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Space Law and the Media

Science Fiction Movies on the Moon

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Abstract

“Science fiction” is a literary and cinematographic genre that is characterized by its capacity for anticipation. Most analyses of science-fiction tend to focus on the scientific and technical predictions, such as Verne’s many accurate predictions concerning travelling to the moon (1865-69). However, science fiction novels and films have also made some striking anticipations of a more social nature. In a number of cases, this has included confronting problems of a legal nature, some of which are currently addressed by international space law, in particular the 1967 Outer Space Treaty (OST). The present paper will focus on four critically acclaimed sci-fi movies showing moon exploration or colonization, either as their main topic or as a side topic. Two of those movies: Fritz Lang’s classic *Woman in the Moon* (1929), and the more recent independent movie *Moon* (2009), touch upon the issue of mining lunar resources and provide us with the occasion to reflect, among other legal issues, on the exploitation of the Moon’s natural resources. Another classic sci-fi movie, *H.G. Wells’ First Men in the Moon* (1964), raised the issue of the harmful biological contamination of celestial bodies, a hazard that must be prevented according to Art. IX OST. Finally, Kubrick’s and Clarke’s masterpiece *2001: A Space Odyssey* (1968), although not directly devoted to the Moon, at some point touches upon two important legal issues of lunar exploration: 1) the duty of States to inform the international community about their activities conducted on the Moon (Art. XI OST); and 2) the right to visit Moon stations and other lunar facilities by representatives of other States (Art. XII OST).

I. Introduction

The Moon is the only natural satellite of the Earth. As such, it is the closest celestial body to us. Its clear, round appearance in the firmament has undoubtedly inspired our ancestors since the dawn of time. Its constant presence has had a strong influence in the development of civilization – by showing philosophers and astronomers that there are other worlds like the Earth in the sky, by providing a celestial cycle to be used for the first calendars, etc. No wonder, the Moon also inspired the first “science-fiction” tales recorded in human history. Around 160 B.C., the Syrian-born Greek satirist author Lucian of Samosata wrote perhaps the oldest story about a journey to the

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Moon.¹ Under the ironic title of “True Story”, it tells about a ship full of Greek soldiers that is transported by an unusually large storm up into the air, and then it flies adrift in the sky for eight days, until finally landing on the lunar surface. There, the voyagers encounter the inhabitants of the Moon and become friends with them. The Greeks even help the “Moonites” in their war against the inhabitants of the Sun, who are their rivals over the colonization of the Morning Star (the planet Venus). The peace treaty agreed upon between the two empires, the “Moonite” and the “Sunite”, may be the very first reference ever made to an interplanetary rule of law.²

Indeed, while most analyses of science-fiction works tend to focus on the scientific and technical predictions, sci-fi stories and films have also made some striking anticipations of a more social nature. In a number of cases, this has included confronting problems of a legal nature.

For instance, in the nineteenth century, renowned French writer Jules Verne explored the possibility of people traveling to the Moon by means of a gigantic cannon, the cost of which would be defrayed by contributions from all nations in the world.³ In his fiction, Verne not only envisioned international cooperation in the peaceful exploration of outer space, but more remarkably, he also anticipated that such exploration would be conducted by transforming military hardware into technology destined for civil purposes. This is exactly what happened in the second half of the 20th century, when the USSR and the USA turned intercontinental ballistic missiles technology into launching rockets, in order to send the first artificial satellites and the first astronauts into outer space.⁴

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- 1 Lucian of Samosata, “A True Story”. A good classic edition is included in “Lucian with an English translation by A.M. Harmon of Yale University in eight volumes”, volume I, William Heineman Ltd, London (1913, reprinted 1972), pages 247 *et seq.* Another translation of the same work is available on the Internet (under the alternative title of “The True History”) at: <http://lucianofsamosata.info/TheTrueHistory.html>. [All websites referenced in this paper were last visited on 23 December 2015].
 - 2 “On the following conditions the Sunites and their allies make peace with the Moonites and their allies, to wit: That the Sunites tear down the dividing wall and do not invade the moon again [...]; That the Moonites permit the stars to be autonomous, and do not make war on the Sunites; That each country aid the other if it be attacked; [...] That the colony on the Morning Star be planted in common, and that anyone else who so desires may take part of it; That the treaty be inscribed on a slab of electrum and set up in mid-air, on the common confines.” “Lucian [...]”, 1972 (See note 1 above), volume I, p. 273.
 - 3 Jules Verne, “De la terre à la lune”, 1865. The best edition in English is “The Annotated Jules Verne – From the Earth to the Moon”, Walter James Miller (editor), Gramercy Books, New York, 1995.
 - 4 W. J. Miller, “The Annotated Jules Verne – From the Earth to the Moon”, Afterword, p. 162. These two remarkable social anticipations came in addition to Verne’s many accurate scientific and technical predictions concerning travelling to the moon, which can be found in both “From the Earth to the Moon” and its sequel,

Around the turn of the century, the new art of cinematography was fast to catch up, and very shortly after its inception, in 1902, the first ever science-fiction story was brought to the screen. Naturally, it was about a trip to the Moon.⁵ Ever since then, “science fiction has made magnificent use of the Moon.”⁶

II. Woman in the Moon (*Frau im Mond*)

The first of the four movies analyzed in this paper, *Woman in the Moon*, is a silent film that premiered in 1929. It was written and directed by German-Austrian Fritz Lang (who was already famous by his 1927 epic masterpiece *Metropolis*), and it is considered a classic of German Expressionist cinema of the 1920s. Lang wrote the script based on the novel “Die Frau im Mond” (1928) by Thea von Harbou, his wife and collaborator at the time. Notable German rocket experts such as Hermann Oberth and Willy Ley served as technical consultants on the film. It was released in the USA as *By Rocket to the Moon* and in Great Britain as *Woman in the Moon*.⁷

Depicting the first human expedition to the Moon, the film is a mixture of scientific speculation and melodrama.⁸ The first part – concerning the preparation of the trip and the physical foundations of a voyage to the Moon, as well as the launch of the rocket – is far more solid than the second part, when scientific constraints all but disappear – characters are shown walking and breathing freely on the lunar surface – and purely dramatic scenes prevail.

The purpose of the trip is to verify the theory of one of the travelers, professor Manfeldt, about the existence of large amounts of gold on our satellite. A gang of evil businessmen have learned of Mannfeldt’s ideas and insist on having one of them included in the team of lunar explorers. Finally, we also witness the romance between two other travelers: the idealistic entrepreneur Helius – the promoter of the trip – and her assistant Friede, both of whom will end up stranded on the Moon.

Woman in the Moon is widely considered the first “serious” science fiction film ever made. The basics of rocket travel were presented to a mass audience for the first time, including the use of a multi-stage rocket. The rocket is fully assembled in a tall building and then moved to the launch pad, like many

“Around the Moon” (1869). For a good essay describing all such predictions, See Dean Regas, “The Science of Jules Verne’s Fiction”, *Sky & Telescope* June 2015, pages 32-37.

5 A *Trip to the Moon (Le voyage dans la lune)* by French director Georges Méliès became an instant classic in the history of cinema, while obtaining also a huge success wherever it was projected, in Europe and in the Americas. It can be watched at: <https://www.youtube.com/watch?v=qz9IS73Uwkw>.

6 Francis Lyall & Paul B. Larsen, “Space Law – A Treatise”, Ashgate, 2009, p. 177.

7 See entry in Wikipedia: https://en.wikipedia.org/wiki/Woman_in_the_Moon.

8 Wikipedia, *ibid*.

modern launch vehicles. Most significantly, as launch approaches, the launch team counts the seconds backwards from ten to zero (“now”, or *jetzt*, was used for zero). As a result, *Woman in the Moon* is often cited as the first occurrence of the “countdown to zero” before a rocket launch.⁹ Apparently, Lang himself came up with this idea, which was intended to add a more dramatic effect to the key moment of departure of the travelers toward outer space.¹⁰

III. Legal Issues Raised by *Woman in the Moon*

Besides its many technical merits, the film also raises two questions that are relevant from the point of view of space law. The first one is the fact that a group of individuals (or for that matter, any private physical or legal person) undertake an expedition to the Moon apparently on their own, without any kind of control or supervision by any State: this is not possible under current international and national space law. Secondly, we have of course the issue of the exploitation of lunar resources. Note that the non-appropriation principle as currently embodied in international space law is not at stake here: the explorers do not make any claim over the Moon or intend to colonize it. Their intention is rather to extract the gold that they have found under the Moon’s surface and take it to the Earth for commercial purposes: can this legally be done? The two questions will surface again even more strongly in the last movie analyzed in the present paper (*Moon*), and are thus better addressed together later in the paper.

IV. *2001: A Space Odyssey*

This celebrated movie, which had its premiere in April 1968, was the brain-child of two geniuses: American director Stanley Kubrick – who had decided to make “the proverbial good science fiction movie” – and English novelist and futurist Arthur C. Clarke.

In the words of the Encyclopedia Britannica, this science-fiction film “set the benchmark for all subsequent movies in the genre and consistently ranks among the top 10 movies ever made,” being “especially known for its groundbreaking special effects and unconventional narrative.”¹¹

9 Wikipedia, *ibid*. The scene of the rocket launch can be watched at:

<https://www.youtube.com/watch?v=uQlwhG76P9A&list=RDuQlwhG76P9A#t=0>.

10 www.spektrum.de/quiz/was-verdankt-die-raumfahrt-dem-stummfilm-die-frau-im-mond-1929-von-fritz-lang/636420. By contrast, Verne’s voyage to the Moon started with a count-up: “Thirty-five! Thirty-six! Thirty-seven! Thirty-eight! Thirty-nine! Forty! Fire!” “The Annotated Jules Verne”, p. 152.

11 www.britannica.com/topic/2001-A-Space-Odyssey-film-1968. See also the corresponding entry in Wikipedia: [https://en.wikipedia.org/wiki/2001:_A_Space_Odyssey_\(film\)](https://en.wikipedia.org/wiki/2001:_A_Space_Odyssey_(film)).

According to the script, in the year 2001, space travel is an utterly routine activity, and manned stations exist in Earth's orbit and on the Moon. An uneasy but peaceful coexistence is maintained between the different space powers. The balance is broken when a singular monolith of a seemingly extraterrestrial origin is found under the Moon's surface by United States astronauts. The US Government decides to keep this finding secret, and as a result the American moon base, situated in the crater Clavius, refuses to receive any further visits from its Soviet counterparts.

The movie then shows the voyage undertaken some time later by American spacecraft *Discovery* towards Jupiter – some of the most memorable scenes of the movie focusing on the problems encountered by the crew with their intelligent computer *HAL 9000*. The story ends with a trip “beyond the infinite” made by the only surviving crew member, who eventually returns to Earth as a reborn person, as a “star child”, heralding a new step in the evolution of mankind.

The movie was controversial from the beginning, and it was too often misunderstood (it still is). The reason is that the underlying message (mankind's first encounter with an alien intelligence, symbolically represented by the black monoliths), which is very clear in Clarke's novel, becomes abstract and almost totally disappears in Kubrick's movie. The latter is above all an audiovisual experience; an authentic masterpiece which, as such, is open to alternative interpretations.

Undoubtedly, one of the strongest assets of the movie is its realism. Kubrick's obsession about getting expert adviser, and his painstaking work to film all details in as credible a fashion as possible, became legendary. The result is a most vivid and realistic depiction of the life of astronauts in outer space.¹²

Precisely for this reason, it is noteworthy that one of the very few “mistakes” made in the movie concerns the only reference made to international space law. In one scene located inside the giant wheel-shaped space station, some characters refer to an obscure “IAS Convention” as the text governing human activities in outer space.¹³ Obviously, this convention does not exist – it is just a fiction invented by the authors.

Had Kubrick researched this particular subject matter as carefully as he did with all other aspects of astronautics, he could have easily found out that already in 1959, the United Nations Organization had established a Committee on the Peaceful Uses of Outer Space (COPUOS) charged, among other tasks,

12 Piers Bizony's book “2001 – Filming the Future”, Aurum Press, London, 1994, provides an excellent account of how this film was conceived and brought to the screen.

13 The exact words are: “Two days ago, one of our rocket buses was denied permission for emergency landing at Clavius. [...] Denying them any permission to land is a direct violation of the IAS Convention”. The whole scene can be watched at: <https://www.youtube.com/watch?v=PlPMxgHQKg8>. This scenario is also mentioned in Lyall & Larsen, “Space Law – A Treatise”, p. 187, n. 53.

with the elaboration of international rules applying to the activities of States in outer space.

Moreover, he would have found that discussions in this UN Committee had already resulted, in October 1967 (therefore, several months before the movie was released), in the entry into force of the first major convention in this area: the Outer Space Treaty,¹⁴ subsequently ratified or adhered to by all space-faring nations.¹⁵

V. Legal Issues Raised by 2001: *A Space Odyssey*

Although not directly devoted to the Moon, *2001: A Space Odyssey* touches upon two important legal issues of lunar exploration, both of which are embodied in the 1967 Outer Space Treaty (hereinafter, OST): 1) the duty of States to inform the international community about their activities conducted on the Moon (Art. XI OST); and 2) the right to visit moon stations and other lunar facilities by representatives of other States (Art. XII OST).

According to Art. XI OST, there is a general obligation for States parties to the Treaty to inform the UN Secretary General as well as the international scientific community and the public of the “nature, conduct, location and results” of their activities in outer space, including the Moon and other celestial bodies. To be sure, this is a very lax requirement, and the qualification “to the greatest extent feasible and practicable” renders the provision relatively vague in its obligatory content.¹⁶

However, it is hard to think of a more significant result of outer space exploration than finding an artifact from an alien civilization. Keeping secret the discovery of the monolith buried in the Moon would surely violate, if not the rules, at least the spirit of the OST, whose foundations are transparency (Art. XI) and international cooperation (Art. IX) among States parties. Moreover, the Treaty declares that exploration of outer space, including the Moon and other celestial bodies, is to be done “for the benefit and in the interests of all countries [...], and shall be the province of all mankind” (Art. I).

14 Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, 610 UNTS 205, (1967) 6 ILM 386.

15 Of course, it is also very likely that the lack of any reference to the UN or to the OST in the film was not a “mistake”, but rather a deliberate option made by the authors. The aim would be to maintain a politically neutral flavor and a timeless character in their movie. In the same vein, *2001* mentions repeatedly a fictitious “United States Astronautics Agency”, instead of referring to the actually existing National Aeronautics and Space Administration, NASA.

16 Jean-François Mayence & Thomas Reuter, “Article XI”, in Stephan Hobe, Bernhard Schmidt-Tedd & Kai-Uwe Schrögl (eds.), “Cologne Commentary on Space Law”, Vol. 1 (Outer Space Treaty), 2009, pp. 189 et seq.

Also, under Art. XII OST, “stations, installations, equipment and space vehicles on the Moon” are to be open to inspection by representatives of the other State parties, on the basis of reciprocity, and subject to prior notice, for reasons of safety and to avoid interference with normal activities being carried out there.¹⁷ In brief, Moon base Clavius has to allow visits by other States, provided that the requirements established in the OST provision are met. Routine visits and inspections might be eluded temporarily with the excuse of a quarantine, as alleged in the movie by the Clavius authorities. But denying permission to a supposedly emergency landing from a foreign spacecraft would be a much harder “visit” to refuse. Such an action would amount to an omission to assist astronauts in an event of accident, distress or emergency landing, something that would run against another one of the UN Outer Space Treaties: the 1968 Rescue Agreement.¹⁸

In brief, actions undertaken by Moon base Clavius with an aim to conceal the alien monolith that was found buried in the Moon could be violating a number of principles embodied in the OST, as well as Article 2 of the Rescue Agreement.

In 1979, a new treaty was adopted by the United Nations General Assembly dealing specifically with the Moon and other celestial bodies; it entered into force in 1984.¹⁹ Interestingly, the Moon Agreement (MA) contains two provisions that go directly to the heart of the problems touched upon by 2001. After repeating in Art. 15.1 the same provision on access to lunar facilities that was made by Art. XII OST, Art. 10.2 MA explicitly states that any “persons in distress on the moon” are to be offered shelter in the stations, installations, vehicles and other facilities of States parties.

Also, Art. 5.3 MA says that should one State party find signs of organic life on the Moon, that State should promptly inform the UN Secretary General as well as the public and the international scientific community. However, it is well known that the Moon Agreement has a very low level of ratification, and that its provisions are not binding on any of the major space powers.²⁰ We will examine the Moon Agreement again in Section X below, when analyzing the exploitation of lunar resources.

17 Lesley Jane Smith, “Article XII”, in Stephan Hobe, Bernhard Schmidt-Tedd & Kai-Uwe Schrögl (eds.), “Cologne Commentary on Space Law”, Vol. 1 (Outer Space Treaty), 2009, pp. 207 et seq.

18 Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space, 610 UNTS 8843.

19 Agreement Governing the Activities of States on the Moon and other Celestial Bodies, 1363 UNTS 21; (1979) 18 ILM 1434.

20 As of 31 December 2015, the Moon Agreement had just 16 States parties, as opposed to 103 States parties for the Outer Space Treaty.

VI. *H.G. Wells' First Men in the Moon*

Another classic sci-fi movie with a lunar theme is a British film under the title *H.G. Wells' First Men in the Moon* (or simply *First Men in the Moon*), which was directed by Nathan Juran and released in 1964. Noted Hollywood special effects specialist Ray Harryhausen made possible to film two different expeditions to the Moon (the “cavorite” one, and the “UN” one; see plot below). He also used stop-motion effects in order to provide animated Selenites and other creatures for the movie.²¹

Instead of a rocket, a gravity blocking substance is conceived here by the protagonists, two late 19th century Englishmen. They call it “cavorite” because of the name of its inventor, amateur scientist Joseph Cavor. Panels of it are used for building a rudimentary spaceship. That allows three explorers: Cavor, Bedford, and Kate, to leave the Earth and make a controlled flight to the Moon. There they find a developed, ant-like race of inhabitants living beneath the surface of the Moon. Their big-brained ruler, the Prime Lunar, decides to retain the explorers for life so that the Selenites’ secret, quiet existence is not revealed to the inhabitants of the Earth. Eventually, Bedford and Kate manage to return to Earth, while Cavor decides to stay in order to study the Selenite civilization. When decades later a United Nations rocket expedition reaches the Moon, they will find out that all the Selenites have been killed off by earthly microbes that were inadvertently brought to the Moon by Cavor and to which they had no immunity.²²

VII. *Legal Issues Raised by First Men in the Moon*

The tragic end of the Selenites brings to the fore the important issue of the harmful contamination of the Moon and other celestial bodies by terrestrial explorers. This is a hazard that must be prevented, according to Art. IX OST. The Moon Agreement also requires its States parties to take measures necessary to prevent the disruption of the existing balance of the lunar natural environment (Art. 7.1 MA).

Although biological contamination is not directly addressed in the UN Outer Space Treaties, there is a whole body of standards already existing in that specific area: the so-called “planetary protection”. These rules have been progressively developed since 1964 by the Committee on Space Research

21 See the corresponding entry at Wikipedia: [https://en.wikipedia.org/wiki/First_Men_in_the_Moon_\(1964_film\)](https://en.wikipedia.org/wiki/First_Men_in_the_Moon_(1964_film)). A trailer of this movie can be watched at: https://www.youtube.com/watch?v=CMw6O6r_JxE.

22 This plot twist does not appear in H.G. Wells’ tale “The First Men in the Moon” (1901) that served as inspiration for the movie. It is taken instead from Wells’ most famous and influential work: “The War of the Worlds” (1898), where the Martians invading the Earth are wiped out by terrestrial bacteria.

(COSPAR), which is a non-governmental organization composed of independent and internationally renowned space scientists.²³

COSPAR's Planetary Protection Policy (PPP) classifies all interplanetary missions in five separate categories, depending on: a) the degree of astrobiological interest of the celestial body which is the subject of study; and b) the likelihood that the area to be explored may have conditions that are adequate for the growth and propagation of terrestrial life.²⁴

In this context, missions to the Moon are classified under Category II. This category encompasses space missions destined to visit those celestial bodies that have a certain degree of interest from the point of view of biological studies, but where risk of contamination with earthly microbes is extremely low. Missions destined to those celestial bodies (comprising the majority of Solar System bodies) should produce documentation detailing planned operations and identifying the materials that are going to be introduced into the environment of that celestial body.²⁵ However, no biological contamination control measures are required for lunar (or any other Category II) landing missions.²⁶

According to Art. IX OST (and Art. 7.1 MA), affecting the Earth's environment by introducing alien materials in it is another hazard that must also be prevented. In particular, the introduction of alien organisms into the biosphere of our planet – the so-called “back contamination” – is a very remote possibility, but one the occurrence of which could have potentially disastrous consequences for terrestrial life.

This was already pointed out in a 1962 report by the Space Studies Board of the US National Academy of Sciences, which recommended that NASA “do everything possible to minimize the risk of back contamination.” As a result, the US Government established in 1966 an Interagency Committee on Back Contamination, which advised that, as a preventive measure, astronauts and hardware reaching the Moon had to be quarantined. Accordingly, when the first *Apollo* expeditions that landed on the Moon arrived back to Earth, the astronauts together with their capsule and the lunar samples brought with them were biologically isolated. Isolation was done first inside a Mobile Quarantine Facility, and afterwards in a building that NASA had constructed in 1969 for this specific purpose in its Houston space center: the Lunar

23 <http://cosparhq.cnes.fr/>.

24 https://cosparhq.cnes.fr/sites/default/files/ppp_article_linked_to_ppp_webpage.pdf.

25 Private organizations participating in the Google Lunar X-Prize competition (<http://lunar.xprize.org/>) are imposed, among other requirements, compliance with the documentation requirements established by the COSPAR's PPP for lunar missions.

26 As could be expected, it is missions to Mars in particular that receive most attention and which have the most burdensome planetary protection requirements (such as sterilization, etc.) in order to prevent biological contamination of that planet. See also NASA's website on planetary protection: <http://planetaryprotection.nasa.gov/about>.

Receiving Laboratory. The last three *Apollo* expeditions to the Moon abandoned this protocol, after the absence of any biological activity on the Moon had been sufficiently proven.²⁷

Additional legal issues raised by *First Men in the Moon* are: 1) The possibility of claiming sovereignty over the Moon, as the protagonists do “for Queen Victoria” in the movie. Such an action might have succeeded in an hypothetical expedition to the Moon conducted in 1899, but certainly not by the time the second expedition arrives, in 1964. Any claim of sovereignty over outer space and celestial bodies was unanimously ruled out in 1963 by the UN General Assembly in its Resolution 1962 (XVIII), and again in 1967 by the entry into force of the Outer Space Treaty (Art. II OST). 2) The possibility for individuals to carry out a trip to the Moon without any control or supervision by a State: this is also against current international and national space law, as per Art. VI OST and the legislation of States that have enacted domestic space law, such as the US, the UK, and others.²⁸ We will analyze this issue with more detail in Section IX below.

VIII. *Moon*

Moon is a very remarkable British independent sci-fi drama movie co-written and directed by British director Duncan Jones. It premiered at the 2009 Sundance Film Festival. It received very positive reviews from film critics, and it obtained a number of awards from film festivals in Europe and America.²⁹ The story is set in 2035. It follows Sam Bell, a man who experiences a personal crisis as he nears the end of a three-year solitary stint mining helium-3 in *Sarang*, a private facility located on the far side³⁰ of the Moon. It turns out that Lunar Industries, the corporation Bell is working for, is using very unscrupulous cost-saving methods while carrying out the exploitation of lunar

27 Michael Meltzer, “When Biospheres Collide”, NASA SP-2011-4234 (2011). This book provides a very detailed historical account of NASA’s Planetary Protection programs, including all measures adopted during the *Apollo* space program in order to prevent back contamination. It is available online at: www.nasa.gov/connect/ebooks/when_biospheres_collide_detail.html. It is ironic to note here that the title of that book pays tribute to yet another classic sci-fi movie: *When Worlds Collide* (1951).

28 For instance, Section 3 of the UK Outer Space Act 1986 prohibits any unlicensed UK activity in space.

29 See the corresponding entry at Wikipedia: [https://en.wikipedia.org/wiki/Moon_\(film\)](https://en.wikipedia.org/wiki/Moon_(film)). See also the film’s official website: www.sonyclassics.com/moon/.

30 The Moon is tidally locked to Earth, so that the rotational period around its axis coincides with its period of revolution around the Earth. As a result, from our planet we can only ever see one lunar hemisphere, the so-called “near side”, while the other one, i.e. the “far side”, is perennially hidden. Conversely, as seen from the Moon, the Earth is visible only for observers located on the lunar near side.

resources. This includes making use of clones as employees, and preventing any communication of the latter with the Earth. Bell – or rather his most recent clone – decides to go back to Earth in order to denounce these irregular practices. Despite all difficulties and dangers, he will eventually succeed.

IX. Legal Issues Raised by *Moon* (I): State Licensing and Supervision

Under Art. VI OST, States are responsible for all activities carried out in outer space, including those conducted by non-governmental (i.e. private) entities. Insofar as private entities such as companies and other private organizations will engage in the exploration and use of the Moon, relevant States must exercise proper control, issue appropriate licences, and supervise the activities of those legal persons that are their nationals. This will be essential for States in order to make sure that they are complying with their obligations under international space law.

The consequence is that any corporation setting up a privately-owned station – for example, a mining facility, such as Lunar Industries' in this movie – anywhere on the Moon³¹ will still be subject to the control and supervision of the corresponding State. The latter should ensure that the corporation does not engage in practices that violate international law, including the United Nations Charter, or the Universal Declaration of Human Rights.³² Also, when licensing commercial activities such as e.g. space tourism on the Moon, States should impose strict requirements so as to prevent any disruption and contamination of the lunar environment, or any interferences with the activities of other States, in order to comply with their international law obligations.

X. Legal Issues Raised by *Moon* (II): Exploitation of Lunar Resources

Moon portrays the use of the helium-3 isotope as a fuel for nuclear fusion, this kind of power generation having become the Earth's primary source of energy. Some experts disagree with this vision, pointing out that the isotope is generally far from being abundant in the lunar soil, and that helium-3 alone will not justify setting up a lunar resource extraction industry. Moreover, as of today, nuclear fusion remains unproven as a viable process for obtaining electrical power.³³

31 It is legally irrelevant that this is done on the far side of the Moon. However, it makes the Earth invisible, and thus radio communications with Earth, although still possible, become more complex.

32 According to Art. III OST, activities in the exploration and use of outer space, including the Moon and other celestial bodies, shall be carried out in accordance with international law.

33 Ian A. Crawford, "Lunar resources: A review", in *Progress in Physical Geography*, April 2015; vol. 39, 2: pp. 137-167: http://ppg.sagepub.com/search/results?fulltext=ian+a.+crawford&submit=yes&journal_set=spppg&src=selected&andorexactfulltext

However, there are many other exploitable raw materials in the Moon that are of potential economic interest. Certain useful metals that are relatively abundant in the lunar crust such as titanium and aluminum could be mined. Other metals that are known to exist – albeit in smaller amounts – in the Moon as well, such as uranium, thorium, and rare-earth elements, will likewise become interesting if found in large enough concentrations. Some essential gases such as oxygen and hydrogen could be extracted from surface minerals. Lunar soil (regolith) itself could be used as a building material. The discovery of water ice buried or mixed with the lunar soil in permanently shadowed craters around the poles has very significant implications, as this is a particularly useful resource for a future colonization of our satellite. Even solar energy collected on arrays placed on the surface of the Moon and then beamed to Earth has been suggested as a possible lunar export.³⁴

Lunar resources would first of all be applied to enabling continued exploration and other human activities (for instance, space tourism, or astronomical studies) on the Moon itself. Use of those resources would then expand to support a future industrial capability in the space within the Earth-Moon system – the region often referred to as “cislunar space”. In the longer term, activities elsewhere in the Solar System could also be conveniently supplied from the Moon, since weaker lunar gravity means that it is easier launching into space from the Moon than having to transport the materials out of Earth’s gravity well. Eventually, some lunar materials might also be imported to Earth and contribute directly to the global economy.³⁵

However, exploitation of natural resources from the Moon and from other celestial bodies, such as asteroids, is currently unsatisfactorily regulated by international law.

Although the OST may not be explicit in this regard, there seems to be a basic consensus that the Moon itself, as well as any part thereof, are not available for private ownership by individuals or companies. But the status of specific materials extracted from the Moon is a different matter. As noted among other authors by Lyall and Larsen, permanent appropriation of lunar samples, and thus a right of private ownership over lunar materials, has already happened in the past and cannot be precluded in this area.³⁶

By contrast, the 1979 Moon Agreement declares in its Art. 11.1 that the Moon and its natural resources are “the common heritage of mankind”, and in article 11.3 that lunar natural resources cannot become the subject of a right of property. Since natural resources cannot be subject to private appropriation, Art. 11.5 calls for the establishment of an international legal regime

=and&x=0&y=0. A preliminary version of this paper is freely available at: <http://arxiv.org/abs/1410.6865?context=astro-ph.EP>.

34 I. A. Crawford, *ibid.*

35 I. A. Crawford, *ibid.*

36 F. Lyall & P.B. Larsen, *ibid.*, p. 188, note 56.

to govern their exploitation, once such exploitation is about to become feasible. According to Art. 11.7, the purpose of such international regime will be, *inter alia*, the orderly and safe development of the natural resources of the Moon, their rational management, and an equitable sharing by all States parties in the benefits derived from those resources.

As already noted however, the Moon Agreement has received very limited acceptance, and none of the major spacefaring nations is a party or is currently inclined to adhere to it. Although it is binding on those States that have ratified it, the Moon Agreement will certainly not be an impediment for other non-party States to move ahead and start the exploitation of lunar resources in a different manner as the one prescribed by that treaty.³⁷

Discussions on the Moon Agreement held at the Legal Subcommittee of COPUOS in recent years, under the permanent agenda item "Status and application of the five United Nations treaties on outer space", have yielded some interesting reflections and documents, but no definite conclusion has been reached about the Agreement. The COPUOS debates made obvious that there is a lack of consensus in the international community as to how to proceed on this matter and as to what role the Moon Agreement should play, if any, in the future exploitation of lunar resources.³⁸

An alternative solution to the international regime foreseen by the Moon Agreement is to recognize private ownership over extraterrestrial resources to non-governmental entities. These non-governmental entities would then carry out the actual exploitation, subject to authorization and supervision by the corresponding States parties (pursuant to Art. VI OST), in order to ensure compliance with all provisions of the latter Treaty.

This was done by a new provision adopted in 2015 by the United States within the framework of its Commercial Space Launch Competitiveness Act.³⁹ The new provision directs the President to facilitate and promote space resources exploration and recovery, and establishes a legal right to space resources that US citizens may obtain from asteroids and other celestial bodies. Such right must be consistent with current law and international obligations of the US, and will be subject to authorization and continuing supervision by the US Federal Government. Finally, the Act assures that the US does not assert

37 F. Lyall & P.B. Larsen, *ibid.*, p. 195, note 85.

38 See e.g. COPUOS Legal Subcommittee official reports for the years 2007 and 2008: Doc. A/AC.105/891 (www.unoosa.org/oosa/en/ourwork/copuos/lsc/2007/index.html), paragraphs 42 and 43 as well as Annex I; and Doc. A/AC.105/917 (www.unoosa.org/oosa/en/ourwork/copuos/lsc/2008/index.html), par. 42 and Annex I.

39 U.S. Commercial Space Launch Competitiveness Act (H.R. 2262), signed into law by President Barack Obama on 25 November 2015.

sovereignty or any kind of exclusive rights, including ownership, over any celestial body.⁴⁰

As a reaction to the new US law, a position paper was adopted by consensus by the Board of Directors of the International Institute of Space Law (IISL) on 20 December 2015.⁴¹ The paper acknowledges that under current international space law, it is not clear whether there is a right to take and consume non-renewable natural resources such as minerals and water that are present in celestial bodies. According to the IISL, given the absence of a clear prohibition of the taking of resources in the OST, the new US Act is a possible interpretation of the OST, and thus does not violate the Treaty.⁴²

Nevertheless, the position paper concludes, it is an open question whether this legal solution is satisfactory. It might best be regarded as a starting point for initiating discussions in this area, with a view to the future development of international rules that will coordinate the free exploration and use of outer space, including resource extraction, with the benefit and the interests of all countries.⁴³

In any case, certainty as to the applicable legal regime is a fundamental necessity for making possible a future lunar economic exploitation.⁴⁴

The development of lunar resources will require the establishment of an international legal regime which encourages large-scale investment in prospecting and extraction activities, while at the same time ensuring that outer space does not become a source of international conflict.⁴⁵

To conclude: the legal regime for the future exploitation of lunar and other extraterrestrial resources is still a legal void, one of the few to be found in current international space law, and one that will have to be addressed one

40 The Act determines in Sec. 51303 that US citizens engaged in commercial recovery of an asteroid resource or a space resource “shall be entitled to any asteroid resource or space resource obtained, including to possess, own, transport, use and sell the asteroid resource or space resource obtained in accordance with applicable law, including the international obligations of the United States.”

41 The IISL Position Paper is available at: www.iislweb.org/html/20151220_news.html. It is also published in the present 2015 IISL Proceedings.

42 IISL Position Paper, part II.

43 IISL Position Paper, part III.

For some perspectives on those future international discussions, See: Jeff Foust, “New Law Unlikely to Settle Debate on Space Resource Rights”, Space News, Dec. 4, 2015: <http://spacenews.com/new-law-unlikely-to-settle-debate-on-space-resource-rights/>; Marcia Smith, Space Policy Online, 13 December 2015: www.spacepolicyonline.com/news/asteroid-bill-authors-open-to-international-discussions-but-not-regulatory-yoke; Tanja Masson-Zwaan & Bob Richards, Leiden Law Blog, 22 December 2015, at: <http://leidenlawblog.nl/articles/will-the-united-states-rule-space-resource-mining>.

44 F. Lyall & P.B. Larsen, *ibid.*, p. 196.

45 I. A. Crawford, *ibid.*

day. Science fiction movies will continue helping us along in the task, by inspiring us and by putting into pictures all the fantastic possibilities that lie ahead.⁴⁶

46 The author would like to commend the IISL for organizing, within its annual Colloquium on the Law of Outer Space, a panel on “The Portrayal of Space Law in Media and Movies”. By bridging two of my lifelong interests: Space Law and science fiction, IISL provided the inspiration for writing the present paper. The author also wishes to express his gratitude to Steven Mirmina, Senior Attorney at NASA, for co-chairing such a fantastic panel during the 2015 IISL Colloquium in Jerusalem, and for making some suggestions for improving the language of this paper.

