



Proef ingediend met het oog op het behalen
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GOING TO MARS

**In Search of a Solid Legal Framework for this Planet not yet
Visited by Humankind**

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FOREWORD

I can hardly grasp that my career as a student is almost over. I ponder the implications every day and when I do, I get a tingle running down my spine. Even more so now, after finishing my dissertation, freeing myself of a considerable load, as it probably is for every student.

However, I must admit that I thoroughly enjoyed writing this thesis and I never saw it as a burden, due to the fact that the subject interests me more than I can clearly put into words. I am not only elated when I think about graduating, but filled with excitement when I think about the possibilities ahead. Heading out into space, exploring its' farthest reaches, and eventually, colonization. How breathtaking! Well known science fiction television series from as far back as the 60's, depicting a future for the human race, such as Star Trek, become more realistic and prophetic each day and it absolutely perplexes me. Mostly since this shows our apparently limitless imagination and steadfast desire for progression as a species. Humankind is nowhere near the end of its story. *Au contraire*, if we want to ensure our survival as a species, holding on to our ideals and continuing to apply these to our space endeavors seems to be our only option.

That being said, some acknowledgements are in order. Firstly, I want to thank Professor Erick Franckx for his guidance and insights on this dissertation.

Secondly, I want to thank my parents, whom were so kind as to offer me the comfort and quiet of their home when I needed it and financed part of my education. And last but not least, a big thanks to my close friends whom had to endure my numerous lectures and speeches about space travel willy-nilly while trying to enjoy their beer. Their willingness to engage in discussions often put me on the right path. I can imagine some of them rolling their eyes when I wasn't looking and rushed head-first into one more conversation about Mars, but all were kind enough to realize the importance these talks had to me and I never lost anyone's unconditional support, for which they deserve all praise. Some of them even took the time to give my thesis a read and, whether out of curiosity, interest or friendship, I can only be grateful.

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1 Introduction

During the last six decades humankind has taken its first steps towards freeing itself from the confines of Earth. Technology has advanced tremendously and the conquest of outer space and planets like Mars is not only desirable, it is inevitable.¹ The time has come for the world to set itself a whole new goal: colonizing the Red Planet, better known as Mars. No longer will science fiction authors and idealists be solely dreaming up stories and penning down their wildest dreams about space travel, but are real-world enterprises slowly, but surely working towards realizing this fantasy as well.

Visionaries like ELON MUSK² and ROBERT ZUBRIN³ have taken the lead in this ambitious plan and have stimulated public debate on the matter. We must overcome our fear of reaching outer space, because to innovate, technical risk is necessary.

In its early stages, space exploration was characterized by rapid growth and progress, but, in the last decades, that progress has stagnated considerably. People such as MUSK and ZUBRIN are now trying to change this passive attitude, but in doing so, take on great responsibilities and challenges. Apart from the obvious technological challenges, legal, political and ethical concerns will unavoidably arise as well.

Lately, a paradigm shift is already becoming noticeable. In 2017, the Outer Space Treaty celebrated its 50th birthday and the United States did not let this moment slip by unnoticed. They seized the moment as the perfect time for a Committee Hearing to go back to what had previously been agreed upon and reflect on possible improvements and necessary changes. The Hearing launched under the title “Reopening the American Frontier” and acknowledges the lack of clarity and the need for reform.⁴ The fact that the United States, as a major spacefaring power,

¹ For a comprehensive petition on why we should explore outer space and particularly Mars the books of ROBERT ZUBRIN are highly recommended. See R. ZUBRIN, *The Case for Mars*, New York, Free Press, 2011, 383 p. and R. ZUBRIN, *Entering Space, Creating a Spacefaring Civilization*, New York, Tarcher/Penguin, 1999, 305 p.

² CEO and Chief Designer of SpaceX. He has the goal to reduce the risk of human extinction and wants to achieve this goal by colonizing Mars.

³ Former senior engineer at Lockheed Martin Astronautics, founder and president of the Mars Society, president of Pioneer Astronautics, an aerospace R&D company in Colorado. He is a renowned aerospace engineer and crafted a blueprint for Mars exploration, called Mars Direct. The Mars Society is an international space-advocacy organization that focusses on intensive research for Mars exploration and settlement.

⁴ *Reopening the American Frontier: Reducing Regulatory Barriers and Expanding American Free Enterprise in Space*, Hearing before the Subcommittee on Space, Science and Competitiveness of the

is preoccupied with these matters, shows that the current climate seems favorable for a new space era.

These legal (and to a lesser degree political and ethical) challenges will be the subject of this comment. Is the world, legally speaking, ready for outer space exploration and conquest? The main goal here is to go in search of a solid legal framework for extraterrestrial celestial bodies, like Mars and the Moon. International organizations have begun drafting laws to govern outer space, but the body of space law is still at an embryonic stage and jurisprudence is entering unknown territory.

The exploration and colonization of Mars will be the focal point, since other planets in our solar system are thus far uninhabitable or unreachable with current modern-day technology.⁵ The exploration and colonization of the Moon will be touched as well now and then, but is of lesser importance since the Moon has no atmosphere and lacks sufficient resources. It is therefore not an ideal target for colonization.⁶ This does not rule out the Moon as a destination altogether, since operating Moon bases might be established. Therefore, Earth's natural satellite cannot be left untouched in this research.

Aside from the focus on Mars, another focal point in this analysis will be the United States. The United States is a major power in the space scene and has been the industry leader almost since the beginning. The US has the biggest independent space program (followed by Europe's European Space Agency) and because of this exceptional position the U.S. will presumably have a large influence on what legal structures will be adopted or rejected.⁷ A look at American space law and space policy is therefore indispensable.

This study opens with an in-depth examination of the body of outer space law. The 1967 Outer Space Treaty is discussed, as well as other treaties and the Cold War era, of which the impact cannot be overlooked. These treaties and the Cold

Committee on Commerce, Science and Transportation, US Senate, 115th Congress, 2017, 1-50. Hereinafter 2017 Space Hearing or Space Hearing.

⁵ R. ZUBRIN, *The Case for Mars*, New York, Free Press, 2011, xxv-xxvi.

⁶ R. ZUBRIN, *Entering Space, Creating a Spacefaring Civilization*, New York, Tarcher/Penguin, 1999, 94-96.

⁷ D.A. PORRAS, "The 'Common Heritage' of Outer Space", *CWILJ* 2006, (143) 146; Hearing before the Subcommittee on Science, Technology and Space of the Committee on Commerce, Science and Transportation, US Senate, 108th Congress, 2003, (1-46) 3-4, <https://archive.org/details/tails/gov.gpo.fdsys.CHRG-108shrg97061>. Hereinafter 2003 Space Hearing.

War influences are crucial for a full comprehension of space law as it stands today.

Once the current legal regime is dealt with, the search will move toward shortcomings in present system. The diseases that currently infect space law, such as shortcomings in regard to property rights in outer space or loopholes and uncertainties in the Outer Space Treaty, will be handled in depth and the quest for a cure will be set forth. Sometimes a Band-Aid might stop the bleeding, other times a vaccine can render us immune to the infection. This will all be concluded by an ambitious proposal to fully cure current defects in outer space law completely.

This ambition might be one of the main obstacles of this inquiry: we have not reached Mars yet and all the proposed ideas have a highly hypothetical character. Any of these suggested schemes will require great effort and political decisiveness. Moreover, all these proposals have their own particular pros and cons. But however the case, if these proposals do not sort any effect, at least they got us thinking. The path to the right answer is paved with a lot of what if's, but it's a great theoretical exercise nonetheless. It might even be our duty to ponder upon these hypothetical questions, because we would already admit defeat if we didn't. And defeat and failure is simply unacceptable.

2 The future exploration and colonization of celestial bodies

For the first time since the Moon missions in the sixties and seventies, there's a renewed public interest and passion about space travel. Human endeavors in outer space have progressed slowly over six decades and did not match the expectations created at the start of the Space Age.⁸ However, the recent successes of private companies to reach outer space and best the slow growing developments by public agencies suggest a paradigm shift for space exploration. Companies such as SpaceX⁹, Virgin Galactic¹⁰ and Mars One¹¹ show that an added economic component serves to double humankind's efforts to reach beyond Earth's atmosphere and prove that we are on the verge of a new era in space travel.

Before, only the United States of America (U.S.), the Union of Soviet Socialist Republics (USSR) and Europe concerned themselves with the exploration of space by building launch facilities, extraterrestrial probes and sending out manned flights. But these great powers are now joined by other nations such as China¹², Japan¹³ and India¹⁴.

⁸ Z. MEYER, "Private Commercialization of Space in an International Regime: A Proposal for a Space District", *NJILB* 2010, (241) 241.

⁹ Space Exploration Technologies Corporation, see <http://www.spacex.com/about>.

¹⁰ Virgin Galactic is a subsidiary of the Virgin Group. It is a company that wants to monetize space travel by offering suborbital spaceflights to paying customers, visit <http://www.virgingalactic.com/human-spaceflight/> for more information.

¹¹ A corporation that wants to establish a permanent human settlement on Mars. The first crew is expected to arrive by 2033. More info can be found on their website: <http://www.mars-one.com/>. The company, led by BAS LANSDORP, has been criticized heavily and the project has been met with ample skepticism. See L. GRUSH, "How You'll Die on Mars", *Popular Science*, 26 May 2015, <https://www.popsoci.com/how-youll-die-mars>; E. HOWELL, "Mars One Execs Dispute Criticism of Red Planet Colony Mission", *Space.com*, 11 May 2015, <https://www.space.com/29361-mars-one-colony-project-criticism-defense.html>.

¹² China founded a National Space Program in 1993, appointed the China National Space Administration (CNSA) and has launched several manned space flights. See E. HOWELL, "China National Space Administration: Facts & Information", *Space.com*, 25 May 2016, <https://www.space.com/22743-china-national-space-administration.html>.

¹³ Japan has been active in the field since the fifties, but great failures led them to merge all existing related corporations into one Space Agency in 2003. The Japan Aerospace Exploration Agency (JAXA) has made enormous steps forward, as can be seen on their own website: <http://global.jaxa.jp/>.

¹⁴ India has a space program since 1969, but was not able to catch up with the heavyweights until quite recently. On June the fifth of 2017, the Indian Space Research Organization (ISRO) launched it's most powerful and heaviest rocket yet and slowly but certainly, India is joining the international space scene. For more information, see T. MALIK, "India Just Launched Its Heaviest & Most Powerful Rocket Yet", *Space.com*, 5 June 2017, <https://www.space.com/37093-india-launches-most-powerful-rocket-yet.html>.

The odds that the human race sets foot on planets besides Earth are becoming more realistic than ever.¹⁵ Entrepreneur ELON MUSK aspires to send 1 million people to the Red Planet and colonize it within 50 years.¹⁶ He hereby opens up space travel, not only to scientist and military services, but to a wide audience that was previously kept on the sidelines.

For this wildly ambitious plan, MUSK founded SpaceX in 2002. The company's self-attributed business goal is to 'design, manufacture and launch advanced rockets and spacecrafts and to revolutionize space technology, with the ultimate goal of enabling people to live on other planets'.¹⁷

Another company with the desire of going to Mars is the Dutch company Mars One, founded by BAS LANSDROP and ARNO WIELDERS in 2011. They share SpaceX's goal to establish a permanent human settlement on Mars.¹⁸

Finally, NASA revealed a detailed plan in October 2015 outlining the establishment of a permanent human presence on Mars.¹⁹ Be that as it may, NASA is heavily subjected to the whimsical dispositions of the White House.²⁰

Consequently, these enterprises will create a new legal void. Presently, there are several treaties (e.g. the Moon Treaty²¹, the Outer Space Treaty²²) whose principles govern outer space, but as will be shown later, these are insufficient for modern day space travel.

¹⁵ On the 67th International Astronautic Congress SpaceX CEO ELON MUSK sketched the outline of his company's plans to go to Mars and build a permanent, self-sustainable human presence there. In his speech, he focused on the many technological challenges that lie ahead and made a (rather optimistic) estimate of 10 more years for men to set foot on the planet Mars. The entire presentation "Making Humans a Multi-Planetary Species" can be watched on YouTube, see E. Musk, "Making Humans a Multi-Planetary Species", 67th International Astronautic Congress, 27 september 2016, https://www.youtube.com/watch?v=H7Uyfqj_TE8.

¹⁶ Ibid.

¹⁷ See "About" on the SpaceX website, <http://www.spacex.com/about>.

¹⁸ See "About Mars One" on the Mars One website, <http://www.mars-one.com/about-mars-one>.

¹⁹ X., "NASA's Journey to Mars", NASA, 8 October 2015, https://www.nasa.gov/sites/default/files/atoms/files/journey-to-mars-next-steps-20151008_508.pdf.

²⁰ See *infra*, paragraph 2.2 "U.S. Space Policy from Kennedy to Trump", 13.

²¹ Agreement Governing the Activities of States on the Moon and Other Celestial (5 December 1979), *United Nations Treaty Series*, vol. 1363, 3. Entered into force on 11 July 1984. Hereinafter Moon Treaty.

²² 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), *United Nations Treaty Series*, vol. 610, 207. Hereinafter Outer Space Treaty, OST or the Treaty.

There are several legal conundrums to which current space law does not provide an adequate answer. For instance:

- How will we reconcile the non-appropriation clause and the “province of mankind”-principle with the ambition of private enterprises to travel to the Moon to profit from lunar resources?²³
- How can we colonize a planet such as Mars when current treaties state that appropriation is not permitted?
- Would it not be desirable to form an international alliance or central authority to oversee future space endeavors, provide technical support and enforce space regulation?
- Can our current terrestrial legal systems be applied into a Martian environment with high levels of stress and existential anxiety?
- The relationship between Earth and an extra-terrestrial colony could be difficult and dangerous. Will Earth be the owner of this colony? What will happen in case this colony wants independence? What happens in case of conflict on the colony?

During the course of this research, these questions will be discussed. Some more comprehensive than others. But in order to find answers to these questions, we need a better understanding of why an outer space conquest is desired.

2.1 Reasons to explore outer space, celestial bodies and Mars

The planet Mars is not an ideal biotope for humankind. It is a barren wasteland with neither breathable air, nor liquid water and is far too cold to inhabit. Even more so, the journey would be long (estimates vary from 6 to 10 months), dangerous and living quarters for the journey will be very cramped.²⁴ This begs the question: why go to Mars at all, or for that matter, any other planet? One such reason is adventure and curiosity, to pursue the dream of venturing out into space, just because we can.

Although the prospect of boldly going where no man has gone before is intriguing to say the least, critics will not see this as an adequate argument to spend billions

²³ B.C. BRITTINGHAM, “Does the World Really Need New Space Law?”, *ORIL* 2010, (31) 32.

²⁴ E. REGIS, “Let’s Not Move to Mars”, *New York Times* 2015, <https://www.nytimes.com/2015/09/21/opinion/lets-not-move-to-mars.html>.

of dollars on a “yes we can” space campaign. People might be more easily persuaded by more pragmatic reasons such as the scientific and industrial advancements from space technology which contribute to everyday life, commercial profit and the various social benefits.²⁵

In an article written by T.S. TWIBELL, the author criticizes the current legal framework and accredits numerous advantages to the commercialization and development of space ventures:²⁶

- There are enormous economic advantages. According to TWIBELL:²⁷

*“The current space industry today is a multi-billion dollar industry with revenues of \$40 billion annually. Although these figures sound impressive, they are a result of small-scale, isolated space ventures which merely scratch the surface of what can be achieved given changes in the current legal regime.”*²⁸

- The benefits to science are endless. Better vaccines²⁹ and antibiotics can be produced in outer space due to the fact that “[t]he conditions in space enable improved production over earthbound laboratories at seven hundred times the quantity and four times the purity”.³⁰ This enhanced production capability is the result of the absence of or reduction in gravity, the vacuum in space and the extremes in temperature.³¹ Scientific pro-

²⁵ Z. MEYER, “Private Commercialization of Space in an International Regime: A Proposal for a Space District”, *NJILB* 2010, (241) 243.

²⁶ T.S. TWIBELL, “Circumnavigating International Space Law”, *ILSA Journal of Int’l and Comparative Law* 1997, 259-295.

²⁷ *Ibid.*, 259.

²⁸ More recent sources state that the global space economy totaled \$329 billion worldwide in 2015. See C. HIVEY, “Space Foundation Report Reveals Global Space Economy at \$329 Billion in 2016”, The Space Foundation, 3 August 2016, <https://www.spacefoundation.org/news/space-foundation-report-reveals-global-space-economy-329-billion-2016>.

²⁹ An example I personally like to use when explaining the advantages of space exploration to interested laymen is that of two ten day missions the Space Shuttle has done: in zero gravity experiments scientist could work out the structure of certain animal viruses, thereby allowing the development of veterinary vaccines worth several billion dollars to the economy. This is a fine example not only of the scientific gain of outer space development, but also of the vast benefits to the economy. See R. ZUBRIN, *Entering Space, Creating a Spacefaring Civilization*, New York, Tarcher/Penguin, 1999, 59.

³⁰ *Ibid.*; N.C. GOLDMAN, *American Space Law: International and Domestic*, San Diego, Iowa State University Press, 1988, 25.

³¹ Z. MEYER, “Private Commercialization of Space in an International Regime: A Proposal for a Space District”, *NJILB* 2010, (241) 244.

gress made by the space programs is regularly incorporated in improvements to our daily quality of life.³² Entering space and particularly colonizing Mars would be a catalyst for invention and technological advancement.³³

- Industrial issues such as the depletion of certain natural resources on earth could be resolved by mining moons, asteroids and comets.³⁴ The aforementioned vacuum is not only beneficial for medicine production, it is also the perfect environment for the material processing that is fundamental in many manufacturing industries, including metallurgy, pharmaceuticals, semiconductors, genetic engineering and molecular electronics.³⁵
- Last but not least, the social benefits must not be forgotten. Establishing colonies in outer space could offer a response to possible future crises, both manmade and natural.³⁶ Colonies would certainly create a means of escape in case of cataclysmic events on planet Earth and could possibly be our salvation. SpaceX's ELON MUSK has publicly reiterated this and turned this into a popular argument. MUSK did a presentation in 2016 on the subject matter, stating the following:

"I think there are really two fundamental paths. History is going to bifurcate along two directions. One path is, we stay on Earth forever, and then there will be some eventual extinction event. I do not have an immediate doomsday prophecy, but eventually, history suggests, there will be some doomsday event."

³² Such as scratch-resistant lenses, camera phones, CAT scans, water purification systems, wireless handsets, baby formula, smoke detectors, portable computers and so on. For more information see X., "20 Inventions We Wouldn't Have without Space Travel", NASA, <https://www.jpl.nasa.gov/in-fographics/infographic.view.php?id=11358>.

³³ R. ZUBRIN, *Entering Space: Creating a Spacefaring civilization*, New York, Tarcher/Penguin, 1999, 108.

³⁴ T.S. TWIBELL, "Circumnavigating International Space Law", *ILSA Journal of Int'l and Comparative Law* 1997, (259) 261.

³⁵ Z. MEYER, "Private Commercialization of Space in an International Regime: A Proposal for a Space District", *NJILB* 2010, (241) 244.

³⁶ T.S. TWIBELL, "Circumnavigating International Space Law", *ILSA Journal of Int'l and Comparative Law* 1997, (259) 261.

*The alternative is to become a spacefaring civilization and a multi-planetary species, which I hope you would agree is the right way to go.*³⁷

Due to the growing importance of SpaceX and their recent efforts to colonize the planet Mars in the near future, our focus will be on this endeavor and to seek methods to overcome legal obstacles inherent to humankind's mission of developing a dynamic space industry. Overcoming these legal complications might be an incentive for commercial spacefaring powers to lay the foundation for a new space age and provide the answer to numerous unsolved puzzles for humankind.

2.2 U.S. space policy from Kennedy to Trump

The United States of America always had a leading position in exploring outer space.³⁸ The U.S. pioneered the space age in the sixties, but unfortunately could not maintain this momentum in past decades.³⁹ Even with the diminished role of NASA and a growing number of international space competitors⁴⁰, we aim our attention to the United States in the hope that one day they will lead us to the next extraterrestrial breakthrough. Given the position of the United States in terms of space exploration, a glance at American space policy might prove advantageous for a better understanding of the existing space establishment.

For Americans, it all started with President JOHN F. KENNEDY'S vision to explore outer space and to be the first to land a man on the Moon (and bring him back safely). He confirmed his exploratory goals in his 1962 speech to Rice University:

*"We choose to go to the moon. We choose to go to the moon in this decade and do the other things, not because they are easy, but because they are hard, because that goal will serve to organize and measure the best of our energies and skills, because that challenge is one that we are willing to accept, one we are unwilling to postpone, and one which we intend to win, and the others, too."*⁴¹

³⁷ E. MUSK, "Making Humans a Multi-Planetary Species", 67th International Astronautic Congress, 27 September 2016, https://www.youtube.com/watch?v=H7Uyfqi_TE8.

³⁸ D. QUAYLE, "America's Future in Space", *Harv. J. L. & Tech.* 1990, (3) 3.

³⁹ Ibid.

⁴⁰ S.J. MARKOVICH, "Space Exploration and Competitiveness", Council on Foreign Relations, 5 December 2014, <https://www.cfr.org/backgrounder/space-exploration-and-us-competitiveness>.

⁴¹ Text of President JOHN F. KENNEDY'S Rice Stadium Moon Speech, September 12, 1962, <https://er.jsc.nasa.gov/seh/ricetalk.htm>.

With these inspirational words NASA succeeded in the mission, even two years before the deadline.⁴² It is quite sad to notice that the “Father of Space Exploration” was never there to witness the fruit of his labor.⁴³

This love for space exploration was continued by President RONALD REAGAN, who supported NASA’s program resulting in the launch of the first Space Shuttle and the construction of an International Space Station.⁴⁴ The ISS is to this day a living testament of the space optimism of that time. Still, REAGAN’S space legacy is not all puppies and sunshine. The Station has been a fiscal and schedule catastrophe, with global estimated costs between \$30 and \$100 billion and a final timeframe of sixteen years to completion.⁴⁵ The President hoped the project would only cost \$8 billion dollars and would take only a decade to complete.⁴⁶

Ever since the ambitions of these two presidents, further space exploration lacks progress. In the past two decades, there were some efforts to revive the space scene, but to this day without major results. In 2004, President GEORGE W. BUSH announced his ambitions for the future of space development in a speech at NASA headquarters, where he revealed plans to establish a manned Moon base by 2020 (followed by a Mars mission in an unspecified time afterwards).⁴⁷ Later he created the Commission on Implementation of United States Exploration Policy.⁴⁸ This Commission held public hearings and polled different stakeholders.⁴⁹ The Commission published various recommendations in its final report, including ways to reorganize NASA.⁵⁰ There are some inspiring propositions to be found in the report. For example, the Commission suggests creating monetary award (ranging between \$100 million to \$1 billion) for the first entity to locate and maintain

⁴² B.C. GRUNER, “A New Hope for International Space Law: Incorporating Nineteenth Century First Possession Principles into the 1967 Space Treaty for the Colonization of Outer Space in the Twenty-First Century”, *Seton Hall L. Rev.* 2004, (299) 317.

⁴³ J.F. KENNEDY was killed on November 22, 1963. Neil Armstrong walked the surface of the Moon July 21, 1969.

⁴⁴ S. O’KEAFE, “Remembering the Legacy of President Ronald Reagan”, NASA, 6 June 2004, https://www.nasa.gov/audience/formedia/speeches/reagan_legacy.html.

⁴⁵ B.C. GRUNER, “A New Hope for International Space Law: Incorporating Nineteenth Century First Possession Principles into the 1967 Space Treaty for the Colonization of Outer Space in the Twenty-First Century”, *Seton Hall L. Rev.* 2004, (299) 320.

⁴⁶ Ibid.

⁴⁷ X., “President Bush Offers New Vision for NASA”, NASA, 14 January 2004, https://www.nasa.gov/missions/solarsystem/bush_vision.html; D.E. SANGER, R.W. STEVENSON, “Bush Backs Goal of Flight to Moon to Establish Base”, *New York Times*, 15 January 2004, <https://www.nytimes.com/2004/01/15/us/bush-backs-goal-of-flight-to-moon-to-establish-base.html>.

⁴⁸ R. SATTTLER, “Transporting a Legal System for Property Rights: From the Earth to the Stars”, *Chicago Journal of Int. L.* 2005, (23) 23.

⁴⁹ Ibid., 23-24.

⁵⁰ E.C. ALDRIDGE et al., “Report of the President’s Commission on Implementation of U.S. Space Exploration Policy, A Journey to Inspire, Innovate and Discover”, NASA, 19 June 2004, 1-64, https://www.nasa.gov/pdf/60736main_M2M_report_small.pdf.

human life on the Moon for a specific period of time, hoping to spark private entrepreneurship.⁵¹ They also promoted the creation of tax incentives for the private industry, which was introduced in Congress through the Invest in Space Now Act in 2003⁵² and the Zero Gravity, Zero Tax Act in that same year.⁵³ The Commission also suggests improved property rights. They argue that property rights of private industries should be secured, but offers little to no instruction as to how these rights are to be created and protected.⁵⁴

President BUSH's efforts to innovate space exploration seem somewhat futile, since the implementation of his ideas require a complete modernization of current treaties and his attempts are a mere drop in the ocean.⁵⁵ An overhaul of the current property rules in outer space calls for a great deal of political courage. In hindsight, it can be concluded that BUSH did not possess the strength, nor the charisma to stimulate such innovation, since establishing a Moon base by 2020

⁵¹ E.C. ALDRIDGE et al., "Report of the President's Commission on Implementation of U.S. Space Exploration Policy, A Journey to Inspire, Innovate and Discover", 19 June 2004, 33, https://www.nasa.gov/pdf/60736main_M2M_report_small.pdf. Congress never followed up on this recommendation, but private foundations have since seen the light of day. For example, the X-Prize Foundation awarded a ten million dollar prize to the spacecraft SpaceShipOne for achieving suborbital flight twice within one week. See R. SATTLER, "Transporting a Legal System for Property Rights: From the Earth to the Stars", *Chicago Journal of Int. L.* 2005, (23) 24-25. Google also tried to stimulate space exploration through the Google Lunar X-Prize. A \$20 million prize was awarded to the team that first landed a rover (an unmanned vehicle) on the surface of the Moon, also through the X-Prize Foundation. See <https://lunar.xprize.org>. Although these monetary prizes are not nearly enough to cover the expense that comes with space travel, many corporations apply for marketing reasons and the prestige that comes with it. See R. ZUBRIN, *Entering Space: Creating a Spacefaring Civilization*, New York, Penguin/Putnam, 1999, 55-57.

⁵² R. SATTLER, "Transporting a Legal System for Property Rights: From the Earth to the Stars", *Chicago Journal of Int. L.* 2005, (23) 26. Taxpayers who buy stock in a U.S. company, whose core mission is contributing to space transportation, will receive a certain tax credit.

⁵³ Ibid. This act would exempt any income derived from the production of items from outer space in its whole. Space related income would therefore be excluded from taxable gross income until 2012. The Act has been renewed in 2005 and 2008 (extending the tax exemption until 2018). See Zero Gravity, Zero Tax Act of 2005, <https://www.congress.gov/bill/109th-congress/house-bill/1024/text> and Zero Gravity, Zero Tax Act of 2008, <https://www.congress.gov/bill/110th-congress/house-bill/5310/text>. The Zero Gravity, Zero Tax Acts never passed and therefore, never saw the light of day.

⁵⁴ R. SATTLER, "Transporting a Legal System for Property Rights: From the Earth to the Stars", *Chicago Journal of Int. L.* 2005, (23) 26-27.

⁵⁵ B.C. GRUNER, "A New Hope for International Space Law: Incorporating Nineteenth Century First Possession Principles into the 1967 Space Treaty for the Colonization of Outer Space in the Twenty-First Century", *Seton Hall L. Rev.* 2004, (299) 320.

seems nowhere near realistic.⁵⁶ His plan was met with some skepticism in scientific circles, among other things because he promised a return to the Moon, but left his successors to deal with the costs.⁵⁷

BARACK OBAMA, investigated the human spaceflight plans from his predecessor and concluded that costs were too high and the agenda was too far behind schedule.⁵⁸ He decided to cancel plans for going to the Moon by 2020: he instructed NASA instead to get astronauts to a near-Earth asteroid by 2025 and then on to the vicinity of Mars somewhere in 2030.⁵⁹ It seems that any space program that spans more than ten years is doomed from the beginning, due to the eight year limitation on the American presidency.⁶⁰ However, BUSH's plans weren't all for naught: his space program may have provided some direction for NASA and it can be argued that it rejuvenated the drive for colonizing the Moon and Mars.⁶¹

In 2017 President DONALD TRUMP has renewed BUSH's vision to send astronauts back to the Moon, as he signed the Space Policy Directive 1.⁶² Of course, this fits right into the President's plans to "*make America great again*", but in order to achieve his aspirations he will have to put his money where his mouth is. In the same year, TRUMP proposed budget cuts for NASA close to an all time low: the agency's funding has dropped from 4,5% of the national budget in 1966 to a mere 0,479% in 2017.⁶³ His administration also declared to end financial support

⁵⁶ ESA has plans to build a Moon base, but NASA is not involved (see *infra* paragraph 2.3. "Defining the term colonization", 17). NASA stated it to be possible to establish a Moon base by 2022 in 2016, but this is only theoretical. No actual efforts have been made to actually build such a settlement. See R. GRAY, "'We Could Be Living on the Moon by 2022': NASA Claims a 'Cheap' \$10 Billion Lunar Base Will Be Ready for Humans in Just Six Years", Daily Mail, 24 March 2016, <http://www.dailymail.co.uk/sciencetech/article-3507665/Could-living-moon-2022-Nasa-scientists-reveal-plans-build-lunar-base-six-years-10-billion.html>.

⁵⁷ B.C. GRUNER, "A New Hope for International Space Law: Incorporating Nineteenth Century First Possession Principles into the 1967 Space Treaty for the Colonization of Outer Space in the Twenty-First Century", *Seton Hall L. Rev.* 2004, (299) 319.

⁵⁸ M. WALL, "President Obama's Space Legacy: Mars, Private Spaceflight and More", Space.com, 19 January 2017, <https://www.space.com/35394-president-obama-spaceflight-exploration-legacy.html>.

⁵⁹ Ibid.

⁶⁰ B.C. GRUNER, "A New Hope for International Space Law: Incorporating Nineteenth Century First Possession Principles into the 1967 Space Treaty for the Colonization of Outer Space in the Twenty-First Century", *Seton Hall L. Rev.* 2004, (299) 319-320.

⁶¹ Ibid., 318.

⁶² J.R. WANG, "New Space Policy Directive Calls for Human Expansion Across Solar System", NASA, 11 December 2017, <https://www.nasa.gov/press-release/new-space-policy-directive-calls-for-human-expansion-across-solar-system>.

⁶³ H. BRUECK, "Trump wants to send astronauts back to the moon, but his proposed budget cuts NASA funding close to an all-time low", Business Insider, 12 December 2017, <http://www.businessinsider.com/trump-nasa-moon-space-policy-directive-federal-funding-2017-12?international=true&r=US&IR=T>. For the NASA 2017 Budget, see https://www.nasa.gov/sites/default/files/atoms/files/fy_2017_nasa_agency_fact_sheet.pdf.

for the International Space Station program by 2025⁶⁴, although this news cannot be seen as a surprise, since the President is more set on the Moon than lower Earth-orbit.⁶⁵ TRUMP'S administration wants to privatize the ISS, making it a possible commercial platform.⁶⁶

In 2018, TRUMP effectively changed course and took action. In the budget request, the administration requested a \$150 million increase for NASA in fiscal year 2019.⁶⁷ In March 2018 Congress also completed its work on spendings for fiscal year 2018, and NASA's budget was increased by \$1.1 billion dollars, giving the agency a total budget of \$20.7 billion.⁶⁸ From the looks of it, the future looks bright for NASA.⁶⁹ How these budget increases will play out in practice, remains to be seen. There was a committee established as well, as will be explained later.

2.3 Defining the term 'colonization'

Talking about colonization this day and age feels curious. Every piece of land on our planet has been discovered and falls under the jurisdiction of a sovereign state (with some exceptions, like Antarctica for example). Colonizing new territories sounds like a nineteenth century phenomenon and doesn't quite fit in a modern, globalized society. However, in this contemporary world, the word 'colonization' is starting to reappear. Humans are imperialistic by nature and with Earth fully explored we dream of going into outer space to quench our thirst. But how should we view colonization in a modern sense?

⁶⁴ L. GRUSH, "Trump Administration Wants to End NASA Funding for the International Space Station by 2025", The Verge, 24 January 2018, <https://www.theverge.com/2018/1/24/16930154/nasa-in-international-space-station-president-trump-budget-request-2025>.

⁶⁵ The International Space Station also has a limited life span, see *infra* note 75.

⁶⁶ C. DAVENPORT, "The Trump Administration Wants to Turn the International Space Station into a Commercially Run Venture, NASA Document Shows", Washington Post, 11 February 2018, https://www.washingtonpost.com/news/the-switch/wp/2018/02/11/the-trump-administration-wants-to-turn-the-international-space-station-into-a-commercially-run-venture/?utm_term=.c6916f8309d3.

⁶⁷ C. DAVENPORT, "The Trump Administration Wants to Turn the International Space Station into a Commercially Run Venture, NASA Document Shows", Washington Post, 11 February 2018, https://www.washingtonpost.com/news/the-switch/wp/2018/02/11/the-trump-administration-wants-to-turn-the-international-space-station-into-a-commercially-run-venture/?utm_term=.c6916f8309d3.

⁶⁸ X., "Trump, Congress Approves Largest US Research Spending Increase in a Decade", Science Magazine, 23 March 2018, <http://www.sciencemag.org/news/2018/03/updated-us-spending-deal-contains-largest-research-spending-increase-decade>. This \$1.6 billion above the administration's requested amount of \$19.092 billion.

⁶⁹ The NASA budget will take up 0,501% of the federal budget (set at \$4.214 trillion). See K. AMADEO, "US Federal Budget Breakdown", The Balance, 22 March 2018, <https://www.the-balance.com/u-s-federal-budget-breakdown-3305789> and Budget of the U.S. Government, Office of Management and Budget, Fiscal Year 2019, 117, <https://www.whitehouse.gov/wp-content/uploads/2018/02/budget-fy2019.pdf>.

According to article VIII of the Space Treaty, space vessels have a national jurisdiction on board. But does a vessel establish a colony once it lands on a celestial body? And when it does establish a colony, does article VIII extend to include the body's surface and do we need more?

Defining the term colonization serves a purpose in that we can determine where the current legal framework fails. What's the scope of current treaties and where do we draw the line between scientific research and a permanent settlement in outer space?

In modern day literature "colonization" is mostly described as a phenomenon where people move to another part of the world to live there permanently and gain and maintain control over indigenous people.⁷⁰ It is a technical term, that does not quite fit the bill when applied to spacefaring and settling on planets like Mars. Several elements of the definition cannot be applied under the same conditions when going into outer space, making a *sui generis* description necessary. Different elements of this definition will be analyzed:

1. Moving to another part of the world
2. Live there permanently
3. Gain and maintain control over indigenous people

The first part is the easiest part: clearly, we are not going to another part of the world, we are going to a whole new world altogether. Creating a fitting definition of colonization starts with adapting this part to 'moving to the Moon or other celestial bodies'.⁷¹

Secondly, there is the term "permanently". It might be the only part of the definition that does not need altering. There is a vast difference between visiting the Moon or other celestial bodies for scientific purposes with the ultimate goal of coming back home on considerably short notice and going there with the intention of staying indefinitely. Colonization, both in the original sense and the adapted sense, have a permanent intention. By using the term "permanently",

⁷⁰ H.L. WESSELING, *Imperialism and Colonialism, Essays on the History of European Expansion*, London, Greenwood Press, 1997, ix; G. CICCARIELLO-MAHER, "Colonialism", *The Encyclopedia of Political Thought* 2015, 1, <http://www.academia.edu/6357169/Colonialism>; R. ACUNA, "Occupied America" in R. DELGADO (ed.), *The Latino/a Condition: A Critical Reader*, New York, New York University Press, 1998, 171.

⁷¹ This terminology stays in line with the words used in the 1967 Outer Space Treaty.

colonization distinguishes itself from previous Moon missions and other outer space missions with mere explorative goals.

However, when using the term “permanent” it is still unclear if a person is to stay at least for a couple of years or for the rest of his or her entire life. But rather than to go into a theoretical argumentation about the meaning of the word permanent in this specific situation, it is considered opportune to fill in this term according to the facts *in casu*. Due to the very hypothetical character of a colonization at this moment, it is very hard to predict what a ‘permanent settlement’ will fathom. For instance, when a group of people is leaving Earth to go to Mars, it is unlikely for this group to return, because their return will probably be technologically impossible.⁷² There is no discussion of course that this is a permanent settlement, whatever the goal of the journey might be. Another example would be a settlement on the Moon, where returning to Earth would be a viable option. The interpretation will depend on the circumstances, in regard to the main objectives of the settlement.

A current illustration of a permanent settlement on the Moon is the vision of Director-General JOHANN-DIETRICH WÖRNER to develop a “Moon Village”, where scientific and technological activities could develop, but also activities based on exploiting resources or even tourism.⁷³ The term “permanently” is in this case fulfilled, not because one person spends their life (or several years) on the Moon, but rather because an entire *group* of people is staying there for a significant time and thus making it a permanent settlement.

A concept that can arguably not be regarded as a permanent settlement is the International Space Station (ISS). It does not have a permanent character: the longest stay there was by SCOTT KELLY and MIKHAIL KORNIENKO for a maximum period of 340 days⁷⁴ and the ISS is to be decommissioned in 2024.⁷⁵ It could be

⁷² In his book ZUBRIN addresses this problem and proposes a technical plan to resolve this issue. Even though we don’t have the technology today, the knowledge to produce this tech is currently available. R. ZUBRIN, *The Case for Mars*, New York, Free Press, 2011, 1-18.

⁷³ This vision is explained in a video, released on the ESA website from the main control room in Darmstadt. For the video, see http://www.esa.int/spaceinvideos/Videos/2016/02/ESA_Euronews_Moon_Village.

⁷⁴ X., “NASA astronaut Scott Kelly Returns Safely to Earth after One Year Mission”, NASA, 2 March 2016, <https://www.nasa.gov/press-release/nasa-astronaut-scott-kelly-returns-safely-to-earth-after-one-year-mission>.

⁷⁵ The original date for decommissioning ISS has been moved up from 2020 until 2024. While the ISS was originally designed and tested for 15 years, it may now operate for 26 years. For more information, see “Extending the Operational Life of the International Space Station Until 2024”, Office of Audits, 18 September 2014, <https://oig.nasa.gov/audits/reports/FY14/IG-14-031.pdf>. The White House confirmed this extension and approves funding through 2024. For more information, see

argued that the ISS has a permanent character, due to its 20 year existence to this day and permanent presence of different crews, but still fails the definition because there is no territory. It does serve well as an example for the content of “permanent”: permanency should not be assessed because of physical presence of an individual who has the purpose to live there permanently, but rather through the permanent occupation by several humans. In the definition, the “purpose of living there permanently” is thus best replaced with a more accurate “establish a permanent settlement there”.

Thirdly, there is the question of ruling over indigenous people in the original definition. To this day there is no evidence of life on Mars and even though it is one of the main objectives of NASA to determine if there is or ever was life on the Red Planet, it is safe to say that there are no native little green men⁷⁶ walking the surface of the planet.⁷⁷ This ensures that the third and last part of the definition is completely redundant. We are not going to Mars to rule over indigenous Martians. Because the definition of ‘colonization’ might be a bit too narrow if this part of the description is abandoned, it might be convenient to replace this section by a relevant alternative. This part of the definition can be described as the ‘objective part’: it gives a purpose to settling elsewhere. This is why this part will be replaced by a similar but more fitting teleological part.

There are several reasons to go to Mars, which have already been treated previously.⁷⁸ They could be reduced to the following: scientific, industrial, economic and social purposes. Therefore, this part of the definition will be replaced by: “to gain and maintain scientific, industrial, commercial and social benefit to all humankind”. The addition of the term humankind is important, since colonizing another planet cannot serve the benefit of an individual or a select group of individuals, as can be derived from the current legal framework concerning outer

<https://obamawhitehouse.archives.gov/blog/2014/01/08/obama-administration-extends-international-space-station-until-least-2024>. Trump’s administration declared on 24 January 2018 that they want to eliminate NASA funding for the ISS entirely by 2025. The end of the ISS is thus getting closer and closer. See L. GRUSH, “Trump administration wants to end NASA funding for the International Space Station by 2025”, The Verge, January 24, 2018, <https://www.theverge.com/2018/1/24/16930154/nasa-international-space-station-president-trump-budget-request-2025>.

⁷⁶ If there is life on the planet Mars, this life would most likely manifest itself in the form of microbes or other micro-organisms. For more information, see PENELOPE BOSTON’S TED Talk “There might just be life on Mars”, available on https://www.ted.com/talks/penelope_boston.

⁷⁷ See “Programs and Missions” on the NASA Mars Exploration website, <https://mars.nasa.gov/programmissions/science/goal1/>.

⁷⁸ See *supra*, paragraph 2.1 “Reasons to explore outer space, celestial bodies and Mars”, 10.

space: the Outer Space Treaty also mentions the terms “the common interests of all mankind” in the preamble, thereby emphasizing its importance.⁷⁹

This leaves a new and unique definition of colonization in the context of space travel:

Colonization can be defined as the phenomenon where people move to the Moon or other celestial bodies, with the purpose of establishing a permanent settlement and to gain and maintain scientific, industrial, commercial and social benefit in the common interest of all humankind.

When using the term colonization in this study, it will always be in reference to this specific description, leaving the original definition behind.

3 The current legal regime for space travel and space exploration

International space law mostly consists of a series of United Nations treaties, conceived in the early stages of space exploration. In 1958, the UN created the Office for Outer Space Affairs⁸⁰ that tries to establish international cooperation in the peaceful use and exploration of space.⁸¹ One year later the Committee on the Peaceful Uses of Outer Space⁸² was founded, tasked with “reviewing international cooperation in peaceful uses of outer space, studying space-related activities that could be undertaken by the United Nations, encouraging space research programs, and studying legal problems arising from the exploration of outer space.”⁸³

⁷⁹ On a rather personal note, the use of the traditional term ‘mankind’ in the Treaty is something that has grown to aggravate me during the writing of this dissertation. It was by reading RICHARD DAWKINS’ “The God Delusion” that I grew aware of the ambiguous nature of the term. Even though there are several arguments for a modification of the Treaty, the addition of a mere two letters seems a reasonable adjustment to bring the OST into the 21st century. The more inclusive term ‘humankind’ would be a more preferable term to add to any revisions of the Outer Space Treaty. I will use the term ‘humankind’ where-ever possible, though not when it is in reference to the OST, to stay in accordance to the Treaty’s own terminology. See R. DAWKINS, *The God Delusion*, London, Bantam Press, 2006, (406) 115.

⁸⁰ Hereinafter UNOOSA.

⁸¹ See “About Us” on the UNOOSA website, <http://www.unoosa.org/oosa/en/aboutus/index.html>.

⁸² Hereinafter COPUOS.

⁸³ See “Our Work” on the UNOOSA website, <http://www.unoosa.org/oosa/en/ourwork/copuos/index.html>.

UNOOSA can be viewed as the most important forum for developing and creating space law and the committee is responsible for four generally accepted treaties⁸⁴: The Outer Space Treaty, The Rescue and Return Treaty, The Liability Treaty and The Registration Convention. UNOOSA is responsible for another treaty, The Moon Treaty, but this treaty has been ratified by only 13 countries, none of them spacefaring.⁸⁵

International space law is also affected by United Nations soft law guidelines, e.g. the Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space or the Rio Declaration on Environment and Development.

3.1 The 1967 Outer Space Treaty

It has been 50 years since the Outer Space Treaty (OST or Treaty) has seen the light. It has become the most important and complete international agreement governing outer space and celestial bodies and remains so to this day.⁸⁶ It forms the basis of what is called the *corpus iuris spatialis*⁸⁷ and is the cornerstone for peaceful use of outer space.⁸⁸

The United Nation's General Assembly adopted it in 1966, after being advised by the UN Legal Subcommittee. The treaty was based on the Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space, which had been adopted by the General Assembly in 1963⁸⁹ and lays the groundwork for international space law. Its main principles are the following:

- The exploration and use of outer space shall be carried out for the benefit and in the interests of all countries and shall be the province of all mankind;⁹⁰

⁸⁴ T.J. HERRON, "Deep Space Thinking: What Elon Musk's Idea to Nuke Mars Teaches Us About Regulating the 'Visionaries and Daredevils' of Outer Space", *Columbia Journal of Environmental Law* 2016, (553) 558.

⁸⁵ See *infra* paragraph 3.2 "Other space agreements", 25.

⁸⁶ J.J. FREESE, "Outer Space Treaty and International Relations Theory: For the Benefit of All Mankind" in A. LELE (ed.), *50 Years of the Outer Space Treaty: Tracing the Journey*, New Delhi, Pentagon Press, 2017, 13.

⁸⁷ T.S. TWIBELL, "Circumnavigating International Space Law", *ILSA Journal of Int'l and Comparative Law* 1997, (259) 263. Latin expression meaning "body of space law".

⁸⁸ J. PRASAD in A. LELE (ed.), *50 Years of the Outer Space Treaty: Tracing the Journey*, New Delhi, Pentagon Press, 2017, vii.

⁸⁹ Preamble Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies.

⁹⁰ Art. I OST.

- Outer space shall be free for exploration and use by all States;⁹¹
- Outer space is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means;⁹²
- States shall not place nuclear weapons or other weapons of mass destruction in orbit or on celestial bodies or station them in outer space in any other manner;⁹³
- The Moon and other celestial bodies shall be used exclusively for peaceful purposes;⁹⁴
- Astronauts shall be regarded as the envoys of mankind;⁹⁵
- States shall be responsible for national space activities whether carried out by governmental or non-governmental entities;⁹⁶ and
- States shall be liable for damage caused by their space objects;⁹⁷

The notion that a state only has control and jurisdiction over its vehicle and personnel and not over the area surrounding this vehicle in outer space is similar to the principles regarding Antarctica and rules regarding maritime law.⁹⁸ The 1958 High Seas Convention⁹⁹ states:

"The high seas being open to all nations, no State may validly purport to subject any part of them to its sovereignty. [...] These freedoms, and others which are recognized by the general principles of international law, shall be exercised by all States with reasonable regard to the interests of other States in their exercise of the freedom of the high seas."

The similarities with the Antarctica Treaty are even more significant. The convention commands peaceful use for Antarctica and prevents militarization of the Antarctic¹⁰⁰, ensures freedom of scientific research¹⁰¹ and forbids sovereignty claims in the area.¹⁰² The analogous word choice is no coincidence, since the

⁹¹ Ibid.

⁹² Art. II OST.

⁹³ Art. IV OST.

⁹⁴ Ibid.

⁹⁵ Art. V OST.

⁹⁶ Art. VI OST.

⁹⁷ Art. VII OST.

⁹⁸ T.S. TWIBELL, "Space Law: Legal Restraints on Commercialization and Development of Outer Space", *UMKC L. Rev.* 1997, (590) 594.

⁹⁹ Article II United Nations Convention on the High Seas (29 April 1958), *United Nations Treaty Series*, vol. 450, 11. Hereinafter High Seas Convention.

¹⁰⁰ Article I Antarctica Treaty (23 June 1961), *United Nations Treaty Series*, vol. 402, 71. Hereinafter Antarctica Treaty or AT. The Antarctica Treaty and related documents are collectively known as the Antarctica Treaty System or ATS.

¹⁰¹ Art. II AT.

¹⁰² Art. IV, 2 AT.

Antarctica Treaty served as an example for the drafters of the 1967 Outer Space Treaty.¹⁰³ It was President EISENHOWER, who addressed the United Nation's General Assembly on September 22, 1960 and recommended that these principles acted as precedent for an international agreement regarding outer space.¹⁰⁴

The most substantial principle in the Outer Space Treaty is that nations cannot appropriate parts of space, thereby marking outer space a *res communis*.¹⁰⁵ Unfortunately, this non-appropriation principle creates uncertainty for investors due to expensive costs and the fact that space faring is a dangerous business.¹⁰⁶ Not only is there uncertainty for investors, but this principle also leads to legal ambiguity due to conflicting interpretations and vague standards as will be explained later.^{107 108}

Another important principle is the "province of mankind"-principle¹⁰⁹ as laid down in the first article of the Outer Space Treaty: "the exploration and use of outer space, including the Moon and other celestial bodies, shall be carried out for the benefit and in the interest of all countries, irrespective of their degree of economic or scientific development". The "province of mankind"-principle is part of what is called the "three freedom principles" of Article I: freedom of access (that ensures that all humankind shall benefit from exploration and use of outer space, that the universe "shall be the province of all mankind"), freedom of exploration and freedom of use (for scientific research).¹¹⁰

¹⁰³ E. HUSBY, "Sovereignty and Property Rights in Outer Space", *J. Int'l L. & Prac.* 1994, (359) 362.

¹⁰⁴ Narrative concerning the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, see <https://www.state.gov/t/isn/5181.htm#narrative>.

¹⁰⁵ T.S. TWIBELL, "Space Law: Legal Restraints on Commercialization and Development of Outer Space", *UMKC L. Rev.* 1997, (590) 618.

¹⁰⁶ *Ibid.*, 613-615.

¹⁰⁷ B.C. GRUNER, "A New Hope for International Space Law: Incorporating Nineteenth Century First Possession Principles into the 1967 Space Treaty for the Colonization of Outer Space in the Twenty-First Century", *Seton Hall L. Rev.* 2004, (299-357) 322.

¹⁰⁸ See *infra* paragraph 3.5 "Pitfalls in the current *corpus iuris spatialis*", 34.

¹⁰⁹ Not to be confused with the common heritage of mankind concept. The Moon Treaty uses the common heritage concept in Article XI: "the Moon and its natural resources are the common heritage of mankind". During the negotiations of the Moon Treaty the U.S. generally interpreted the two as indistinguishable and they were as such considered to be an extension of the international *res communis* principle. The Soviet Union objected to this interchangeability, so there is no consensus that the two terms are in fact synonyms. The common heritage principle has limited spatial coverage: it applies only to the Moon and its orbits, but not to the vacuum of space as such. There has been argued that the common heritage principle is designed to replace the vague province of mankind principle, but poor ratification of the Moon Treaty contrasts this conclusion. See J.I. GABRYNOWICZ, "The 'Province' and 'Heritage' of Mankind Reconsidered: A New Beginning", NASA, Johnson Space Center, 2nd Conference on Lunar Bases and Space Activities of the 21st Century, vol. 2, (691) 692, <https://ntrs.nasa.gov/search.jsp?R=19930004830>; D. TAN, "Towards a New Regime for the Protection of Outer Space as 'Province of Mankind'", *Yale J. Int'l L.* 2000, (146) 162.

¹¹⁰ D.A. PORRAS, "The 'Common Heritage' of Outer Space", *CWILJ* 2006, (143) 153-154.

Although, in its early days, the Treaty was a groundbreaking, unseen document creating new and unique legal concepts such as the non-appropriation and “providence of mankind”-principles or the freedom of access, now many authors have raised their voice and request a revision or reinterpretation of the treaty.¹¹¹ And given that the Outer Space Treaty is more of a collected set of respected principles¹¹² than a codification of hard enforceable law, the interests of States of maintaining space as *res communis* may change in the future.¹¹³ This argument is reinforced by Article XVI of the OST, which allows State parties to withdraw from the Treaty after they give one year’s written notice.¹¹⁴ ¹¹⁵ It is therefore very easy for a country with the ambition to colonize outer space, to make light of the *res communis* principle, once this ambition becomes a reality. There's no knowing how the international community would react to such an act.

3.2 Other Space agreements

After the conception of the Outer Space Treaty, other treaties were created at a rapid pace. In 1968 the Rescue Agreement¹¹⁶ was negotiated, elaborating on aspects of articles V and VIII¹¹⁷ of the Outer Space Treaty. It determines that States shall take all possible actions to rescue and assist astronauts present within that state’s territory (due to accident, distress, emergency or an unintentional landing) and immediately transport them back to the state from which they launched. The treaty does not cover assistance and rescue outside the confines

¹¹¹ Ibid.; R. ZUBRIN, *Entering Space, Creating a Spacefaring Civilization*, New York, Tarcher/Penguin, 1999, 12-14; S. BRUHNS, J. HAQQ-MISRA, “A Pragmatic Approach to Sovereignty on Mars”, *Space Policy* 2016, 57-63; T.S. TWIBELL, “Circumnavigating International Space Law”, *ILSA Journal of International and Comparative Law* 1997, 259-295; B.C. BRITTINGHAM, “Does the World Really Need New Space Law?”, *ORIL* 2010, 31-54.

¹¹² The Treaty does not contain any “hard” obligations, but only general goals and statements of policy. The current body of space law never matured beyond the level of soft law and can therefore only be seen as a set of respected principles. D. TAN, “Towards a New Regime for the Protection of Outer Space as ‘Province of Mankind’”, *Yale J. Int’l L.* 2000, (146) 165-166.

¹¹³ B.C. GRUNER, “A New Hope for International Space Law: Incorporating Nineteenth Century First Possession Principles into the 1967 Space Treaty for the Colonization of Outer Space in the Twenty-First Century”, *Seton Hall L. Rev.* 2004, (299) 342.

¹¹⁴ Ibid., 322.

¹¹⁵ Some authors argue however that the rules incorporates in the Outer Space Treaty have become international customary law. Withdrawal from the Treaty would therefore not release a state of its obligations, preventing appropriation yet again. See T.S. TWIBELL, “Circumnavigating International Space Law”, *ILSA Journal of Int’l and Comparative Law* 1997, (259) 270. Others argue it is not, for example K.A. BACA, “Property Rights in Outer Space”, *J. Air L. & Com.* 1993, (1042) 1060-1071. He argues that only practice can create custom. Currently there’s insufficient practice in outer space to validate the Treaty as customary law.

¹¹⁶ Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space (22 April 1968), *United Nations Treaty Series*, vol. 672, 119.

¹¹⁷ Article V contains several rescue provisions for astronauts and article VIII lays down some liability rules.

of our planet. States are also obligated to assist launching states in recovering space objects that return to Earth outside the launching state's territory.

The 1972 Convention on International Liability for Damage Caused by Space Objects¹¹⁸ elaborates on article VII of the Outer Space Treaty. The convention established that a launching state shall be absolutely liable to pay compensation for damage caused by its space objects on the surface of the Earth or to an aircraft. The convention also introduces methods for the settlement of disputes.

In 1974, State parties agreed to register their launched objects in the Registration Convention.¹¹⁹ Each entry is listed in "an appropriate registry", which they should maintain.

The rapid growth of space law ran out of steam in 1979, when the original drafters of the Moon Treaty tried to elaborate on a number of principles from the 1967 OST. Due to conflicts of interest between spacefaring powers and developing countries, whom promoted the principle of "common heritage of mankind", the treaty was largely rejected by the international community.¹²⁰ The Moon Treaty provides a more in depth explanation of the "common heritage of mankind" principle, as opposed to the vague "province of mankind"-principle in the Outer Space Treaty. Article 11 states: "[n]either the surface nor the subsurface of the moon, nor any part of the natural resources in place, shall become property of any State, international intergovernmental or non-governmental organization, national organization or non-governmental entity or of any natural person". Major spacefaring powers were not willing to submit to this definition, since the vagueness of the Outer Space Treaty leaves room for interpretation: in the Outer Space Treaty it could still be argued that private individuals can appropriate.¹²¹

Only thirteen countries ratified the treaty while superpowers such as the U.S. and the USSR did not, leaving mostly non-spacefaring countries.¹²² In conclusion, the treaty can hardly be called pertinent.

¹¹⁸ Convention on the International Liability for Damage Caused by Space Objects (29 March 1972), *United Nations Treaty Series*, vol. 961, 187. Hereinafter Liability Convention.

¹¹⁹ Convention on Registration of Objects Launched into Outer Space (12 November 1974, *United Nations Treaty Series*, vol. 1023, 15.

¹²⁰ V. KOPAL, "Origins of Space Law and the Role of the United Nations" in C. BRÜNNER, A. SOUCEK (eds.), *Outer Space in Society, Politics and Law*, Mörlenbach, Springer Vienna, 2011, 229.

¹²¹ H. KEEFE, "Making the Final Frontier Feasible: A Critical Look at the Current Body of Outer Space Law", *Santa Clara Computer & High Tech. L.J.* 1995, (345) 357.

¹²² B.C. BRITTINGHAM, "Does the World Really Need Space Law?", *ORIL* 2010, (31) 35.

Aside from the treaties discussed above, other important international space law has been created regionally through multinational agreements, such as the Convention for the Establishment of a European Space Agency¹²³, the Agreement Relating to the International Telecommunications Satellite Organization¹²⁴ and the International Space Station Intergovernmental Agreement¹²⁵. Especially the latter is of importance, as the International Space Station and its accompanying agreement serve as a multinational experiment on what can be achieved in outer space when spacefaring nations and other nations work together. So far, the ISS has been an excellent example of cooperation between actors such as the United States and Russia for example. These countries working closely together is a great achievement in a post Cold War era and both countries deserve a pat on the back for their cooperative efforts. The fact that nations are able to work together on such a large scale¹²⁶ proves that collaboration in outer space is possible and the whole experiment can serve as inspiration for future Mars endeavors.

Of particular interest to a Mars conquest is article 19 of the ISS Agreement, that regulates disputes over sharing of discoveries on the space station. In the article, a useful idea is suggested: a state holds jurisdiction over the elements it has contributed to the space station.¹²⁷ Sensitive information gained in the space station can thus be kept for the eyes of one state only, but nothing prevents states to openly share benefits and knowledge as is regularly done in practice.¹²⁸ The principles laid down in the agreement can serve as potential models for any forthcoming space partnerships.¹²⁹

¹²³ Convention for the Establishment of a European Space Agency (30 May 1975), ESA Publications Division, http://www.spacelaw.olemiss.edu/library/space/International_Agreements/Multilateral/1975%20ESA%20Convention.pdf.

¹²⁴ Agreement Relating to the International Telecommunications Satellite Organization "INTELSAT" (20 August 1971), *United Nations Treaty Series*, vol. 1220, 22.

¹²⁵ Agreement among the Government of the United States of America, Governments of Member States of the European Space Agency, the Government of Japan and the Government of Canada on Cooperation in the Detailed Design, Development, Operation and Utilization of the Permanently Manned Civil Space Station (29 January 1998), *U.S. Treaties and Other International Acts Series* 12927, <https://www.state.gov/documents/organization/107683.pdf>. Article 1 stipulates a clear cooperation policy: "a long term international co-operative frame-work on the basis of genuine partnership, for the detailed design, development, operation, and utilisation of a permanently inhabited civil Space Station for peaceful purposes, in accordance with international law". Hereinafter International Space Station Intergovernmental Agreement, ISS Agreement or IGA.

¹²⁶ The ISS is roughly the size of an American football field (356 feet wide compared to 360 longitude of a field) and an estimated cost of 150 billion U.S. dollars.

¹²⁷ Art. 19 ISS Agreement.

¹²⁸ D.A. PORRAS, "The 'Common Heritage' of Outer Space", *CWILJ* 2006, (143) 164.

¹²⁹ As PORRAS rightly points out, there is however a problem with non-contributing nations. Nations are required to contribute to the partnership before they can gain the benefits of space exploration. What is the common heritage of countries that cannot subsidize these endeavors and thus cannot partake? This could again be solved through the rather loose interpretation of the "province of mankind"-principle as discussed above. See D.A. PORRAS, "The 'Common Heritage' of Outer Space", *CWILJ* 2006, (143) 164 and *supra* paragraph 3.1. "The 1967 Outer Space Treaty", 22.

Furthermore, there are some bilateral agreements between the United States and the former USSR that were of some importance in the past, such as the Treaty Banning Nuclear Weapons Tests in the Atmosphere, in Outer Space and Under Water¹³⁰ and the Treaty on the Limitation of Anti-Ballistic Missile Systems¹³¹ (terminated in 2002).

3.3 Impact of the Cold War

The Moon Treaty and the Outer Space Treaty are products of their time. When the Cold War erupted between the United States and the Soviet Union, this era of hegemonic tension led to careful compromises. Between 1957 and 1989, the space arena was controlled by these two superpowers.⁵⁵ Space programs were impacted by political objectives and re-enforced the political ideologies of that time.¹³² The Cold War led to a geopolitical competition between the United States and the Soviet Union for dominance in spaceflight capability. This so-called 'space race' got a flying start for the Soviet Union. They were the first to launch an artificial satellite (Sputnik) in orbit, sent the first man and woman into orbit and a Russian astronaut took the first spacewalk.¹³³ To the USSR, these successes displayed the ideological superiority of socialism and communism over capitalism.¹³⁴ The United States quickly responded by founding the National Aeronautics and Space Agency (NASA) in 1959.¹³⁵

The competition between the U.S. and the Soviets was triggered by the prestige that came with space faring, which could possibly lead to political advantages,¹³⁶ and by military concerns. It was believed that outer space would be the next battlefield and the moon a potential military basis.¹³⁷ The power struggle caused

¹³⁰ Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and Under Water (10 October 1963), *United Nations Treaty Series*, vol. 480, 43. Hereinafter Partial Nuclear Test Ban Treaty or PTBT.

¹³¹ Treaty on the Limitation of Anti-Ballistic Missile Systems (26 May 1972), *United Nations Treaty Systems*, vol. 13446, 14.

¹³² M. SHEEHAN, *The International Politics of Space*, New York, Routledge, 2007, 2.

¹³³ M.J. LISTNER, "The Ownership and Exploration of Outer Space: A Look at Foundational Law and Future Legal Challenges to Current Claims", *Regent J.Int.L.* 2003, (75) 76; C. VENET, "'The Political Dimension' in C. BRÜNNER, A. SOUCEK (eds.), *Outer Space in Society, Politics and Law*, Mörlenbach, Springer Vienna, 2011, 74.

¹³⁴ C. VENET, "'The Political Dimension' in C. BRÜNNER, A. SOUCEK (eds.), *Outer Space in Society, Politics and Law*, Mörlenbach, Springer Vienna, 2011, 74.

¹³⁵ V. KOPAL, "Origins of Space Law and the Role of the United Nations" in C. BRÜNNER, A. SOUCEK (eds.), *Outer Space in Society, Politics and Law*, Mörlenbach, Springer Vienna, 2011, 229.

¹³⁶ C. VENET, "'The Political Dimension' in C. BRÜNNER, A. SOUCEK (eds.), *Outer Space in Society, Politics and Law*, Mörlenbach, Springer Vienna, 2011, 74.

¹³⁷ J.G. CHERIAN, J. ABRAHAM, "Concept of Private Property in Space - An Analysis", *JICLT* 2007, (211) 212.

paranoia and further distrust and these tensions directly lead to the avoidance of the right to own any part of outer space. The two superpowers, as well as other nations, feared domination and property claims by another, resulting in the establishment of the Committee on the Peaceful Uses of Outer Space (COPUOS) in 1959, and ultimately gave rise to a cautionary Outer Space Treaty in 1968.¹³⁸ To prevent further international rivalries the treaty included the aforementioned “province of all mankind”-principal and a non-appropriation clause which states that space is not subjected to appropriation by the exercise of sovereignty claims.¹³⁹ Regarding the fear that outer space could be used as a military outpost, an emphasis was placed in article IV on the *peaceful* use of space. The establishment of military bases, installations and fortifications, the testing of any type of weapons and the conduct of military maneuvers on celestial bodies was also forbidden.¹⁴⁰

The Cold War clearly had an impact on space law. The current treaties deliberately do not take commercialization, natural space resources and production in outer space into account.¹⁴¹ Furthermore, the USSR wanted a ban on all private activity in outer space, but the United States dismissed this idea.¹⁴²

The space scene, in its early Cold War days, was government driven, due to national security concerns and the great dangers associated with space travel. This led to a narrow interpretation of the space domain: the sector was limited to scientific and technological aspects, leaving aside economic features.¹⁴³

The fear that rivalries between East and West would get the upper hand, is obviously visible in the UN space treaties. Space is “the province of all mankind” and cannot be subject of national appropriation.¹⁴⁴ Astronauts are “the envoys of all mankind” and international peace and security are paramount¹⁴⁵. Nuclear

¹³⁸ Ibid.

¹³⁹ Art. I-II OST.

¹⁴⁰ Art. IV OST.

¹⁴¹ T.J. HERRON, “Deep Space Thinking: What ELON MUSK’s Idea to Nuke Mars Teaches Us About Regulating the ‘Visionaries and Daredevils’ of Outer Space”, *Columbia Journal of Environmental Law* 2016, (554) 559.

¹⁴² A. WASSER, D. JOBES, “Space Settlements, Property Rights and International Law: Could a Lunar Settlement Claim the Lunar Real Estate It Needs to Survive?”, *Journal of Air Law and Commerce* 2008, (38) 41. The American negotiators feared that this proposal by the Soviets was a way to “extend Communist principles to outer space”, or otherwise suspected this idea as a tactical strategy. I.e. if the United States would do a concession on private companies in outer space, they thought the Soviets would want a concession on another front.

¹⁴³ C. VENET, “The Economic Dimension” in C. BRÜNNER, A. SOUCEK (eds.), *Outer Space in Society, Politics and Law*, Mörlenbach, Springer Vienna, 2011, 55.

¹⁴⁴ Art. I-II OST.

¹⁴⁵ Art. III OST.

weapons or any other form of mass destruction weapons are prohibited in space as well as military bases, installations and fortifications. Military personnel can only be used for scientific research or peaceful purposes.¹⁴⁶ Furthermore the Liability Convention favors a strong pro-victim doctrine, by establishing absolute liability for any injury or loss caused by a space object on Earth or to an aircraft in flight.¹⁴⁷ All these examples are a clear reflection of Cold War concerns.

The space scene today is characterized by a great amount of cooperation between Russia and the United States (think about the International Space Station), leaving the Cold War far behind. Remnants of this struggle remain visible in space law and raise the question if it might not be the right time to abandon these fossils in a quickly evolving space scenery.

3.4 Space Law Today

3.4.1 General

After the shortcomings of the Moon Treaty it became clear that there were no immediate new intentions of drafting additional legally binding documents. The United Nations afterwards declared relevant directives through resolutions adopted by the General Assembly. A few examples are:

- The Principles Governing the Use by States of Satellites for International Television Broadcasting (1982)¹⁴⁸

¹⁴⁶ Art. IV OST. This leaves us with the rather absurd situation where outer space is better protected against nuclear threat than our own Mother Earth. According to the Treaty on the Non-Proliferation of Nuclear Weapons or the Non-Proliferation Treaty (NPT) five recognized states may possess nuclear weapons. They agreed not to use these weapons unless they are themselves under nuclear attack. There are 190 parties, but nations as India and Pakistan have not signed, although they have admitted to possess nuclear weapons. The Outer Space Treaty is signed only by 105 parties, but Pakistan and India for example, as well as all other major nuclear powers have signed the treaty. According to the 1963 Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and Under Water (Partial Test Ban Treaty), nuclear tests are prohibited in the atmosphere, outer space and under water, leaving tests conducted underground out of the equation. One could not wish for a better place to test nuclear weapons than outer space (not that it should be encouraged in any way, on Earth or in space for that matter), since it is uninhabited, therefore diminishing the threat to human and other life on Earth significantly if not wholly. History proves however that nuclear tests in space are not entirely without risk. The American Starfish Prime experiment in 1962 shows this. There was considerable damage, among others to satellites that failed due to the damage the radiation caused to the electronics. This discussion however reaches far beyond the limits of this dissertation and could probably fill numerous pages of a new dissertation altogether. For more information on the Starfish Prime Test, see E.G. STASSINOPOULOS, "The Starfish Exo-atmospheric, High-altitude Nuclear Weapons Test", NASA, 22 April 2015, <https://nepp.nasa.gov/files/26652/2015-561-Stassinopoulos-Final-Paper-Web-HEART2015-STAR-FISH-supplemental-TN26292.pdf>.

¹⁴⁷ Art. IV (1)(a) Liability Convention; J.I. GABRYNOWICZ, "Space Law: Its Cold War Origins and Challenges in the Era of Globalization", *Suffolk U.L. Rev.* 2004, (1041) 1044.

¹⁴⁸ Principles Governing the Use by States of Artificial Earth Satellites for International Direct Television Broadcasting (10 December 1982), *U.N. Doc.*, A/RES/37/92.

- Principles Relevant to the Use of Nuclear Power Sources in Outer Space (1992)¹⁴⁹
- and the Declaration on International Cooperation in the Exploration and Use of Outer Space for the Benefit and in the Interest of All States, Particularly of the Developing Countries (1996).¹⁵⁰

Unlike the Space Treaties, these principles are not legally binding and can only be regarded as authoritative additional law.¹⁵¹

Since the treaties often tend to be vague and not fully comprehensive, we are left with a legal system⁶⁸ showing a lack of integrity. They do not address economic issues like commercial space flights, space tourism and mining for resources in outer space. The incompleteness of international space law leaves many challenges for present day policy- and lawmakers. Further development relies upon the willingness of governments to cooperate and strive towards a common goal of completing the *corpus iuris spatialis*.

However, in addition to the existing United Nations Treaties and General Assembly Resolutions, a lot of spacefaring countries are creating their very own national space laws, thereby governing their own space activities, including the activities of private organizations under their jurisdiction.¹⁵² Needless to say, national regulations have to be in compliance with the existing international legal framework, especially the principles of the United Nations concerning outer space.

3.4.2 American Space Law

Since the relevance of the U.S. in space, it is only logical to examine American space law as it stands today. A look at its domestic law is therefore indispensable for a better understanding of space law today.

¹⁴⁹ Principles Relevant to the Use of Nuclear Power Sources in Outer Space (14 December 1992), *U.N. Doc.*, A/RES/47/68.

¹⁵⁰ Declaration on International Cooperation in the Exploration and Use of Outer Space for the Benefit and Interest of All States, Taking into Particular Account the Needs of Developing Countries (13 December 1996), *U.N. Doc.*, A/RES/51/122.

¹⁵¹ V. KOPAL, 'Origins of Space Law and the Role of the United Nations' in C. BRÜNNER, A. SOUCEK (eds.), *Outer Space in Society, Politics and Law*, Mörlenbach, Springer Vienna, 2011, 229.

¹⁵² V. KOPAL, 'Origins of Space Law and the Role of the United Nations' in C. BRÜNNER, A. SOUCEK (eds.), *Outer Space in Society, Politics and Law*, Mörlenbach, Springer Vienna, 2011, 230.

On policy level, there are several government agencies with fundamental duties in domestic space law, such as the Department of Defense (DOD)¹⁵³, the National Aeronautics and Space Administration (NASA)¹⁵⁴, the Department of Transportation (DOT)¹⁵⁵, and the Department of Commerce (DOC).^{156 157} Each agency has its own specialty and executes the US government's wishes for the space program.¹⁵⁸

On a legal level, several important Acts need to be brought up. The first to be mentioned is the National Aeronautics and Space Act of 1958.¹⁵⁹ It outlines the United States civil space program and the National Aeronautics and Space Agency, widely known as NASA.¹⁶⁰ The Act opens with a proper preconception of the objectives of U.S. space activities. It promotes the expansion of human knowledge of aspects of outer space and the atmosphere, the advancement of the usefulness and performance of outer space, the establishment of long-term analysis of potential benefits from peaceful use of outer space and the promotion of international cooperation.¹⁶¹

Emphasis in the NAS Act is the civilian aspect of US space activities. In contrast to the Soviet program, that was distinctly military, EISENHOWER wanted a space program under civil control.¹⁶² All space related personnel, duties, powers were transferred from the Department of Defense to NASA.¹⁶³ The position of NASA is therefore somewhat unique, since it has extensive authority mostly unavailable to other civil federal agencies.¹⁶⁴

¹⁵³ The DOD concentrates on national security in outer space activities. T.S. TWIBELL, "Space Law: Legal Restraints on Commercialization and Development of Outer Space", *UMKC L. Rev.* 1997, (590) 605.

¹⁵⁴ NASA is the biggest authority in U.S. space industry and primary regulator of U.S. space activities. They play a substantial role in scientific research and development and aiding the DOD, DOT and DOC with their respective responsibilities. T.S. TWIBELL, "Space Law: Legal Restraints on Commercialization and Development of Outer Space", *UMKC L. Rev.* 1997, (590) 605-606.

¹⁵⁵ The DOT has shared responsibilities with the DOD, though concentrates more on the regulatory aspects of transportation such as commercial launchings. TWIBELL, "Space Law: Legal Restraints on Commercialization and Development of Outer Space", *UMKC L. Rev.* 1997, (590) 605.

¹⁵⁶ The DOC focusses on developing commercial interests in outer space. T.S. TWIBELL, "Space Law: Legal Restraints on Commercialization and Development of Outer Space", *UMKC L. Rev.* 1997, (590) 605.

¹⁵⁷ T.S. TWIBELL, "Space Law: Legal Restraints on Commercialization and Development of Outer Space", *UMKC L. Rev.* 1997, (590) 605.

¹⁵⁸ *Ibid.*

¹⁵⁹ National Aeronautics and Space Act (29 July 1958), *Public Law* 85-568, 72 Stat., 426, <https://www.gpo.gov/fdsys/pkg/STATUTE-72/pdf/STATUTE-72-Pg426-2.pdf>. Hereinafter NAS Act.

¹⁶⁰ J.I. GABRYNOWICZ, "Space Law: Its Cold War Origins and Challenges in the Era of Globalization", *Suffolk U.L. Rev.* 2004, (1041) 1047.

¹⁶¹ Sec. 102 (c) 1-8 NAS Act.

¹⁶² J.I. GABRYNOWICZ, "Space Law: Its Cold War Origins and Challenges in the Era of Globalization", *Suffolk U.L. Rev.*, (1041) 1047.

¹⁶³ *Ibid.*

¹⁶⁴ *Ibid.*, 1048.

Another important act is the 1984 Commercial Space Launch Act. It is this act that authorizes the Department of Transportation to regulate and facilitate commercial space launches.¹⁶⁵ Through the Act, the DOT can regulate and license all private launches, to ensure safe and responsible send-offs.¹⁶⁶ Companies such as SpaceX, Virgin Galactic or United Launch Alliance must therefore go through the DOT to ensure permission for their space ventures. The purpose of the Act was to advocate economic growth and commercialization of outer space.¹⁶⁷

It wasn't until the 1988 amendment of the Commercial Space Launch Act that it had a real impact on the industry. The amendment was the direct consequence of the Space Shuttle Challenger disaster in 1986 and tried to address the liability problems: U.S. government previously could not be held accountable, while private launchers were exposed to unlimited third-party liability.¹⁶⁸ The amendment demands a launcher to insure against damage to government property and third-party liability.¹⁶⁹

Other U.S. domestic space law include the 1962 Comsat Act and the 1992 Land Remote Sensing Policy Act. These acts concern satellite communications and remote sensing systems and are therefore not relevant in this analysis.

The United States tries to keep on top of its game in the space arena and the development of statutory law shows a certain degree of maturity. The fact that the U.S. tries to keep up with space law is also shown through the latest space hearing: the Hearing before the Subcommittee on Space, Science and Competitiveness of the Committee on Commerce, Science and Transportation in the U.S. Senate¹⁷⁰ didn't want the 50th anniversary of the Outer Space Treaty to pass by

¹⁶⁵ Commercial Space Launch Act, 30 October 1984.

¹⁶⁶ T.S. TWIBELL, "Space Law: Legal Restraints on Commercialization and Development of Outer Space", *UMKC L. Rev.* 1997, (590) 607.

¹⁶⁷ J.I. GABRYNOWICZ, "Space Law: Its Cold War Origins and Challenges in the Era of Globalization", *Suffolk U.L. Rev.*, (1041) 1048.

¹⁶⁸ *Ibid*, 1049.

¹⁶⁹ *Ibid*.

¹⁷⁰ *Reopening the American Frontier: Reducing Regulatory Barriers and Expanding American Free Enterprise in Space*, Hearing before the Subcommittee on Space, Science and Competitiveness of the Committee on Commerce, Science and Transportation, US Senate, 115th Congress, 2017, 1-50. The Space Hearing consisted of three separate hearings in April, July and August. In the hearings, important attendees and contributors where TIM HUGHES (Vice-President of SpaceX and former counsellor to the Committee on Science and Technology in the United States House of Representatives and as result contributed had a major influence on contemporary commercial space law), BILL NELSON (former astronaut and currently senator for the Democratic Party in the US Congress), ROBERT T. BIGELOW (founder and president of Bigelow Aerospace), GEORGE WHITESIDES (CEO Galactic Ventures) and ROBERT MEYERSON (president of Blue Origin).

unnoticed and senator TED CRUZ, who acted as chairman of the committee, recognized that the National Space Program is on "*the verge of a renaissance*".¹⁷¹ The Space Hearing examined partnerships between the U.S. government and private enterprises, to better America's leading position in the industry. The efforts made by the U.S. show that the U.S. is effectively leaving the government controlled space environment behind and focusing on private development of the space industry, acknowledging its importance and trying to provide a favorable climate for private space investors.

One last suggestion for American policymakers would be to develop a concrete definition of the "province of mankind"-principle in national legislation. The 2017 Space Hearing did not put this idea forward, but doing so might influence the international point of view. Due to the fact that the Outer Space Treaty does not offer a precise definition, the U.S. can freely adopt one within the limitations of Article I of the Treaty. The U.S. could fill in this term by stating that outer space should be the province of mankind, acknowledging the right of every nation to enter outer space, welcoming all people to become equal partners in space exploration and recognizing relative equitable sharing of outer space benefits. Relative equitable sharing is briefly discussed in the next paragraph.

3.5 Pitfalls in the current *corpus iuris spatialis*

3.5.1 The concept of province of mankind

The freedom of access or "province of mankind"-principle is very vaguely defined and there is no agreement on a precise definition.¹⁷² This will result in an interpretation by pioneering states of this principle to their own needs and interests.¹⁷³ There has been discussion as to whether this principle means equitable sharing of benefits or more easily that it only means that all humankind should have equal access to space.¹⁷⁴ According to this last interpretation, a nation that has insufficient funds for its own space program, legitimately shares in the benefits for example through developed vaccines and antibiotics or by registering orbital positions in geostationary orbit and creating revenue by leasing the positions to companies with interests in satellite launching. This could be seen as "relative sharing" of outer space benefits, whereas for example a usage tax in outer space

¹⁷¹ Ibid.

¹⁷² D.A. PORRAS, "The 'Common Heritage' of Outer Space", *CWILJ* 2006, (143) 145.

¹⁷³ Ibid.

¹⁷⁴ C.M. PETRAS, "Space Force Alpha: Military Use of the International Space Station and the Concepts of 'Peaceful Purposes'", *A.F. L. Rev.* 2002, (135) 151-152.

for spacefaring nations would be a more absolute approach.¹⁷⁵ Relative sharing is thus best described as the equitable sharing of outer space benefits for every nation, where a non-spacefaring nation gains the benefit of outer space exploration through a chain reaction triggered by the actions of a spacefaring nation who yields most benefits of space exploration. Along these lines, benefits will trickle down to non-spacefaring nations and by extension to every citizen on Earth. This domino effect seems justifiable, because spacefaring nations invest the most in space exploration in terms of money and labor, as opposed to non-spacefaring nations.

3.5.2 The *res communis* problem: private citizens and sovereign states versus the Outer Space Treaty

Article II of the Outer Space Treaty prevents states from making sovereign claims on extraterrestrial lands. However, the article does not mention property rights of private individuals and companies (it only mentions *national* appropriation and thus only prohibits nations from making claims of sovereignty in space). This is a direct result of the period in which the treaty was drafted. At that time, only national governments were concerned with outer space.¹⁷⁶ It could be argued that there is room for interpretation, but a glance at the draft history of the Treaty suggests that the participating delegates' prevalent opinion leaned towards a prohibition of both public and private appropriation.¹⁷⁷

Distinguished legal scholar STEPHEN GOROVE¹⁷⁸ dedicates an entire study to the interpretation of Article II of the Outer Space Treaty, in 1969 and comes to the following conclusion:¹⁷⁹

"The Treaty in its present form appears to contain no prohibition regarding individual appropriation or acquisition by a private association or an international organization, even if other than the United Nations. Thus,

¹⁷⁵ See *infra* paragraph 5.3.1 "Allocating property rights on Mars before arrival", 49. Here a Mars Tax is proposed to deal with the province of mankind problem.

¹⁷⁶ T.J. HERRON, "Deep Space Thinking: What ELON MUSK's Idea to Nuke Mars Teaches Us About Regulating the "Visionaries and Daredevils" of Outer Space", *Columbia Journal of Environmental Law* 2016, (554) 559.

¹⁷⁷ S. HOBE, B. SCHMIDT-TEDD, K.U. SCHROGL (eds.), *Cologne Commentary on Space Law, Volume I: Outer Space Treaty*, Cologne, Carl Heymanns Verlag, 2009, 50.

¹⁷⁸ STEPHEN GOROVE was amongst the first to deal with many unanswered questions at the time, i.e. does collecting resources in outer space empower appropriation? Is it possible for a nation or state to appropriate certain regions for its own use in outer space? If not nations, do private actors have appropriation rights in other space? These questions remain relevant in a modern-day society. See generally S. GOROVE, "Interpretation of Article II of the Outer Space Treaty", *Fordham Law Review* 1969, 349-354.

¹⁷⁹ *Ibid.*, 351.

at present, an individual acting on his own behalf or on behalf of another individual or a private association or an international organization could lawfully appropriate any part of outer space, including the moon and other celestial bodies."

There is a view in legal doctrine that assumes that private property is an emanation of the rights of a state, as the restrictions placed upon a sovereign state is extended to individuals through their citizenship.¹⁸⁰ In other words, if a state cannot assert any realty ownership in outer space, neither can an individual. The original source of the title of ownership is considered to be evolving from the state and if a state has no such sovereign rights, the title can never pass from a state to to a private holder.¹⁸¹ This point of view would certainly make things easier and put an end to the discussion, but it leaves a very strict interpretation of the treaty, leaving no wiggle room at all. It could endanger future missions of private investors in outer space, who would then have no proper motivation to make massive investments in a very uncertain and unstable environment.

There is also discussion as to what non-appropriation encompasses and how far it reaches. Some argue that the provision only prohibits ownership of the land, others argue that it goes further and also prohibits appropriation of resources found within the land.¹⁸²

Despite different interpretations in legal doctrine, Article II of the Treaty seems to leave a gaping loophole in international space law that needs to be resolved. It is also important to notice that interpreting the treaty in favor of private appropriation, could lead to an unusual situation where corporations have more access to the planet than nations.¹⁸³ HUSBY for example interprets the Treaty in the light of the UNCLOS Convention, where appropriation of the resources is allowed if it is done with reasonable regard to the interest of other states.¹⁸⁴ There

¹⁸⁰ T.E. SIMMONS, "Deploying the Common Law to Quasi-Marxist Property on Mars", *Gonz. L. Rev.* 2015, (25-78) 43; J.G. CHERIAN, J. ABRAHAM, "Concept of Private Property in Space - An Analysis", *J. Int'l Com. L. & Tech.* 2007, (211) 213; L.M. FOUNTAIN, "Creating Momentum in Space: Ending the Paralysis Produced by the "Common Heritage of Mankind" Doctrine", *Conn. L. Rev.* 2003, (1753) 1753.

¹⁸¹ T.E. SIMMONS, "Deploying the Common Law to Quasi-Marxist Property on Mars", *Gonz. L. Rev.* 2015, (25) 43; J.G. CHERIAN, J. ABRAHAM, "Concept of Private Property in Space - An Analysis", *J. Int'l Com. L. & Tech.* 2007, (211) 213;

¹⁸² R. SATTler, "Transporting a Legal System for Property Rights: From the Earth to the Stars", *Chicago Journal of Int. L.* 2005, (23) 28; E. HUSBY, "Sovereignty and Property Rights in Outer Space", *J. Int'l L. & Prac.* 1994, (359) 370.

¹⁸³ J. HAQQ-MISRA, "The New Frontier: Homesteading on Mars", *Earth Magazine*, 25 May 2015, <https://www.earthmagazine.org/article/comment-new-frontier-homesteading-mars>

¹⁸⁴ E. HUSBY, "Sovereignty and Property Rights in Outer Space", *J. Int'l L. & Prac.* 1994, (359) 370.

is something to say for this interpretation, since the UNCLOS Convention¹⁸⁵ indeed served as an example for the Outer Space Treaty. Others argue that resources are a part of the land and cannot be treated separately as such.¹⁸⁶ In any case, it is clear that the Treaty is unclear and therefore unworkable. The rather socialist approach of the Outer Space Treaty seems outdated with today's predominant free-market economy.¹⁸⁷

Property rights are mentioned by the Moon Treaty in art. 11, section 3: "[...] *The placement of personnel, space vehicles, equipment, facilities, stations and installations on or below the surface of the Moon [or other celestial bodies], shall not create a right of ownership over the surface or the subsurface of the Moon [or any other celestial bodies] [...]*". It does allow the use of lunar resources, but only to the extent needed for scientific investigations in support of their missions.¹⁸⁸ Important to note is that none of the major spacefaring powers are party to the Moon Treaty, because it further restricted their ownership and property rights.¹⁸⁹ While nations such as America or Russia cannot claim parts of or entire celestial bodies through national appropriation, a loose interpretation of the Treaty allows them to build small communities through their citizens that do not fall under their sovereign reign. When one would make a claim on part of a celestial body, the Outer Space Treaty only prevents this land being ruled by a government, so this loophole prevents major spacefaring nations to join the Moon Treaty that eliminates this escape route.¹⁹⁰ The question is whether sovereignty is a *conditio sine qua non* for the colonization of Mars. Some authors propose pragmatic models where sovereignty on Mars would be consistent with the current legal framework, as will be explained in the next chapter.

¹⁸⁵ United Nations Convention on the Law of the Sea (10 December 1982), *United Nations Treaty Series*, vol. 1833. Hereinafter UNCLOS Convention or UNCLOS. For a more in-depth discussion of this treaty, see infra paragraph 5.3.3. "Other treaties and agreements can serve as an example", 53.

¹⁸⁶ R. SATTLER, "Transporting a Legal System for Property Rights: From the Earth to the Stars", *Chicago Journal of Int. L.* 2005, (23) 29.

¹⁸⁷ L.M. FOUNTAIN, "Creating Momentum in Space: Ending the Paralysis Produced by the "Common Heritage of Mankind" Doctrine, *Conn. L. Rev.* 2003, (1753) 1760. K.A. BACA even argues that this provision is to some extent in conflict with other multilateral treaties. See K.A. BACA, "Property Rights in Outer Space", *J. Air L. & Com.* 1993, (1042) 1065-1066.

¹⁸⁸ Art. VI Moon Treaty.

¹⁸⁹ R. SATTLER, "Transporting a Legal System for Property Rights: From the Earth to the Stars", *Chicago Journal of Int. L.* 2005, (23) 30.

¹⁹⁰ D.E. MARKO, "A Kinder, Gentler Moon Treaty: A Critical Review of the Current Moon Treaty and a Proposed Alternative", *J. Nat. Resources & Envtl. L.* 1992, (293) 322.

Traveling to Mars will probably not raise any legal issues in the early stages, since the first settlements on the planet will most likely be scientific outposts.¹⁹¹ But these needs will change once humanity starts large scale operations on the Red Planet in order to colonize it. The undefined province of mankind principle in article I and the non-appropriation provision in article II of the Outer Space Treaty need to be resolved, the sooner the better.

4 Property rights and sovereignty issues

4.1 The Principle of non-appropriation in space law

Article II of the Outer Space Treaty makes it impossible to make sovereign or territorial claims on any celestial body, thus presenting a legal problem for space-faring nations or companies to colonize Mars or other celestial bodies:

*"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."*¹⁹²

When the Apollo astronauts planted the American flag on lunar soil, this was a mere symbolic gesture. When hearing upon this particular action, one cannot help to think about Christopher Columbus and his fellow explorers in the 15th century. These explorers landed there for the first time and marked their conquest with the planting of a flag.

When thinking of Columbus and the "Age of Discovery", the Doctrine of Discovery comes to mind. Under this doctrine, the conquering nation who planted a flag on newly discovered land, thereby claimed this land and all attached to it, opening it up for commercial rights and submitting it to the sovereign rule of that nation.¹⁹³ An element of doctrine is the term *terra nullius*, or vacant lands. It stated that parcels that were occupied by no-one, or were occupied, but in a way, that was unknown and unrecognized by European standards and legal orders, were empty and accessible for European discovery claims.¹⁹⁴

¹⁹¹ These outposts are legally covered under article I of the Space Treaty, which states that there shall be freedom of scientific research.

¹⁹² Art. II OST.

¹⁹³ R.J. MILLER, "The International Law of Colonialism: A Comparative Analysis", *Lewis & Clarke L. Rev.* 2011, (847) 848-849.

¹⁹⁴ *Ibid.*, 864.

If this doctrine were applied in a modern-day space age, the Moon would be under sovereign rule of the United States of America. However, no claim to the Moon was made that day in 1969 and the landing did not establish any particular rights. The U.S. government was very clear on this point: each Lunar Module carried an inscribed plaque acknowledging, “*We came in peace for all mankind*”.¹⁹⁵ No authority, jurisdiction or control over the Moon was gained by anyone that day and the Outer Space Treaty would in any way forbid the United States of making such a claim. Nonetheless, if we want to become a spacefaring civilization with the ultimate goal of colonizing Mars and other celestial bodies, we will need to make a sharp turn.

4.2 Extraterrestrial real state: some attempts at outer space ownership in practice

Certain organizations or individuals have claimed land ownership of celestial bodies in the past. These claims provide us with an example of appropriation that speaks to the imagination, but that demonstrates nonetheless the serious problem of property rights in space. The aforementioned loophole in art. II of the Outer Space Treaty has been used as an opportunity by several private entities, such as Lunar Embassy.¹⁹⁶ This company, founded by DENNIS M. HOPE offers lunar lots to private entities for a fairly small price¹⁹⁷ since 1996.¹⁹⁸ The legal validity of such claims remains uncertain. In the frequently asked questions section of the Lunar Embassy website¹⁹⁹ the company acknowledges the 1967 Outer Space Treaties and points towards the difference between government appropriation and private property claims. Lunar Embassy assumes that by filing a declaration of ownership with the U.S. government, it has established a legal basis for ownership, by claiming it first. In 1980 HOPE went to his local U.S. government office and claimed the entire lunar surface, as well as all other eight planets in our solar systems (including their moons),²⁰⁰ that he is now selling off piece by piece. It

¹⁹⁵ V. POP, “Appropriation in Outer Space: The Relationship between Land Ownership and Sovereignty on the Celestial Bodies”, *Space Policy Journal* 2000, (275) 280; K. LEIB, “State Sovereignty in space: Current Models and Possible Futures”, *Astropolitics* 2015, (1) 6.

¹⁹⁶ Other companies selling “lunar deeds” are Lunar International, founded in 1996 (see www.lunarregistry.com) and Lunar Republic, founded in 1999 and now called Lunar Republic Society (see www.lunarland.com).

¹⁹⁷ 19,99 dollars, plus taxes and a handling fee for a one acre parcel.

¹⁹⁸ M.J. LISTNER, “The Ownership and Exploitation of Outer Space: A Look at Foundational Law and Future Legal Challenges to Current Claims”, *Regent J. Int’l L.* 2003, (75) 88.

¹⁹⁹ See FAQ, <http://lunarembassy.com/general-faq/>, last visited March 15, 2018.

²⁰⁰ FAQ, “What is the Lunar Embassy’s legal basis for selling extraterrestrial properties?”, <http://lunarembassy.com/general-faq/>.

seems absurd and almost comical, that the local authorities pose little to no questions to HOPE's claim.

None of the signatories of the Outer Space Treaty have as of yet objected to the claims of Lunar Embassy, but none of the parties have affirmed the claims either.²⁰¹ A possible suit defying the claim could be filed in the future by the United Nations, the Russian Federation or the United States of America and could clarify the whole matter once and for all.²⁰²

Space law scholars²⁰³ and lawyers often regard the claims of Lunar Embassy as fraudulent or fake.²⁰⁴ The International Institute of Space Law (hereinafter IISL) has, in addition, issued a statement to tackle private property claims in outer space, stating that private property claims in outer space are prohibited by international law.²⁰⁵

In a previous statement, the IISL emphasizes that these claims are often viewed as a scam:²⁰⁶

"Claims to own the Moon or parts thereof by private parties have been made for many years, but so far such claims have not been taken very seriously. However, this could change, as "deeds to lunar property" have started to appear, raising the opportunity for individuals to be misled. In addition, the scope of such claims has been extended recently to other celestial bodies. Thus, the Board of Directors of the International Institute of Space Law (IISL) has concluded that there is a need for a statement regarding the current legal situation concerning claims to private property rights to the Moon and other celestial bodies or parts thereof."

²⁰¹ M.J. LISTNER, "The Ownership and Exploitation of Outer Space: A Look at Foundational Law and Future Legal Challenges to Current Claims", *Regent J. Int'l L.* 2003, (75) 88-89.

²⁰² *Ibid.*, 89.

²⁰³ VIRGILIU POP is one of the scholars that has deconstructed these private property claims. See V. POP, *Who Owns the Moon? Extraterrestrial Aspects of Land and Mineral Resources Ownership*, New York, Springer, 2009, 27-33. See also *infra* note 206.

²⁰⁴ T.D. DALTON, "Developing the Final Frontier: Defining Private Property Rights on Celestial Bodies for the Benefit of All Mankind", *Cornell Law School Graduate Student Papers* 2010, (1) 3.

²⁰⁵ Statement of the Board of Directors of the International Institute of Space Law, International Institute of Space Law, 22 March 2009, <http://www.iislweb.org/docs/Statement%20BoD.pdf>.

²⁰⁶ Statement of the Board of Directors of the International Institute of Space Law On The Claims to Property Rights Regarding the Moon and Other Celestial Bodies, International Institute of Space Law, 1 July 2004, http://iislweb.org/wwwnls1.a2hosted.com/wp-content/uploads/2015/03/IISL_Outer_Space_Treaty_Statement.pdf.

Further in the statement, they claim:

"[A]ccording to international law, and pursuant to Article VI, the activities of non-governmental entities (private parties) are national activities. The prohibition of national appropriation by Article II thus includes appropriation by non-governmental entities (i.e. private entities whether individuals or corporations) since that would be a national activity. The prohibition of national appropriation also precludes the application of any national legislation on a territorial basis to validate a "private claim". Hence, it is not sufficient for sellers of lunar deeds to point to national law, or the silence of national authorities, to justify their ostensible claims. The sellers of such deeds are unable to acquire legal title to their claims. Accordingly, the deeds they sell have no legal value or significance, and convey no recognized rights whatsoever."

The IISL interprets the Outer Space Treaty in a way that makes these claims invalid. It can also be argued that these claims have no historically legitimate basis, since there is no occupation of the land²⁰⁷: DAVID HOPE, nor any of the other dealers have never visited, paid taxes, or immersed in activity on the property in question.²⁰⁸

Another person with the idea to claim ownership in outer space is GREGORY W. NEMITZ, who declared to be the owner of an asteroid called Eros.²⁰⁹ The case was brought before a United States court when NEMITZ protested a landing of a NASA probe on the asteroid. Case law on this subject is exceptional, but the court ignored the appropriation elements of the case and dismissed NEMITZ's claim on the grounds that he had no legitimate title to prove his ownership to the property in question.²¹⁰ The dispute focusses on whether NEMITZ has an existing property right, thereby forgetting the real question at hand, namely if the appellant has the legal capacity to possess property rights in outer space.²¹¹

²⁰⁷ R. SIMBERG, "Homesteading the Final Frontier: A Practical Proposal for Securing Property Rights in Space", *Competitive Enterprise Institute Issue Analysis* 2012, (1) 17.

²⁰⁸ K. LEIB, "State Sovereignty in Space: Current Models and Possible Futures", *Astropolitics* 2015, (1) 12.

²⁰⁹ K. DAVIDSON, "Final Frontier for Lawyers - Property Rights in Space/Land Claims, Commercial Schemes and Dreams Have Legal Eagles Hovering", *SF Gate*, 16 October 2005, <https://www.sfgate.com/news/article/Final-frontier-for-lawyers-property-rights-in-2564610.php>.

²¹⁰ The Defendant's motion to dismiss, the response of the Appellant and the Judge's order to dismiss can be found on the website of the Eros Project, <http://www.erosproject.com/mtdindex.html>.

²¹¹ R. KELLY, "Nemitz v. United States, A Case of First Impression: Appropriation, Private Property Rights and Space Law Before the Federal Courts of the United States", *Journal of Space Law* 2004, (297) 305.

In the hypothesis that the court would have addressed this question and (however unlikely this sounds) would have recognized NEMITZ's claim, this would have been contrary to the Outer Space Treaty according to VIRGILIU POP, since a State authorization would be interpreted *de facto* as a way of national appropriation, thus making it unlawful.²¹² As stated by POP, real property should be legally registered and is subject to government regulation and taxation. States should have jurisdiction over said property. Since no state is allowed to do so, under article II of the Outer Space Treaty, no private entity can own land on any celestial body other than our own planet Earth. Yet, the treaty does not clearly and explicitly prohibit States from recognizing, enforcing or endorsing private property rights. If the drafters of the OST had the intention to prohibit the development of any private property rights, they could have done so.²¹³ If a judge were confronted with a dispute over outer space real property, it is improbable to think that he would chose POP's opinion over the plain language of the treaty.²¹⁴

4.3 *Ad astra per aspera*: private ownership of extraterrestrial land as an incentive

The Red Planet is no ideal holiday destination. Land on Mars is naturally harsh and difficult to live in and the Moon is even worse, because it lacks an atmosphere. Homesteading on the Moon or Mars would thus demand significant technological investments, to make it livable and sustainable. Obviously, these alterations through infrastructure would be costly and it seems hard to grasp the scope of the enormous technological commitment this endeavor involves. No country or private entity will risk the massive expenses that go with colonizing Mars, without the legal certainty that their profits will not be distributed to others.²¹⁵

The Outer Space Treaty is drawn up in a rather unusual way, from a capitalistic point of view. There are at least three obstacles to private real property on celestial bodies, that clearly rubs against the principles of free market economies, where one thinks of property as something that can be owned, thereby giving

²¹² V. POP, *Who Owns the Moon? Extraterrestrial Aspects of Land and Mineral Resources Ownership*, New York, Springer, 2009, 27-33 j° 72.

²¹³ T.E. SIMMONS, "Deploying the Common Law to Quasi-Marxist Property on Mars", *Gonz. L. Rev.* 2015, (25) 46.

²¹⁴ *Ibid.*

²¹⁵ D. COLLINS, "Efficient Allocation of Real Property Rights on the Planet Mars", *B.U.J. Sci. & Tech. L.* 2008, (201) 208.

the owner the right to exclude others from the property.²¹⁶ The first impediment is to be found in Article XII, that dictates state parties to open their stations, installations, equipment and space vehicles on the Moon and other celestial bodies to representatives of other governments with a reasonable advance notice.²¹⁷

Secondly, there is of course Article II of the OST, that provides that "*celestial bodies [are] not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means*".²¹⁸

The final stumbling block can be found in Article I of the Treaty, stating that the use of "*celestial bodies, shall be carried out for the benefit and in the interest of all countries, irrespective of their degree of economic or scientific development, and shall be the province of all mankind*".²¹⁹ This article seems to reinterpret ownership rights, at least to some extent: property rights in the sense that we know it are abandoned, repurposing the rights from individual rights to common rights.²²⁰

It could be argued that the treaty has a rather socialist approach. This statement however is rather bold and would probably be heavily contradicted by the United States. A teleological reading of the entire OST suggests no such thing, since the purpose of the convention was merely to ensure peaceful use of outer space, which is understandable in the light of the Cold War tension.

But securing peace in outer space is not the only ambition of the OST. The treaty also clearly wants to avoid a situation of "first come, first served", leading to a very unattractive situation for private investors and organizations, such as SpaceX and Mars One. The Commission instated by G.W. BUSH in 2004²²¹ also confirmed this in its report: "*[N]o company will invest millions of dollars in developing a product to which their legal claim is uncertain*".²²² Allowing private

²¹⁶ T.E. SIMMONS, "Deploying the Common Law to Quasi-Marxist Property on Mars", *Gonz. L. Rev.* 2015, (25) 39-40.

²¹⁷ Art. XII OST.

²¹⁸ Art. II OST.

²¹⁹ Art. I OST.

²²⁰ T.E. SIMMONS, "Deploying the Common Law to Quasi-Marxist Property on Mars", *Gonz. L. Rev.* 2015, (25) 40.

²²¹ "A Journey to Inspire, Innovate and Discover", Report of the President's Commission on Implementation of U.S. Space Exploration Policy, June 2004, https://www.nasa.gov/pdf/60736main_M2M_report_small.pdf

²²² *Ibid.*

ownership on celestial bodies could be, for many reasons²²³, an incentive for these settlement organizations.

5 Tackling the *res communis* problem: several proposals focused on bringing spacefaring into the 21st Century

When the authors drew up the 1967 Outer Space Treaty, their intention was to remove outer space from the galvanized scope of Cold War politics.²²⁴ This resulted in a collapse of the space program, so that its funding could be redistributed to other projects.²²⁵ The Treaty and its *res communis* principle had dismal consequences for the future of spacefaring: the lack of incentive destroyed the United States' further plans of exploring and developing outer space.²²⁶ And even if the Treaty were to be repealed today, the end of the Cold War and the collapse of the Soviet Union may have wiped out most of the driving force that inspired the space race.²²⁷ Nonetheless, a revision of that principle may be the only hope we have for kickstarting a new space age. It is therefore of paramount importance to scrutinize and question the current legal system and to search for a proper system of property rights, wishing for a speedy development of outer space with the ultimate goal of reaping political and economic benefits for all humankind.²²⁸

Allocation of property through first possession is at one end of the spectrum in this inquiry and could be economically and morally justified on the grounds that he who invests labor and capital, deserves fair compensation for his efforts. The complete opposite would be maintaining the *status quo* and leave development on colonies running free. Both possibilities are discussed in the next paragraphs, followed by a search for a middle way.

²²³ See *supra* paragraph 4.3. "Ad astra per aspera: private ownership of extraterrestrial land as an incentive", 42.

²²⁴ R. ZUBRIN, *Entering Space, Creating a Spacefaring Civilization*, New York, Tarcher/Penguin, 1999, 12.

²²⁵ *Ibid.*

²²⁶ B.C. GRUNER, "A New Hope for International Space Law: Incorporating Nineteenth Century First Possession Principles into the 1967 Space Treaty for the Colonization of Outer Space in the Twenty-First Century", *Seton Hall L. Rev.* 2004, (299) 344.

²²⁷ B.C. GRUNER, "A New Hope for International Space Law: Incorporating Nineteenth Century First Possession Principles into the 1967 Space Treaty for the Colonization of Outer Space in the Twenty-First Century", *Seton Hall L. Rev.* 2004, (299) 344.

²²⁸ *Ibid.*

5.1 First proposal: “first come, first served” by implementing the principle of first possession

This proposal is perhaps the most radical of them all, leaving the *res communis* principle completely behind and forgetting the spirit of collaboration. It is based upon the idea of *res nullius*, that can be discovered and appropriated.²²⁹ The discovering nation would be free to explore, exploit and develop newly achieved land and the appropriator is rewarded for his investment.²³⁰

A “discovering nation” however, needs some clarification. For example, GALILEO cannot be seen as the rightful owner of Jupiter’s three largest moons, simply because he built a telescope to observe them.²³¹ His efforts and investments could be described as labor and input of capital, but such a hypothesis would be unreasonable and unmaintainable. Likewise, the efforts of DAVID HOPE to claim ownership of celestial bodies in a declaration cannot be deemed enough.

In the same way, we cannot allot property rights to the United States, because they have sent probes that physically landed on Mars to scientifically research the planet.²³² It would be more logical to require a physical presence of the presumed owner himself on the planet, maintaining effective control over the claimed land.²³³ First possession is thus in contrast with LOCKE’S labor theory of property, where possession is the result of mixing one’s labor with said property.²³⁴

In the hope that first possession would stimulate an aggressive space program, this idea could be strengthened through principles of homesteading, as provided by American history through the 1862 Homestead Act.²³⁵ This American act granted individuals a piece of unsurveyed public land as private property in the United States, for a very low price or for free in exchange for a minimal 5 year stay, maintenance, development and mandatory building of a house on said

²²⁹ Ibid., 346.

²³⁰ Ibid.

²³¹ D. COLLINS, “Efficient Allocation of Real Property Rights on the Planet Mars”, *B.U.J. Sci. & Tech. L.* 2008, (201) 210.

²³² D. COLLINS, “Efficient Allocation of Real Property Rights on the Planet Mars”, *B.U.J. Sci. & Tech. L.* 2008, (201) 211.

²³³ Ibid.

²³⁴ K.A. BACA, “Property Rights in Outer Space”, *J. Air L. & Com.* 1993, (1042) 1054-1055.

²³⁵ B.C. GRUNER, “A New Hope for International Space Law: Incorporating Nineteenth Century First Possession Principles into the 1967 Space Treaty for the Colonization of Outer Space in the Twenty-First Century”, *Seton Hall L. Rev.* 2004, (299) 346-347.

property.²³⁶ By giving investors and pioneers stakes in what they could now call their own property, these land grants were of high importance for the development of the United States of America.²³⁷ Applying similar methods in outer space could advantage the outer space development, making it a great incentive for corporations, organizations and even individuals.²³⁸ If the United States of America would first claim sovereignty on a piece of land on Mars or on the Moon, effectively controlling it, corporations like SpaceX or Moon Express²³⁹ would undoubtedly be thrilled to unfold activities on this plot under the right terms. If these nations would want to act in the spirit of the space treaties, they could allow access to the lands to all humankind and not only its own nationals.²⁴⁰

From the rule of first possession flows the rule of capture to resolve the issue of property rights concerning resources on the property, establishing a rule of ownership over newly discovered natural resources (for example capturing solar rays for energy, minerals or ground water).²⁴¹ This excludes any disputes as to whether the individual has illegally appropriated a resource, providing legal certainty and offering yet again a helping hand in the swift development and exploitation of all celestial resources.²⁴²

In this theory, the vacuum that exists between celestial bodies, continues to be *res communis*. It is easy to compare this idea to the oceans and seas on Earth: the vacuum will be a transportation passageway used to commute between different planets, moons and other celestial bodies in outer space.²⁴³ No nation can be denied access to this 'interstellar highway'.²⁴⁴

Celestial bodies such as planets, moons, asteroids and comets should be redefined as *res nullius*, thereby providing incentives for exploration and exploitation. Nations can reach a celestial body and apply the first possession principle, but

²³⁶ Ibid., 347.

²³⁷ Ibid.

²³⁸ Ibid.

²³⁹ A company founded in 2010 by NAVEEN JAIN, with the objective to send robots to the Moon in order to start mining resources for economic purposes. They state to work in close relations with the U.S. Government, to assure accordance with space treaties. One of the goals of the company is to establish an outpost on the Moon in order to prospect for water and useful minerals. See <http://www.moonexpress.com/>.

²⁴⁰ B.C. GRUNER, "A New Hope for International Space Law: Incorporating Nineteenth Century First Possession Principles into the 1967 Space Treaty for the Colonization of Outer Space in the Twenty-First Century", *Seton Hall L. Rev.* 2004, (299) 348.

²⁴¹ B.C. GRUNER, "A New Hope for International Space Law: Incorporating Nineteenth Century First Possession Principles into the 1967 Space Treaty for the Colonization of Outer Space in the Twenty-First Century", *Seton Hall L. Rev.* 2004, (299) 348.

²⁴² Ibid.

²⁴³ Ibid., 353.

²⁴⁴ Ibid.

instead of claiming it on behalf of the nation, they should claim it on behalf of all humankind, thus respecting the “province of mankind”-principle.²⁴⁵ Next, this nation can implement a first possession system, with its consequential rule of capture.²⁴⁶ Individuals would enjoy property rights and would be rewarded for their investment, but they would also act on behalf of the interest of humanity rather than one single nation. This system would assure all humans equal access to the profits offered by other space.²⁴⁷

There are however some flaws in this system proposed by GRUNER. For starters, it is very utopic and in a way naive to think that this would work. History shows us that humans are not the sharing kind. Secondly, even though it would not be contrary to the “province of all mankind”-principle as laid down in Article I OST, it is still in conflict with Article II OST, that prohibits national appropriation in any form. The transformation of celestial bodies from *res communis* to *res nullius* is difficult to rhyme with the 1967 OST and seems to require unilateral withdrawal from the Treaty or repealing the Treaty in its whole. Finally, it would be practically unfeasible to grant all humans equal access to the rewards offered by outer space, in terms of logistics, unless the “relative sharing” interpretation as discussed previously is adopted in practice.²⁴⁸

In theory, the first possession doctrine offers a solution, but in practice it will require a fundamental paradigm change, demanding unilateral withdrawal, revision or repeal of the Treaty. While this current *status quo* is a state that seems to be untenable, revising the Treaty would require a lot of time to negotiate. Besides, negotiating a treaty is a process that demands consensus and compromise, leaving behind legal documents with vague principles and uncertainty. Space law and the first possession doctrine are complex matters that necessitate more than ambiguous alliances. In the light of this doctrine, it might be time to kick space law into the next gear and abandon the Treaty altogether, either by repealing it or by withdrawing as a nation.

²⁴⁵ Ibid.

²⁴⁶ Ibid.

²⁴⁷ Ibid., 354.

²⁴⁸ See *supra* paragraph 3.5.1. “The concept of province of mankind”, 34.

5.2 The other end of the spectrum: a Martian (or Lunar) colony as an irreversible fact

Imagine that Mars (or the Moon) has been colonized for a couple of decades and hundreds of thousands of people live there. Mars is a thriving settlement, with a lively economy and healthy import and export from and to Earth. Will these citizens accept this age old Outer Space Treaty and still live without any private property?²⁴⁹

It is highly unlikely that settlers will accept this restrictive treaty.²⁵⁰ One must only look at the history of Earth to see that people often long for a right to self determination. This principle is esteemed so highly that it is recognized as a *jus cogens* principle in international law.²⁵¹ It is also included in the United Nations Charter.²⁵² Martian or Lunar colonists would most certainly choose to abandon it and start claiming ownership of the land they occupy.²⁵³ It will depend upon the reaction of governments on Earth as to how this will play out, and when confronted with this fact they will hopefully come to the logical conclusion that they must accept and recognize the colony's claims.²⁵⁴

Under this assumption, there is in fact no need for legal pencil pushing concerning private property rights on celestial bodies: once a space settlement is established, a property rights regime will emerge naturally.²⁵⁵ However, the absence of legislation scares off investors with the will to develop activities in outer space, fearing they will have to spend another fortune on litigation.²⁵⁶ With the first possession doctrine on one end of the spectrum and naturally evolving property

²⁴⁹ A. WASSER, D. JOBES, "Space Settlements, Property Rights and International Law: Could a Lunar Settlement Claim the Lunar Real Estate It Needs to Survive?", *Journal of Air Law and Commerce* 2008, (38) 67. Some level of property rights exists within the current OST, but merely on the space vessel itself. A colony would, according to art. VII OST, have its sender nation(s) to retain jurisdiction over it, without claiming any of the soil. It is however important to note that in common law doctrine, a chattel loses its movable status when becomes fixed to the land, thus again presenting a legal problem. In theory, the affixed chattel then becomes real property and therefore, under the provisions of the OST, common property. See D. COLLINS, "Efficient Allocation of Real Property Rights on the Planet Mars", *B.U.J. Sci. & Tech. L.* 2008, (201) 205.

²⁵⁰ Lessons can be learned from British government over the United States, resulting in the Boston Tea Party and the United States' independence for example.

²⁵¹ Case Concerning East Timor (Portugal v Australia), *ICJ Reports* 1995, at 102, para 29.

²⁵² Chapter 1, Article 1, Part 2 United Nations Charter.

²⁵³ A. WASSER, D. JOBES, "Space Settlements, Property Rights and International Law: Could a Lunar Settlement Claim the Lunar Real Estate It Needs to Survive?", *Journal of Air Law and Commerce* 2008, (38) 67.

²⁵⁴ *Ibid.*

²⁵⁵ *Ibid.*, 70.

²⁵⁶ *Ibid.*

rights on the other end, it is improbable to think that space settlement under “natural circumstances” will ever happen. REINSTEIN summarizes it accurately:

“A legal system that is unclear as to the rights of developers in the land they develop is almost as prohibitive of positive development as a system forbidding development altogether.”²⁵⁷

The need for firm property rights in outer space is even recognized by the President’s 2004 Commission on Implementation of U.S. Space Exploration Policy:

“[I]t is imperative that these issues be recognized and addressed at an early stage in the implementation of the vision, otherwise there will be little significant private sector activity associated with the development of space resources, one of our key goals.”²⁵⁸

Developing a legal framework appears to be a *conditio sine qua non* for space development and the expansion of the human race outside Earthly boundaries. Sitting on the sidelines waiting for change to happen is probably not the way to go, if we still want to see extraterrestrial colonies happen this century.

5.3 Finding an area of compromise

First possession and maintaining the *status quo* are both two extreme positions and it might be the best option to find the middle ground. Several proposals come to mind.

5.3.1 Allocating property rights on Mars before arrival

Property rights could be allocated through competitive bidding prior to an actual Mars landing.²⁵⁹ An administrative structure would then occupy itself with facili-

²⁵⁷ E.J. REINSTEIN, “Owning Outer Space”, *Northwestern Journal of International Law and Business* 1999, (59) 71.

²⁵⁸ “A Journey to Inspire, Innovate and Discover”, Report of the President’s Commission on Implementation of US Space Exploration Policy, June 2004, 34, https://www.nasa.gov/pdf/60736main_M2M_report_small.pdf.

²⁵⁹ D. COLLINS, “Efficient Allocation of Real Property Rights on the Planet Mars”, *B.U.J. Sci. & Tech. L.* 2008, (201) 213; R.P. MERGES, G.H. REYNOLDS, “Space Resources, Common Property and the Collective Action Problem”, *N.Y.U. Envtl. L.J.* 1997, (107) 114-115; K. LEIB, “State Sovereignty is Space: Current Models and Possible Futures”, *Astropolitics* 2015, (1) 16.

tating trades of rights where ownership is determined outside the exchange system according to an easy rule, such as first possession for example.²⁶⁰ This administration could also be tasked with dispute settlement among multiple claimants.²⁶¹ The party that values Mars the most, will be granted title to Mars and would be anticipated to make the most beneficial use of it.²⁶²

Nevertheless, there are several issues with this proposal. First off, it might prove too difficult to determine the exact content of property rights before the economic activity has fully matured and developed.²⁶³ It is impossible to grasp the full length and consequences of an outer space conquest, before it has even started. Furthermore, this kind of allocation would require an immense bureaucracy, rendering this proposal highly inefficient.²⁶⁴ Another argument can be found in the fact that the investor would have to waste valuable resources on the purchase of the land, that could have been funneled more efficiently into researching and developing the planet.²⁶⁵ Finally, it is highly unfavorable for developing countries, who do not have the means to participate in a bidding war. By the time their economy has caught up, all the Martian land might already be sold.

When one entity would claim ownership of (some parts) of Mars, this would be diametrically opposed to the "province of mankind"-provision in the Outer Space Treaty of course. Selling private property on Mars one by one does not benefit humankind at first sight. To circumvent this obstacle, a sort of "Mars Tax" could be proposed. Every putative Mars explorer could pay a usage tax, which would then be shared with all the nations of the world, in recognition of the first article of the Treaty.²⁶⁶ On the other hand, it has been argued before that the fruit of space exploration, such as the development of vaccines and antibiotics for example already benefits all humankind since it would mean a great step forward in medicinal areas, but also economically because of the commercialization these innovations would encompass.²⁶⁷

²⁶⁰ R.P. MERGES, G.H. REYNOLDS, "Space Resources, Common Property and the Collective Action Problem", *N.Y.U. Envtl. L.J.* 1997, (107) 114.

²⁶¹ *Ibid.*

²⁶² D. COLLINS, "Efficient Allocation of Real Property Rights on the Planet Mars", *B.U.J. Sci. & Tech. L.* 2008, (201) 213.

²⁶³ R.P. MERGES, G.H. REYNOLDS, "Space Resources, Common Property and the Collective Action Problem", *N.Y.U. Envtl. L.J.* 1997, (107) 114.

²⁶⁴ D. COLLINS, "Efficient Allocation of Real Property Rights on the Planet Mars", *B.U.J. Sci. & Tech. L.* 2008, (201) 213.

²⁶⁵ *Ibid.*, 214.

²⁶⁶ D. COLLINS, "Efficient Allocation of Real Property Rights on the Planet Mars", *B.U.J. Sci. & Tech. L.* 2008, (201) 214.

²⁶⁷ See *supra* paragraph 3.5.1. "The concept of province of mankind", 34.

Thus far, it seems that this relative interpretation of the “province of mankind”-principle has been adopted in practice. A look at the International Space Station confirms this: there is no mandatory distribution with other nations of technology information²⁶⁸ or scientific discoveries in the current space law framework.²⁶⁹ Hence, active benefits are currently reserved for states capable of participating in outer space activity.²⁷⁰ This loose interpretation as currently maintained, would render the need for a Mars Tax obsolete. States have not contested this current state of affairs, but it seems possible that non-spacefaring nations would object, once Mars exploration is kickstarted. Now the active benefits for spacefaring nations only consist of technological and scientific knowledge. Presently, this might seem too abstract for non-spacefaring nations to object to. Circumstances may easily change when spacefaring nations start mining valuable resources on the Moon or Mars. The problem becomes more tangible for non-spacefaring nations, once space powers start to sell these resources for hard cash. If this is the case and non-spacefaring nations would gradually start to object, this Mars Tax can still offer a solution.²⁷¹

And although outer space and celestial bodies are not subject to national appropriation, it has been argued before that private investors could claim parts of outer space.²⁷² Pre-emptive allocation of property rights could thus be rhymed with the current *corpus iuris spatialis*, notwithstanding the mentioned drawbacks.

Another way to stay in the spirit of the Outer Space Treaty is to set aside a portion of Martian terrain as common territory for the people of Earth. This ground could be the interplanetary equivalent of public property.²⁷³ In this model we can preserve a percentage of Martian equatorial regions, since conditions for human habitation are most favorable there, for public use.²⁷⁴

²⁶⁸ With the exception of mandatory exchange of technological knowledge that is relevant to the direct operations of the International Space Station. Art. 19(1) ISS Agreement.

²⁶⁹ D.A. PORRAS, “The ‘Common Heritage’ of Outer Space”, *CWILJ* 2006, (143) 172.

²⁷⁰ *Ibid.*

²⁷¹ This issue would certainly benefit from a precise definition of “province of mankind”.

²⁷² See *supra* paragraph 3.5.2. “The *res communis* problem: private citizens and sovereign states versus the Outer Space Treaty”, 35.

²⁷³ D. COLLINS, “Efficient Allocation of Real Property Rights on the Planet Mars”, *B.U.J. Sci. & Tech. L.* 2008, (201) 215.

²⁷⁴ R. ZUBRIN, *The Case for Mars*, New York, Free Press, 2011, 153-154.

5.3.2 Bounded first possession by landfall

A better alternative to pre-emptive land appropriation would be real property allocation to the first arriving entity on Mars as proposed by DAVID COLLINS.²⁷⁵ The size of this property can be set at the optimal level necessary to encourage research, exploitation and development, while at the same time still reserving land for others to explore.²⁷⁶ Again, this bounded first possession would be in alignment with the Outer Space Treaty, that in a strict sense only bans sovereign claims to the land. This could be interpreted to mean the planetary sphere itself: landing on a insignificant portion of the planet does not entitle the settler to ownership of all of it.²⁷⁷ The Mars Tax or a loose interpretation through relative benefits could yet again solve issues with article I of the OST.

In this model, second and third place finishers will be rewarded with other parts of the land, making fair competition a possibility.²⁷⁸ No one will be in a hurry to settle on Mars, living in fear that late arrival will result in no more land to occupy. This regime discourages premature missions, since the benefit of landing second will be as high as landing first.²⁷⁹ Additionally, the concern that developing world countries would not have the option of exploring and exploiting regions on Mars would be rendered irrelevant, because vast parts of Mars would probably remain unoccupied, giving these countries a chance to catch up.²⁸⁰

This system leaves room however for disputes between landowners. At least in first stages of the settlement, these disputes can be settled through existing Earthly channels. For example, a dispute between two American land owners can be settled before a Federal Court of the United States.²⁸¹ Disputes between landowners of different nationalities can be settled through the International Court of Justice, that is qualified to settle disputes between sovereign nations as authorized through Chapter XIV of the UN Charter.²⁸² Another option of course, would

²⁷⁵ D. COLLINS, "Efficient Allocation of Real Property Rights on the Planet Mars", *B.U.J. Sci. & Tech. L.* 2008, (201) 215.

²⁷⁶ *Ibid.* See also *infra* paragraph 5.3.3. "Other treaties and agreements that can serve as an example", 53, where an exclusive economic zone is proposed, similar to the EEZ prescribed in UNCLOS. COLLINS suggests a hundred kilometer radius, but this might be a bit too much, as argued in the same section.

²⁷⁷ D. COLLINS, "Efficient Allocation of Real Property Rights on the Planet Mars", *B.U.J. Sci. & Tech. L.* 2008, (201) 215.

²⁷⁸ *Ibid.*, 216.

²⁷⁹ D. COLLINS, "Efficient Allocation of Real Property Rights on the Planet Mars", *B.U.J. Sci. & Tech. L.* 2008, (201) 216.

²⁸⁰ *Ibid.*

²⁸¹ *Ibid.* Jurisdiction would be granted to the Federal Court through admiralty and maritime issues under Article III of the Constitution.

²⁸² *Ibid.*

be the establishment of an overarching institution, with the power to resolve these disputes and additionally to operate as administrative forum tasked for example with registry of lands.

Although this system seems to be in harmony with the existing Outer Space Treaty, several obstructions come to mind. Article XII states that all stations, installations, equipment and space vehicles on celestial bodies shall be open to representatives of other states and this creates the risk of free-riding. An explorer could just sit and wait, until someone else invests huge sums in a Mars settlement, to pick the fruit of another's hard labor. It would be more effective to be the second or third settler to play a strategic waiting game in this case.²⁸³ To solve this problem, it should be allowed to charge a fee for the use of one's facilities.²⁸⁴

Another obstruction COLLINS didn't take into account is one that transcends the legal. It is obvious that this proposal is conceived by a jurist, because it is scientifically flawed. When we arrive on Mars, the first and most important obstacle settlers will face is that of finding water.²⁸⁵ If there is no water surrounding the place of landfall, settlers will have to search around in order to overcome this problem. It seems very inefficient to allot land by landfall, since the absence of water will make it fundamentally inhabitable and therefore worthless.²⁸⁶ A solution would be to offer subsidiary possession rights over the territory that contains water. If the landfall contains water, possession rights will manifest themselves in this area, if not they are transported to the area that does have water.

5.3.3 Other treaties and agreements can serve as an example

The first possession approach as discussed above is used by the International Telecommunications Union²⁸⁷ (ITU), regarding satellite orbital slots.²⁸⁸ This

²⁸³ Ibid., 218.

²⁸⁴ Ibid.

²⁸⁵ S. PETRANEK, *How We'll live on Mars*, London, Simon & Schuster, 2015, 39-42; R. ZUBRIN, *The Case for Mars*, New York, Free Press, 2011, 15. ZUBRIN says that a permanent Mars settlement would be ideally located above "a geothermally heated subsurface reservoir" that could offer the base a vast supply of hot water.

²⁸⁶ Water can be filtered out of the atmosphere by every settler but this requires sophisticated technology and would be highly inefficient, at least in the light of the alternative: just settling in the vicinity of thermal water sources. In this case there is no need to filter water out of the atmosphere, to melt frozen water and as a surplus, the hot water can be used as an electric power source. R. ZUBRIN, *The Case for Mars*, New York, Free Press, 2011, 15.

²⁸⁷ A specialized entity of the United Nations that monitors geostationary orbital slots for satellites and the frequencies for satellite communications.

²⁸⁸ R. SATTler, "Transporting a Legal System for Property Rights: From the Earth to the Stars", *Chicago Journal of Int. L.* 2005, (23) 31.

agency provides many guidelines for nations and private organizations and has an advisory board and settles disputes between nations through arbitration.²⁸⁹ While property rights on celestial bodies are uncertain, the geostationary orbit is the only current area where a space resource is effectively used and regulated.²⁹⁰

The ITU is not a great example to draw a parallel, because it does not face many of the challenges that must be overcome in outer space, like the construction of necessary camps and habitats or the mining of resources.²⁹¹ What we can remember from the ITU is that all the rules provided by this organization is a result of international cooperation, which will be important for the exploration of outer space as well. Furthermore, having an overarching entity administering outer space can be advantageous and can bring more clarity. Establishing a specialized agency for outer space activity, with the power to write guidelines and recommendations and to settle disputes through arbitration might seem compelling in the light of future space exploration.

Another legal structure that has been touched previously is the system of management of Antarctica. One does not need a vivid imagination to see the resemblance between the Antarctic and the vast expanses of undeveloped land on the Moon, Mars and other celestial bodies. The development of Antarctica, as well as sovereignty claims, are restricted by the Antarctic Treaty System. This system can be regarded as an example of successful sharing of international resources.²⁹² Several countries have tried to acquire portions of Antarctica, but these claims were suspended by the Antarctic Treaty of 1959 in favor of a legal system that promotes scientific research and cooperation, in order to protect the delicate environment of Antarctica.²⁹³ Applying the provisions of the Antarctic Treaty System to outer space would bring little improvement, since the Antarctic Treaty already served as an example for the Outer Space Treaty and would therefore fail to have additional value.²⁹⁴

²⁸⁹ Ibid.

²⁹⁰ K.A. BACA, "Property Rights in Outer Space", *J. Air L. & Com.* 1993, (1042) 1071.

²⁹¹ R. SATTler, "Transporting a Legal System for Property Rights: From the Earth to the Stars", *Chicago Journal of Int. L.* 2005, (23) 31.

²⁹² S. BRUHNS, J. HAQQ-MISRA, "A Pragmatic Approach to Sovereignty on Mars", *Space Policy* 2016, (57) 57.

²⁹³ R. SATTler, "Transporting a Legal System for Property Rights: From the Earth to the Stars", *Chicago Journal of Int. L.* 2005, (23) 32.

²⁹⁴ E. HUSBY, "Sovereignty and Property Rights in Outer Space", *J. Int'l L. & Prac.* 1994, (359) 362.

It might not inspire radical changes to the current *corpus iuris spatialis*, but it can nevertheless encourage minor changes. The Antarctic Treaty System regulates for example scientific study, provides a way for parties to exchange information, hands us guidelines for management operations, address handling of waste and protection of native species.²⁹⁵ Certainly the last two provisions might seem relevant for the current space law body. Space waste (or space debris) is presently one of the major problems in outer space²⁹⁶ and will only need further resolve once we conquer outer space. And although no evidence is found of native species on Mars or other celestial bodies, the possibility of finding life in outer space has certainly not been ruled out and it might benefit us to think about protection of native species before we encounter them, for example to avoid terrestrial contamination (this is scientifically called back contamination) if we return from a Mars mission. The Antarctic Treaty System also regulates tourism, another aspect left untouched by the Outer Space Treaty.²⁹⁷ Applying the ATS rashly to outer space is not the way to go, but a glance at the System shows us that many fields in the outer space legal area are as of yet untouched and need further scrutiny.

Another example of a way to manage shared space is the United Nations Convention on the Law of the Sea (UNCLOS)²⁹⁸, the law that is governing the deep seabeds of the Earth's oceans. Interesting in this convention is that it addresses mining issues. It regulates and licenses mining of certain parts of the ocean floor located beyond the reach of national jurisdiction.²⁹⁹ The comparison to outer space lies in the fact that mining these parts of the oceans is expensive and requires complex technologies in order to reach these great depths.³⁰⁰ The Convention also labels deep seabed and oceans as "common heritage of mankind"³⁰¹, terminology that reminds us of the "province of mankind"-principle in the OST.

²⁹⁵ R. SATTler, "Transporting a Legal System for Property Rights: From the Earth to the Stars", *Chicago Journal of Int. L.* 2005, (23) 33.

²⁹⁶ D. TAN, "Towards a New Regime for the Protection of Outer Space as 'Province of Mankind'", *Yale J. Int'l L.* 2000, (146) 151.

²⁹⁷ R. SATTler, "Transporting a Legal System for Property Rights: From the Earth to the Stars", *Chicago Journal of Int. L.* 2005, (23) 33.

²⁹⁸ United Nations Convention on the Law of the Sea (10 December 1982), *United Nations Treaty Series*, vol. 1833, 3.

²⁹⁹ B.E. HEIM, "Exploring the Last Frontiers for Mineral Resources: A Comparison of International Law Regarding the Deep Seabed, Outer Space and Antarctica", *Vand. J. Transnat'l L.* 1990, (819) 822.

³⁰⁰ *Ibid.*, 823.

³⁰¹ Art. 136 UNCLOS.

This principle in the Convention contains an element of active sharing of the benefits derived from exploitation.³⁰²

UNCLOS provides protection for the Exclusive Economic Zone (EEZ) or “The Area”³⁰³, that is designated as common heritage of mankind.³⁰⁴ A state can declare an area between its coasts and two hundred nautical miles as its EEZ and can exercise certain exclusive rights in this area, such as exploitation, exploration and conservation.³⁰⁵ UNCLOS instates an International Seabed Authority (ISA) tasked with equitable distribution and sharing of financial and other benefits derived from activities in the EEZ.³⁰⁶ This mechanism could *mutatis mutandis* be transported to outer space as ROSANNA SATTLER suggests.³⁰⁷ When a nation lands on a certain part of a celestial body, it might seem feasible to grant this nation an area similar to the EEZ. The nation would not have sovereignty over this region, but only yield certain conferred sovereign rights, like the right to exploit, control and manage resources within this area. These rights could then be licensed to private enterprises (or even to another state).³⁰⁸ This reminds us of the first possession principle as discussed above, but differs because of the limited rights offered to a state. There is no full sovereignty, only exclusive rights. Other countries can still fly over the area, pass through it or lay pipelines and cables for example.

SATTLER doesn’t specify however what the national baseline or starting point is from where this area should be measured, nor does she say how far it should reach. This problem could easily be resolved by using the immovable structures as a starting point. 200 nautical miles translates to 370,4 kilometers (kilometer is the used unit in outer space). For the purposes needed on Mars for example, this seem a bit of overkill. A country could easily land several structures roughly 740 kilometers apart and thereby immediately gain very large portions of the planet. If a country, like for example the United States, would want to conquer the Red Planet it would only need 29 landings and fixtures spread over the equator to fully conquer the warmest and most desired part of the planet³⁰⁹, given the

³⁰² B.E. HEIM, “Exploring the Last Frontiers for Mineral Resources: A Comparison of International Law Regarding the Deep Seabed, Outer Space and Antarctica”, *Vand. J. Transnat’l L.* 1990, (819) 827.

³⁰³ Part V UNCLOS.

³⁰⁴ Art. 136, Part XI UNCLOS.

³⁰⁵ Art. 56-57, part V UNCLOS.

³⁰⁶ Art. 140, 2., part XI UNCLOS.

³⁰⁷ R. SATTLER, “Transporting a Legal System for Property Rights: From the Earth to the Stars”, *Chicago Journal of Int. L.* 2005, (23) 41.

³⁰⁸ *Ibid.*, 41-42.

³⁰⁹ R. ZUBRIN, *The Case for Mars*, New York, Free Press, 2011, 153-154.

21.244 km circumference of Mars.³¹⁰ One can imagine that Russia, nor any other country would agree to such a large EEZ. Much more agreeable would be an EEZ somewhere between 5 and 25 kilometers.

In conclusion, the Antarctic Treaty System and the Law of the Sea Convention are fine examples of legal regimes focusing on the problem of extraterritorial property rights. But the Antarctic Treaty System is inadequate and through analogy, difficult to translate to the outer space framework. It can merely serve as guidelines to consider, but offers no real solutions in this particular instance due to the complexity of the outer space context. The Law of the Sea Convention is better suited for the job and seems to offer a great compromise: no sovereignty, but exclusive rights for a nation. It seems like any nation would be more open to this idea than for example a bounded first possession by landfall rule or a "first come, first served"-approach.

6 On what grounds can we justify these proposals?

These proposals, some more than others, require reform. We cannot implement a "first come, first served"-principle or allocation of property rights properly under the current Outer Space Treaty. If these proposals would be implemented, they would need legitimate justification.

The obvious problem is the non-appropriation clause in the Outer Space Treaty and an easy way out would just be to terminate the Treaty altogether. Of course, this approach would make no sense at all, since the objective is to improve the law and terminating the Treaty would certainly be no improvement, but rather a step back.³¹¹ There must be something to replace the non-appropriation provision. Two tracks can be followed: unilateral action versus multilateral action.

³¹⁰ T. SHARP, "How Big is Mars?", Space.com, 2 August 2012, <https://www.space.com/16871-how-big-is-mars.html>.

³¹¹ T.S. TWIBELL, "Circumnavigating International Space Law", *ILSA Journal of Int'l and Comparative Law* 1997, (259) 272.

6.1 Unilateral action

The United States could take unilateral action by terminating its own obligations and providing answers to the issue through federal law or by reinterpreting the Treaty.

TWIBELL states that a reinterpretation of the Treaty could be justified on the *rebus sic stantibus*³¹² doctrine, that allows contracting parties to end their obligations toward each other when the circumstances that led to the engagements in the first place have changed substantially.³¹³ It can be seen as an escape clause to *pacta sunt servanda*³¹⁴ as a general rule.

The doctrine has been included in the 1969 Vienna Convention on the Law of Treaties in Article 62 and is a part of international customary law, but strict requirements must be met and can only lead to termination or withdrawal from a treaty.³¹⁵ Given the post Cold War situation, invoking this doctrine might stand a change, but requesting *rebus sic stantibus* has rarely been proven successful.³¹⁶ The great fear that outer space could be used by one of the two space super powers at the time seems superfluous now. The existence of the non-appropriation clause can be attributed solely to the political environment of the era, preventing the Cold War to spread into space or avoiding territorial claims by these superpowers while other countries had no say in the matter whatsoever.³¹⁷ The Cold War has come to an end and other countries have entered the space arena, so it would seem that times have indeed completely changed.

However, it is questionable whether this doctrine can lead to a reinterpretation of a treaty.³¹⁸ TWIBELL accepts this disposition, referring to DANIEL PATRICK O'CONNELL who advocates a revision of the doctrine as a legal possibility for revision of treaties.³¹⁹

³¹² Latin for "things thus standing".

³¹³ Ibid., 273-274.

³¹⁴ Latin for "agreements must be kept".

³¹⁵ Art. 62 Vienna Convention on the Law of Treaties. Hereinafter Vienna Convention.

³¹⁶ H. LAUTERPACT, *The Function of Law in the International Community*, Oxford, Clarendon Press, 2000, 270.

³¹⁷ See *supra* paragraph 3.3. "Impact of the Cold War", 28.

³¹⁸ Art. 62 of the Vienna Convention only speaks of termination or withdrawal.

³¹⁹ T.S. TWIBELL, "Circumnavigating International Space Law", *ILSA Journal of Int'l and Comparative Law* 1997, (259) 273 (note 60).

It seems like invoking the *rebus sic stantibus* clause to reinterpret the treaty would require jumping through a lot of hoops, since reinterpretation of a treaty through this doctrine is not generally accepted. The Treaty does lend itself for different interpretations, as previously discussed, so unilateral reinterpretation of a treaty, justified by the *rebus sic stantibus* doctrine, might be worth a try.

However, the existence of a withdrawal provision in the Outer Space Treaty, negates the need to implement the *rebus sic stantibus* doctrine.³²⁰ The Outer Space Treaty has a withdrawal provision in Article XVI: any party can withdraw by giving notice of its withdrawal and the withdrawal shall take effect one year after notification. Withdrawal seems very easy: it does not even require a breach from other parties.³²¹

But this solution seems less than ideal. First off, a denunciation of the Treaty is not an appropriate measure if one only seeks to abandon the non-appropriation clause. Secondly, the potential impact and negative consequences for the international community are hard to assess.³²² Other state parties could take a withdrawal from the United States the wrong way and might answer with international sanctions. Since the conquest of outer space will probably be enhanced by international cooperation, withdrawal from United States would not be beneficial to its space program. Furthermore, some authors argue that the provisions laid out in the Treaty have since become customary international law, rendering a denunciation of the Treaty ineffective.³²³

6.2 Multilateral action

Unilateral actions seem to give no answer, considering the many disadvantages. The U.S. would benefit from a strong international cooperation and unilateral action might have the opposite effect. This leaves the multilateral highway, with several exits.

³²⁰ Ibid., 280.

³²¹ Art. XVI OST.

³²² T.S. TWIBELL, "Circumnavigating International Space Law", *ILSA Journal of Int'l and Comparative Law* 1997, (259) 291.

³²³ See *supra* note 115.

The first exit is leaving the 1967 Outer Space Treaty behind by ratifying a new treaty.³²⁴ The pivotal element for success is getting the same parties around the table who have signed the original Treaty and making them sign the subsequent treaty.³²⁵ They must be very clear about their intentions towards the 1967 OST, otherwise the Treaty might stay in effect.³²⁶ Time restraints and motivation seem the biggest obstacles for this solution and although hard to overcome, they seem less substantial than the negative effects of any proposal linked to unilateral action.

The second exit is only a few miles away from the first one of course: if one can successfully gather all State parties to discuss a successor to the OST, then why not simply amend the Treaty? We mustn't unnecessarily complicate things any further: if the non-appropriation clause is the issue, only amend this provision.³²⁷ There is no need to rebuild the whole highway, if there's only one small bump in the road. It certainly addresses the issue of time: amending is less time consuming than drawing up a new treaty altogether. Proposals as allocation before arrival or by landfall or the principle of first possession can easily be incorporated in the Treaty through amendment. The only thing still lacking is the motivation for State parties to sit around the table, but quick or sudden changes in technology could kick everything into the next gear. If the United States wanted to see quick development of the legal regime in outer space, to incentivize its private investors, it should take on the role of a public lobbyist for space and property rights with the United Nations.³²⁸ If the United States would press for political action, this would certainly not go unnoticed and it might pave the path for further international growth in the space industry.

³²⁴ T.S. TWIBELL, "Circumnavigating International Space Law", *ILSA Journal of Int'l and Comparative Law* 1997, (259) 292.

³²⁵ *Ibid.*

³²⁶ *Ibid.*

³²⁷ *Ibid.*, 293.

³²⁸ T.S. TWIBELL, "Circumnavigating International Space Law", *ILSA Journal of Int'l and Comparative Law* 1997, (259) 295.

7 **A unique proposal: a *sui generis* solution for a *sui generis* dilemma**

Although several of the previous proposals might seem adequate, the better solution might be to adopt a whole new structure to facilitate the conquest of outer space. Where many legal scholars have pondered upon the outer space conundrum, most of them only take into account real property issues and leave aside other problems, like for example criminal law and fundamental rights.

Historical models such as protectorates and trusteeships will be the starting point of this proposal. These models will be slightly adapted to meet the requirements of a contemporary outer space colony.

A protectorate is a territory with a special status, where certain aspects of sovereignty are delegated from the protecting state to the protected state.³²⁹ This system derives its legitimacy from the consent of the protected power, thereby eliminating any conflict between the two actors.³³⁰

Applied to a Martian colony, the landing zone of the delegate ship can become a protectorate of its sending state (or in second order, the first site where sufficient water is found). If the United States would be the first to land on Mars, an agreement with this delegation could be drawn up in order to instate such a protectorate, allowing the protected delegates to exercise certain sovereign rights independently from the protecting state concerning domestic policy. It would allow for a small local government to be established on this territory. This local government decides on domestic issues such as safety and justice, education and culture for example, while the protecting state provides criminal law, civil law including tort etcetera.

Another model, that might even serve better is the trusteeship model. A political trustee exercises sovereignty over a territory, but only for a limited time and for the benefit of the inhabitants of that territory.³³¹ Applied to Mars, a trusteeship would then be able to gain independence when it's ready. The protecting state

³²⁹ H.H. PERRITT, "Structures and Standards for Political Trusteeships", *UCLA J. Int'l L. & Foreign Aff.* 2003, (387) 416.

³³⁰ Ibid.

³³¹ H.H. PERRITT, "Structures and Standards for Political Trusteeships", *UCLA J. Int'l L. & Foreign Aff.* 2003, (387) 389.

has the obligation to prepare the trust territory for autonomy and ultimately independence. This system might be preferred to protectorates, since it would not be unthinkable that colonies would want to gain independence after a certain amount of time. The trusteeship model prevents conflict between the two, when the time for independence ultimately comes.

The sending state operates under supervision of the United Nations and controls its protectorates. This state has sovereignty over its delegates in outer space, but the system varies from a colony (in its original sense³³²) because the protectorate has a local government structure. The protectorates implement the law of the sender state. It seems like a fitting solution, since colonists will probably be too preoccupied to engage in drafting a whole new legal system from scratch. These immature new territories will have the power to evolve their own adapted legal system at their own pace and once they are fully ready, an independency procedure can be started, under supervision of the United Nations.

The protectorates or trusteeships should be prepared by protecting states for autonomy, as an emanation of the right to self-determination. This self-governance can be based on the *trias politica* principle proposed by JOHN LOCKE and refined by CHARLES DE MONTESQUIEU: a legislative power has the authority to make laws, a executive power executes and enforces the law and a judicial power interprets and applies the law. How this new form of governance should be filled in in practice, remains to be seen. But this new world offers great opportunity: it is offered a clean slate which can spark a whole new form of democracy. The United States today can hardly be called a democracy. It has semi-oligarchy characteristics with democratic influences: common citizens have little democratic power.³³³ Martian colonists should wield this opportunity to the fullest, for example by leaving the parliamentary democracy behind and opting for a participative democratic model.³³⁴ There is much to say for a system where everyone

³³² In 19th century terms, defined as the territorial annexation and occupation of non-European territories by European states. See J.T. GATHII, "Imperialism, Colonialism and International Law", *Buff. L. Rev.* 2007, (1013) 1013.

³³³ R. ZUBRIN, *Entering Space: Creating a Spacefaring Civilization*, New York, Penguin/Putnam, 1999, 126.

³³⁴ If the colonists would be prepared to take a different road altogether, TERRILL BOURICIUS can be strongly recommended. He criticizes the current democracy as hollowed and has some inspiring thoughts on a new political system. He advocates sortition and participation and suggests a system without political parties, elections and even without a classic parliament. A discussion of his proposals here would be too political and elaborate, but his ideas are certainly worth a read. T.G. BOURICIUS, "Democracy Through Multi-Body Sortition: Athenian Lessons for the Modern Day", *Journal of Public Deliberation* 2013, 1-19. The full text is available at <https://www.publicdeliberation.net/cgi/viewcontent.cgi?article=1220&context=jpd>.

has a vested interest in politics. As astrobiologist CHARLES S. COCKELL accurately states: "*Apathy in a lethal, hostile environment is extremely dangerous.*"³³⁵

The UN can operate as the highest authority. It oversees all the protectorates or trusteeships and keeps national countries in check. It can provide a dispute settlement organization and oversees independency procedures of matured territories. It should also be in charge of fundamental rights.

The Universal Declaration of Human Rights should be implemented in every trusteeship or protectorate, not as guiding principles, but as mandatory law. National fundamental rights should stay terrestrial, for several reasons. The conquest of Mars or any other celestial body, will probably be characterized by a lot of international cooperation. The implementation of international fundamental standards is thus preferred to national norms. Furthermore, departing from the hypothesis that the United States will be one of the first to colonize Mars, it might be an elegant way to dispose of the controversial second amendment to the United States Constitution. The right to keep and bear arms seems counterproductive in a society that is characterized by international cooperation, peaceful conduct and interdependency. There is no room for conservative rights such as these, since progressive thinking is what got us there in the first place.

With regard to fundamental rights, the United Nations could even go further than terrestrial human rights (another reason to dispose of national ones). There might be demand for human rights that fit the Martian bill. Humankind could be motivated to settle on extraterrestrial celestial bodies, because they would gain a higher level of freedom. A Mars colony can only be successful if it can innovate the best forms of law, society and culture Earth has to offer and leaves inferior law and custom behind.³³⁶

There are several human rights that come to mind, when thinking about a Mars colony. Additional fundamental rights could be for example the right to immigrate and emigrate, the right to develop and discuss new fundamental rights and to advocate their acceptance, total abolition of capital punishment, the right to liquid water, food and breathable air, the right to self-government by direct voting,

³³⁵ R. HOLLINGHAM, "How to Create a Bill of Rights for Mars Colonies", BBC Future, 9 July 2014, <http://www.bbc.com/future/story/20140709-why-mars-needs-a-bill-of-rights>.

³³⁶ R. ZUBRIN, *Entering Space: Creating a Spacefaring Civilization*, New York, Penguin/Putnam, 1999, 124.

the right to privacy or the right to have children. The latter seems self-evident, but it certainly is not in space travel. Imagine the 8 month journey to Mars, where travelers are confined to small living spaces, where travelers might get lonely. When boredom strikes people will inevitably search comfort with each other. What to do when someone gets pregnant? This can lead to disastrous consequences: a new human life might endanger food rations, medical supplies and tremendously needed oxygen. Will the crew be prepared for a delivery? A pregnancy can possibly put the whole crew in jeopardy. It is an ethical question, that seems harder to answer than at first sight considered. It might even be a good idea to implement a fundamental right to termination of pregnancy.

There may even be a need for adoption of a set of fundamental responsibilities in this interdependent society. Such as the responsibility to protect Earth from interplanetary contamination. Even though life on Mars hasn't been detected so far, one of the prime reasons to explore the Red Planet is to search for extraterrestrial life.³³⁷ If we succeed in this mission, it is possible that there are pathogens that might do enormous biological damage if returned to Earth.³³⁸ It is of primordial importance to contain these organisms, to operate in sterile environments and install quarantine procedures. Another responsibility can be the responsibility to work together in a peaceful environment in the best interest of the people. The Code of Conduct issued by NASA for its Astronaut Corps may inspire this responsibility: it strives for its members to comport themselves to the highest standards of ethics and integrity, emphasizing teamwork, the protection and balance of the best interests of co-workers, families and NASA, honorable personal behavior that respects the law and avoidance of conflicts of interest and unreasonable risk.³³⁹

The constitution, including fundamental rights and responsibilities should be partly based on deontological ethics, because every spacefaring individual has the duty to contribute and to pull his weight.³⁴⁰

Implementing this system would require an enormous *tour de force*, and its ambitiousness might be constrained by political indecisiveness. But the proposed

³³⁷ See *supra* note 76.

³³⁸ C. SAGAN, J. AGEL, *The Cosmic Connection: An Extraterrestrial Perspective*, New York, Dell Publishing, 1973, 129.

³³⁹ NASA's Astronaut Code of Professional Responsibility, <https://www.jsc.nasa.gov/Bios/AstronautCodeEarthFINAL.pdf>.

³⁴⁰ M.C. BAHTT, "Space for Dissent: Disobedience on Artificial Habitats" in C.S. COCKELL (ed.), *Dissent, Revolution and Liberty beyond Earth*, Edinburgh, Springer, 90.

system is not as absurd and impossible as it seems. Under the current Outer Space Treaty, a nation maintains jurisdiction and control over objects it has launched into space.³⁴¹ If a nation has jurisdiction, it also has the possibility to decide how to execute this jurisdiction: it is free to draw up an agreement with its crew to transfer certain rights at least to the extend of a protectorate. Making this territory a protectorate is then only a matter of nomenclature.

Agreeing upon a trusteeship with the crew is harder to accomplish, because the state does not have the right to proclaim outer space territory as sovereign. Thus, the recognition of the United Nations is needed for trusteeships.

If a state, like the United States would advocate reform within the United Nations to reinterpret the Outer Space Treaty or to alter it slightly, the ball might start rolling. The non-appropriation clause should not be abolished wholly: instating an exclusive economic zone of for example 5 to 25 kilometers around the landing place of the landed object would suffice. An EEZ does not mean sovereignty for a state, only certain sovereign rights. To prevent proliferation of landing sites and subsequent exclusive economic zones, a maximum number of zones can be imposed. A state can maintain control over three to five different zones for example. Afterwards, landings must be conducted in already existing areas, leaving other areas open for different nations (currently spacefaring or future spacefaring nations such as developing countries). The country that gets there first, would be rewarded with choice of landfall.

Although countries may not be enthusiastic about involvement by the United Nations, it should be seen as an area of compromise: some sovereignty rights in return for United Nations control and universal fundamental rights.

This proposal might not find entrance any time soon. Often, it takes a disaster or a crisis to impact a society and policymakers.³⁴² Hopefully, it doesn't have to come this far in space exploration, because any disaster would probably have catastrophic effects. What might spark reform in the space arena is a successful event, such as a successful first landing on Mars. Media coverage and public interest would be unpredictably gigantic, possibly marking this accomplishment

³⁴¹ Article VIII OST.

³⁴² Think of a food crisis or terrorism that can trigger political reform in a society. Our image of society is unmistakably colored by the way media cover these specific events, pointing out imperfections in the system and pressuring policymakers to change or rethink current legislation.

as one of the greatest in history of humankind. This might finally spark the debate and inspire policy makers to go further in the development of space law and ending this era of legal stagnation.

Even if this wildly ambitious plan is not adopted entirely, it does offer some useful insights. Namely, the need for development of tailor-made extraterrestrial fundamental rights and the cession of jurisdiction. Sovereign states will not be thrilled to give up certain parts of their jurisdiction, but the practical feasibility of long distance governance over their objects on Mars, will force them to do so anyway.³⁴³

8 A new role for Europe: the EU as space regulator

During this research, the primary focus was on the United States of America, given its leading status in the industry and their capacity to acknowledge the need for reform in the light of commercialization of outer space. When global reform in policy is needed, we tend to look at the U.S. as a powerful nation to set an example for others to follow. However, the U.S. is not the only player in the field. Other powerful agencies are Roscosmos³⁴⁴, CNSA³⁴⁵ and the European Space Agency. The European Space Agency is the second biggest agency, in terms of budget, with an annual budget of 5.75 billion euros or 6.27 billion American dollars in 2017.³⁴⁶ Roscosmos has been assigned a budget of 20 billion dollars in 2016, but over the course of 10 years.³⁴⁷ NASA easily exceeds Russian and European amounts, but the influence of other space agencies must not be

³⁴³ The distance between Earth and Mars varies from 54,6 million kilometers to 401 million kilometers, depending on Earth and Mars' orbits around the sun. It can take 20 to 40 minutes to send a message from Mars to Earth and another 20 to 40 to send one back, impeding communications between the two considerably. See S. PETRANEK, *How We'll live on Mars*, London, Simon & Schuster, 2015, 1; R. ZUBRIN, *The Case for Mars*, New York, Free Press, 2011, 55.

³⁴⁴ Roscosmos State Corporation for Space Activities, the Russian space agency. Hereinafter Roscosmos.

³⁴⁵ China National Space Agency, hereinafter CNSA.

³⁴⁶ ESA Budget 2017, http://www.esa.int/spaceinimages/Images/2017/01/ESA_budget_2017. NASA's budget in 2017 was 19 billion dollars. NASA Fiscal Year 2017 Budget Request, https://www.nasa.gov/sites/default/files/atoms/files/fy_2017_nasa_agency_fact_sheet.pdf.

³⁴⁷ Due to economic misfortune in Russia, the budget has been severely restricted. E.G. ELLIS, "Russia's Space Program is Blowing Up. So are its Rockets", *Wired.com*, 12 July 2016, <https://www.wired.com/2016/12/russias-space-program-blowing-rockets/>.

overlooked.³⁴⁸ On the contrary: why should we not look at ESA for example, as second biggest actor in the industry, to take the lead in space reform?³⁴⁹

The problem with ESA is that this organization is a non-political institution. Its main focus is of a technical and operational nature. Better positioned to deal with the regulatory and political aspect is the European Union.³⁵⁰ The EU has the intention of incorporating ESA in its structure, but the attempt to do so remains unsuccessful to this date. Nonetheless, the two work closely together.³⁵¹

However the case, the EU is aware of the fast-growing industry and acknowledges this in a communication letter from the European Commission.³⁵² In this letter the commission endorses to promote the position of Europe as a leader in space, so the determination to participate and to stay ahead is without a doubt present.³⁵³ The Commission clearly communicates about the wanted space strategy, but makes no mention of Mars, the Moon or any other celestial body as a target. Instead it focusses on space services, such as satellite images, geo-positioning information, satellite communications and the stability of current space programs.³⁵⁴

But this does not mean that human space travel cannot fit into the goals set forth by the Commission: they propagate innovation, research and development, entrepreneurship and new business opportunities. Travelling to Mars or other celestial bodies would certainly help to fulfill these goals.

³⁴⁸ For example, beside NASA, CNSA and Roscosmos are the only two space agencies with human space flight capabilities. See X., "The world's largest space agencies", *Aerospace Technology*, 15 December 2015, <https://www.aerospace-technology.com/features/featurethe-worlds-largest-space-agencies-4743900/>.

³⁴⁹ Although currently the only space agency with the financial power to send humans to Mars is NASA. A 20-year mission program to Mars would roughly cost 20-30 billion dollars, or 8 to 12 percent of NASA's budget annually. The ESA and Roscosmos budget should be expanded radically to make this mission feasible. ESA could do this, but would have to dedicate 50 to 66 percent of its budget to the Mars cause, which is arguably not a good distribution of its financial resources. See R. ZUBRIN, *The Case for Mars*, New York, Free Press, 2011, xxiv.

³⁵⁰ T. MASSON-ZWAAN, "Recent Developments in EU Space Policy and Law", *Korean Journal of Air and Space Law* 2010, (231) 237. The EU is qualified to deal with outer space issues according to Article 4 of the Lisbon Treaty: the EU has a shared competence for transportation, energy and environmental issues.

³⁵¹ Framework Agreement between the European Community and the European Space Agency, *Official Journal of the European Union* 261, 6 August 2004, 64-68.

³⁵² Communication from the European Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: Space Strategy for Europe, 26 October 2016, 1-13. Hereinafter Communication Letter or Letter.

³⁵³ Communication from the European Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: Space Strategy for Europe, 26 October 2016, 2.

³⁵⁴ *Ibid*, 4-5.

So, if we leave the U.S. out of the equation and focus our attention on Europe, it seems that Europe is an ideal candidate for space reform. ESA has the required scientific knowledge and the EU can push the political agenda. Making ESA an agency of the EU is an obstacle that needs to be overcome first, but this is not a substantial issue, since the will to join forces is clearly present and this decision only awaits execution.³⁵⁵ Nonetheless, in order to catch up with U.S. efforts regarding legislation, ESA and the EU will have to adapt at a rapid pace.

³⁵⁵ The date was set at 2014, but has not been met so far. ESA Agenda 2011, ESA Communications, September 2007, 25, <https://web.archive.org/web/20160303225015/http://www.esa.int/esapub/br/br268/br268.pdf>

9 Conclusion

The current space scene is undoubtedly up to change. Prevailing soft law treaties and vague standards lead to general dissatisfaction. But Rome was not built in one day: change cannot be secured overnight. A new system will only emerge after years, if not decades, of negotiations, information building, clarification, refinement and maybe most importantly international cooperation.

A first step is to clarify the vague provisions of the Outer Space Treaty. And when tasked with this responsibility, we must do so with an open mind. Progressive thinking should come first, because strict and narrow interpretations will not spark any further interest of governments and private enterprises whatsoever. Negotiations should be progressive, yet sustainable and with due regard for future generations and respect for the outer space environment.

From thereon out we must continue our efforts and strive towards a new treaty. It should allow states (and by extension private entities) minimal rights in order to successfully colonize Mars and other celestial bodies. There is no need for full sovereignty, abolition of the non-appropriation clause or violation of the province of mankind principle: the mere permission of several privileges to a state would suffice and the new treaty could be drawn up in a way that abides by the Outer Space Treaty. This new treaty could instate economic exclusive zones around landing areas and could institute a new organization overseeing all outer space activity and settle disputes. The vessels and habitats built on this area remain property of the sovereign state and national law applies on these surroundings, but the land underneath remains province of mankind and merely allows conditional exploration and exploitation rights.

In later stadia, when the first minor settlements are a fact, we must push our boundaries even further. We should be thinking about fundamental rights on extraterrestrial planets and we must acknowledge and respect self-determination of extraterrestrial settlers. If the time comes when space settlers ask for independence, we have the obligation to meet this demand. It is the only way to go forward and colonize planets beyond Mars. Neglecting these demands will undoubtedly lead to conflict and will be anything but a step forward.

We are at the verge of a new world order and we still hold all the cards in our hand. This gives humankind the opportunity to give the best of itself: a clean slate offers the opportunity to prove to future generations what we are capable

of. If we want to conquer outer space and turn it into a cosmic cathedral so to speak, we must start at the beginning. We can start by building small chapels on the Moon and Mars, but if we want to turn it into a magnificent universal monument the first and most important thing to do is build strong fundamentals. Not tomorrow, but today.

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All online sources were visited lastly on 13 May 2018.

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