Michelangelo used someone else marble, he would still be the owner of the statue since the marble would be the accessory.

By analogy, an object constructed by a manufacturer on a celestial body using *in situ* resources would be regarded as a specification of materials belonging to another entity (technically, to "all" in its quality as *res communis*). For this reason, final ownership would rest with the manufacturer. Obviously, the principle of specification offers what was missing initially: a clear rule of ownership.

There is another important benefit to using the principle of specification in determining ownership of an object created from outer space resources: it is a way to circumvent the issue of who owns the *in-situ* resources used by the manufacturer as "ink" when 3D printing the final object.

Eventually, the greatest benefit of the reference to the principle of specification is that this principle exists directly or indirectly in all legal orders. There are variations across the different municipal legislations but the idea that the materials used are accessory to the manufactured created object is commonly accepted.⁴² Other considerations are part of this common acceptance, such as a general understanding that the owner of the materials should be compensated for their loss and that good or bad faith should play a role in the accession to ownership of the newly created object.⁴³ Ultimately, despite the existence of variations in its application, the principle of specification still provides a fairly solid framework for ownership; one that is commonly recognized on Earth among nations and could be transposed to outer space.

5. Conclusion

As a society, we rely on legal rules to tell us who owns what and what our ownership over an object entails in terms of rights.⁴⁴ We can imagine that this need to have rules determining ownership will follow future settlers on the

41 Burdick, William Livesey *The Principles of Roman Law and Their Relation to Modern Law*, The Lawbook Exchange 341-342 (2004).

42 For more details on the variation across different legal orders, see Sprankling, *supra* note 1, at 243-244.

43 Ibid.

44 Blount, *supra* note 4, at 105.

Moon and Mars. While these rules are established and enforced on Earth by States within their jurisdiction, the status of outer space as *res communis* calls for uniformity among the international community when determining the ownership of objects constructed in outer space.

Article VIII of the Outer Space Treaty partially fulfills this need for cases where the object manufactured on a celestial body is made from materials originating from Earth. In that case, the existence of a legal link to Earth facilitates the identification of the applicable law establishing ownership over the object. Nonetheless, the silence of Article VIII of the Outer Space Treaty regarding objects made, partially or entirely, from extraterrestrial materials leaves a gap that needs to be bridged. This becomes imperative since creating objects out of *in situ* resources is the first avenue considered by space actors when envisaging permanent settlement on the Moon or Mars.

In the absence of other binding international norms deciding on this matter, using Roman law in general, and the principle of specification in particular, proves effective. Although considering the principle of specification as a general principle of international law would go too far – its legal effects vary too much across legal orders – ⁴⁵ it offers a strong basis to begin discussing the regime of ownership for objects created in outer space. Because it is widely recognized among spacefaring nations, it provides a common basis for discussion. Because it knows many variations in its application, it also has demonstrated the very much needed flexibility required for the fast-changing scene of space activities.

45 Chatzipanagiotis, *supra* note 10, at 4-5.