



SCHOOL OF  
ECONOMICS AND  
MANAGEMENT

# **Houston, we have a problem...with patents.**

A legal analysis of the territorial scope of  
patents in space

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## Foreword

I have had a fantastic time at Lund University's School of Economics and Management. I want to thank all my amazing professors who have shared their knowledge and opened a new world for me.

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I want to thank my family, parents, relatives and friends who have been an incredible support throughout my studies.

Not to forget the most important person in my life, to my son Aleksandar; Space is timeless and endless - just like my love for you. Love your mom

## Keywords

**Keywords:** Patents, Space Law, Innovation, Res communis, Outer Space Treaty, Patent Infringement, Territoriality

## **Abstract**

In this thesis, the territorial scope of patent law in space is analyzed. The purpose and the research questions are: Do patents apply in space, and can an inventor be protected against unauthorized use of a patented invention made in space? Patents are a national territorial exclusive right that is not applicable in space because there is no jurisdiction. The “Big Five” space treaties were established in the 1960’s and still apply today. According to the *res communis* principle, it is not possible to own something in space because space belongs to all mankind. Other interests in space that are prioritized are national security and sovereignty and public interest. There are good reasons for solving the patent problem in space, because the commercialization in space is increasing and there are huge investments in R&D’s which end up in new great inventions that can benefit the public. The US is the only state with an adapted patent law for space, but it is only applicable if the space object is registered and launched in the US, and it does not protect against third-party infringement. The absence of an international legislation for patents in space makes the issue more difficult. It requires new solutions at national, European, and international levels. Forums such as the WTO, WIPO, and UN have the potential to address the question. However, there have been many political deadlocks that will delay the negotiations. An international agreement may be necessary for all states to join, preventing patent infringement and promoting economic, national, and public interests. A transparency and a drive to invent would have been beneficial, as there are many advantages to the extending patent protection to space. Earth is calling....for patents!

# Abbreviations

CNSA	China National Space Administration
EPC	European Patent Convention
EPO	European Patent Office
ESA	European Space Agency
EU	European Union
IGA	Intergovernmental Agreement
IP	Intellectual Property
ISS	International Space Station
NASA	National Aeronautics and Space Administration
PCT	Patent Cooperation Treaty
R&D	Research and Development
UN	United Nations
UNCLOS	United Nation Convention on the Law of the Sea
UNCOPUOS	The UN Committee on the Peaceful Uses of Space
UNOOSA	The United Nations Office for Outer Space Affairs
UPCA	Agreement on a Unified Patent Court
US	United States of America
WIPO	World Intellectual Property Organization
WTO	World Trade Organisation





# 1 Introduction

## 1.1 Background

Houston, we have a problem.... with patents!

Space is endless and timeless and there are several undiscovered materials that have yet to be found. Therefore, it is invested in enormous sums by both states and private actors in search for new, important innovations. When the treaty for Outer Space was founded in 1967 there was a will among other states to not let the US and Soviet Union, which were the only states that had the capacity to explore and use space during this time, have all the benefits from discoveries in space for all mankind. One of the main freedoms according to the treaty is the freedom to explore and to have access to space and all areas of celestial bodies without discrimination and for the benefit and interest of all countries.

Space activities are high-risk activities but there is also potentially a substantial reward available, both financially and of prestige.<sup>1</sup> Many states participate in space exploration, and it has increased as developing countries have begun using space programs to boost economic development. However, the space race has expanded into the private sector and economic incentives and national funding have led to a rise in space activity by the private actors.<sup>2</sup>

One of the main purposes with patents is to foster technological innovations by providing an incentive for research and development and for the rights holder to have an economic exclusive right.<sup>3</sup> Patents is a territorial right but is not valid in space because of the Outer Space Treaty's main principle of *res communis*<sup>4</sup> and that means that according to the treaties and legislation as it is today it is not possible to have exclusive rights in space. In other words-

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<sup>1</sup>Ram S.Jakhu, and Pelton *Global Space Governance, An International Study* (Springer 2017) p.118

<sup>2</sup> Hastings law journal

<sup>3</sup> One of the Main Functions of the Patent System<sup>1</sup>, WIPO

<sup>4</sup> *Res communis* - *Res communis* is a concept[1] or doctrine.[2] The expression is a Latin term derived from Roman law that preceded today's concepts of the commons and common heritage of mankind.[3] It has relevance in international law and common law.

you cannot own anything in space. That leaves complex issues to be able to enforce valid patents in space and stop infringement. Problems with determining the territorial right to patents in space have been raised in the past, but there have been no international legal changes in the area. De lege lata is that only the US has national patent legislation for inventions in space, but how effective is the national legislation when there are legal loopholes and when there is no international legal instrument that is applicable against a potential patent infringement made in space? There are many interests that are prioritized in space; national security interests, economic interests and the public interest which makes it difficult to say in which direction the legislators will choose to legislate in on an international, European or national level in the future. The thesis addresses the status of territorial effect of patents in space, do patents apply in space and can an inventor be protected against unauthorized use of a patented invention made in space?

## **1.2 Purpose and research questions**

The purpose of the thesis is to describe and analyze the legal problem with the territorial effect of a patent made in space and used in space. To fulfil the purpose above the research questions will be answered:

1. Do patents apply in space?
2. Can an inventor be protected against the unauthorized use of a patented invention made in space?

## **1.3 Delimitations**

The thesis is focused on the territorial principle for patents for inventions made for, used, or made in space and not to space-related material such as satellites that are Earth-bounded. This thesis focuses on the territoriality of patents in space and is not intended to be an in-depth analysis of international law or space law. The chapters concerning space law and international law

discuss legislation and agreements relevant to the purpose and the research question related to patents in space.

#### **1.4 Method and materials**

The method that is used for the thesis is the legal dogmatic method. It is not easy to describe the legal dogmatic method with just a few sentences. It is a way of explaining what one does and the purpose is often considered to be to find the solution to a legal problem.<sup>5</sup> This is done by applying the generally accepted sources of law found in legislation, case law, legislative works and monographs.<sup>6</sup> The materials that will be used are monograms and articles. One of the monograms that has been used is Handbook of Space Law by Von der Dunk and Fabio Tronchetti and especially chapter eighteen which introduces issues regarding patents and space activities. It has also been used three space law books with legal commentaries and legal preparatory work regarding the five most important space treaties, the so-called “Big Five”. An issue paper regarding intellectual property and space prepared by WIPO(World Intellectual Property Organization) has been an important source of information for the research question and further reading.

#### **1.5 Outline**

In the second chapter of the thesis, it will be about space laws. It begins with definitions of space-related terms. Afterwards, the most central space treaties and European and national space law will be presented in brief regarding the research question and how it is related to patents.

To understand which interests can collide with each other and which challenges exist with the legislation with space law related to patents, the third chapter will present the economic, national, and public interests that exist.

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<sup>5</sup> M.Nääv M.Zamboni *Juridisk metodlära* p.21

<sup>6</sup> M.Nääv M.Zamboni *Juridisk metodlära* p.21

In the fourth chapter, the patent legislation related to the territorial scope will be presented from different perspectives; international, European, and national. There are both de lege lata and normative aspects in the de lege feranda subchapter.

Finally, in the last and fifth chapter, there will be a final summary and conclusions for what has come out in all chapters connected to the research question.

## **2 Space Law**

### **2.1 Introduction**

Space law is not a new area of law, but it has become relevant in recent years due to the increased activity of both state and private actors in space. This has led to the addition of complex questions regarding what applies to space objects and their activities in space. The international treaties and agreements that apply to space law date from the late 1960s onwards. When the treaties were established, there were few countries that were engaged in space activities and its main purpose was to maintain peace and promote the access of all states to space. However, it has changed drastically during the last centuries. Many private enterprises make huge investments in space-related activities and even though it is a high-risk investment area it continues to grow. The global space industry is estimated to grow from 350 billion USD (US dollar) in 2020 to 1 trillion USD.<sup>7</sup> At the same time the main principles, such as the idea of outer space being accessible to all humanity, the freedom of space exploration and use by all nations without discrimination, and the prohibition of claiming ownership of outer space territories is the core for space law and that is why these interests lead us to complex legal issues. In the following chapter the core for space law is presented from an international, European and a national perspective.

### **2.2 Definition of Outer Space and Space objects**

When dealing with the research question we first need to define what Space law is. Space law is the body of law that governs space-related activities, and it is a variety of international agreements, treaties, conventions, and United Nations General Assembly resolutions as well as rules and regulations of international organizations.<sup>8</sup> Outer space is another definition that is

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<sup>7</sup> 'Investing in Space Inventions: Patent Protection for Space Technologies', Spruson

<sup>8</sup> 'Space Law', UNOOSA

important for the scope of matter and there are no generally recognized legal definition of outer space, but it is mentioned in the Registration Convention:

“When a space object is launched into earth orbit or beyond, the launching State shall register the space object by means of an entry in an appropriate registry which it shall maintain. Each launching State shall inform the Secretary- General of the United Nation of the establishment of such a registry.”<sup>9</sup>

As a result, it can be stated that a space object, *inter alia*, is an object that is launched into Earth Orbit or beyond.<sup>10</sup> It is also explained as where the air-space law no longer exists, and the space law begins. A space object can be defined as any object that is being launched, or has been launched, into those heights and beyond, whether into earth orbit. Space objects that are being launched beyond those heights are, ‘into outer space.’<sup>11</sup>

### **2.3 The Big Five and International Space Law**

Before the Outer space treaty was founded there were several unresolved issues that needed to be solved. One of the conflicts was that some states had interest in spacefaring and some states did not. There are of course various aspects of this question, but in fact there were only two countries that had the ability of doing spacefaring and that was the United States of America (USA) and Union of the Soviet Socialist Republics (USSR) during that time. It was also very costly to do space fare and there were only a few countries that had the economic capacity to invest in these advanced operations such as the USA, USSR, China, Germany, and France. In 1957 USSR was the first state to launch the first artificial satellite Sputnik.<sup>12</sup>

There was also a concern of military uses of outer space and that was outpointed in the negotiations of the Outer space Treaty.<sup>13</sup> During this time there was an ongoing cold war between the USA and USSR and as it was mentioned they were the only countries that had the capacity to start a war in

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<sup>9</sup> The Registration Convention, Article 2 para 1:

<sup>10</sup> Gangale T, *How high is the sky? The definition and delimitation of outer space and territorial airspace in international law* p.280

<sup>11</sup> Bin Cheng *Studies in International Space Law*. p.493

<sup>12</sup> Hobe, Schmidt- Tedd, Schrogl *Cologne Commentary on Space Law Vol. 1 Outer Space Treaty* p.2

<sup>13</sup> Hobe, Schmidt- Tedd, Schrogl *Cologne Commentary on Space Law Vol. 1 Outer Space Treaty* p.2

space. They were also the most developed countries within the military and its technology. The Outer space treaty was negotiated and established in 1967 and today are 126 states members and it is ratified by 100 states.<sup>14</sup> At this time as it is mentioned it was only states and not private commercial entities that were space actors, and therefore, according to article VI it was stated that States are responsible for under international law for all national activities in outer space and requires that States authorize and exercise continued supervision over activities of nongovernmental activities.<sup>15</sup>

“States Parties to the Treaty shall bear international responsibility for national activities in outer space, including the Moon and other celestial bodies, whether such activities are carried on by governmental agencies or by non-governmental entities, and for assuring that national activities are carried out in conformity with the provisions set forth in the present Treaty. The activities of non-governmental entities in outer space, including the Moon and other celestial bodies, shall require authorization and continuing supervision by the appropriate State Party to the Treaty. When activities are carried on in outer space, including the Moon and other celestial bodies, by an international organization, responsibility for compliance with this Treaty shall be borne both by the international organization and by the States Parties to the Treaty participating in such organization”.<sup>16</sup>

If there is a case of activities carried out by an international organization the responsibility will fall both on the organization and the participating state who is a member of the treaty.<sup>17</sup>The outer space treaty is still one of the main treaties and international agreement for space activities, but it does not address the patent and Intellectual Property(IP) issues specifically and that leads to gaps in the legislation. It is also important to have in mind that when the outer space treaty was negotiated the technology was not so technically advanced as it is today. The main principle for the outer space treaty is res communis and it means that space is common to all, and that the treaty provides for extensive freedom of scientific research and commercial use in outer space.<sup>18</sup> It is to be found in Article I in the Outer Space Treaty:

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<sup>14</sup> Hobe, Schmidt- Tedd, Schrogl Cologne Commentary on Space Law Vol. 1 Outer Space Treaty p.2

<sup>15</sup> Ram S.Jakhu,Pelton *Global Space Governance, An International Study* p.22

<sup>16</sup> Outer Space Treaty Article VI

<sup>17</sup> Ram S.Jakhu,Pelton *Global Space Governance, An International Study* p.121

<sup>18</sup> Auswärtiges Amt, ‘New Guidelines for International Cooperation’

The exploration and use of outer space, including the moon and other celestial bodies, shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development, and shall be the province of all mankind.

Outer space, including the moon and other celestial bodies, shall be free for exploration and use by all States without discrimination of any kind, on a basis of equality and in accordance with international law, and there shall be free access to all areas of celestial bodies.

There shall be freedom of scientific investigation in outer space, including the moon and other celestial bodies, and States shall facilitate and encourage international co-operation in such investigation.<sup>19</sup>

The definition of freedom for exploration and freedom of scientific investigation are important to have in mind as there has been questions whether there is a distinction between the “freedom”<sup>20</sup> or not. One may say that exploration is main findings and scientific investigations is more specific, other may say that they overlap each other.<sup>21</sup>

The other important treaty that was established was the rescue agreement and that was established in 1968 and builds on Articles 5 and 8 of the Outer Space Treaty, which stipulates that States shall take all possible measures to rescue and assist astronauts in distress and promptly return them to the launching State.<sup>22</sup> According to Article VIII in the Outer Space Treaty, each state is liable for damage caused by its space objects, whether such damage will take place on Earth’s surface, in the air or in space.

“A State Party to the Treaty on whose registry an object launched into outer space is carried shall retain jurisdiction and control over such object, and over any personnel thereof, while in outer space or on a celestial body. Ownership of objects launched into outer space, including objects landed or constructed on a celestial body, and of their component parts, is not affected by their presence in outer space or on a celestial body or by their return to the Earth.

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<sup>19</sup> Outer Space Treaty Article I

<sup>20</sup> Hobe, Schmidt-Tedd *Cologne Commentary on Space Law Vol 1 Outer Space treaty* p.34

<sup>21</sup> Hobe, Schmidt-Tedd *Cologne Commentary on Space Law Vol 1 Outer Space treaty* p.34

<sup>22</sup> 'SpaceLawTreatiesandPrinciples', UNOOSA



Such objects or component parts found beyond the limits of the State Party to the Treaty on whose registry they are carried shall be returned to that State Party, which shall, upon request, furnish identifying data prior to their return.”<sup>23</sup>

The Liability Convention is an expansion of article VII of the outer space treaty and is important for how private enterprises do risk management and make their business models and collaborate with the states.<sup>24</sup>

The Convention on International Liability for the Damage Caused by Space Objects is the third important international space legislation and may not be the most central for the patent question as such, but it is important to know that states have the liability to register the space objects that they are responsible for both to the UN(United nation) and their national authorities<sup>25</sup> when it is launched into earth orbit or beyond.<sup>26</sup>

The Convention on Registration of Objects Launched into Outer Space is the fourth convention, and its aim is to make provision for a mechanism that provides States with a means to assist in the identification of space objects, the Registration Convention expanded the scope of the United Nations Register of Objects Launched into Outer Space.<sup>27</sup> Its aim was to identify and register space vehicles and co-ordination of launchings. That would help aid in tracking the objects, provide a means to notify other states, be useful to avoid physical interference between space objects and aircraft and aid in the retrieval of objects which returned to Earth.<sup>28</sup>

Finally, the fifth important space law legislation is the Agreement Governing the Activities of States on the Moon and Other Celestial Bodies (1979 Moon Agreement). This agreement supports the outer space treaty and reinforces the view that the moon and other celestial bodies are not subject to intellectual property rights.<sup>29</sup> It stipulates that these bodies should be used solely for

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<sup>23</sup> Outer Space Treaty Article VIII

<sup>24</sup> Ram S.Jakhu, Pelton *Global Space Governance, An International Study* p.121

<sup>25</sup> 'Online Index of Objects Launched into Outer Space', UNOOSA

<sup>26</sup> 'Online Index of Objects Launched into Outer Space', UNOOSA

<sup>27</sup> Hobe, Schmidt-Tedd *Cologne Commentary on Space Law Vol II* p.234

<sup>28</sup> Hobe, Schmidt-Tedd *Cologne Commentary on Space Law Vol II* p.234

<sup>29</sup> 'The Moon Agreement', UNOOSA

peaceful purposes, their environments must not be disrupted, and the UN must be informed about the location and purpose of any stations established on them.<sup>30</sup> Moreover, the agreement declares that the Moon and its natural resources are the common heritage of humankind and that an international regime should be established to regulate the exploitation of these resources when it becomes feasible.<sup>31</sup>

These five treaties are ratified in many states and applied in national legislations. The UN has been the principal forum for the development of international law since the inception of human activities in other space.<sup>32</sup> A specific UN body was established, the UN Committee on the Peaceful Uses of Outer Space (UNCOPUOS). With the big five treaties which was a very productive space-law making period it turned into a different development with more principles, guidelines and recommendations, so-called soft-law<sup>33</sup> in the UNCOPUOS, now named The United Nations Office for Outer Space Affairs (UNOOSA).<sup>34</sup>

## 2.4 ISS and Tiangong

In space there are two space stations in orbit: The International Space Station (ISS) and the Tiangong Space Station.<sup>35</sup> The ISS is a collaborative effort by five space agencies from fifteen countries and Tiangong is operated solely by China National Space Administration (CNSA) and ISS was founded in 1984 and CNSA in 1993.<sup>36</sup> In these space stations there, research is performed regularly going on and other space objects should be reported to the ISS. The question arises which legal framework will be applicable when an innovation needs to be patented and it must be reported to the ISS, then there will be a risk of early disclosure and the patent will not be valid and according to the novelty criteria.<sup>37</sup> At the ISS there is a lot of cross boarding state research

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<sup>30</sup> 'The Moon Agreement', UNOOSA

<sup>31</sup> 'The Moon Agreement', UNOOSA

<sup>32</sup> Hobe, Schmidt-Tedd *Cologne Commentary Law Vol III* p.XXXV

<sup>33</sup> Hobe, Schmidt-Tedd *Cologne Commentary Law Vol III* p.XXXV

<sup>34</sup> 'History of UNOOSA', UNOOSA

<sup>31</sup> 'Space Law: National Legislation', UNOOSA

<sup>36</sup> China National Space Administration, 'English Homepage'

<sup>37</sup> This is to be found in EPC article 54.

going on and for a patented innovation it can potentially be unclear which jurisdiction that should be applicable if the infringement occurs in space. Another reflection is that each state has ownership and control over the modules it provides, and this means that the ISS is a collection of nationally owned space components rather than an "international" space station per se.<sup>38</sup> At the ISS, Article 21 of the Intergovernmental Agreement (IGA), the courts of each partner country have jurisdiction over their respective modules, and they can apply their own national laws there.<sup>39</sup> This means that the different IP laws of each partner must coexist.<sup>40</sup> For instance, if an invention is realized in a USA space element the USA Patent Act will be applicable as the invention is considered to have occurred on US territory.<sup>41</sup>

More in detail the agreement of Article 21 of the IGA says that the ownership of the patents is typically allocated to the partner nation that develops them. When an invention is created through the collaboration of multiple states crew, the partner states involved negotiate to set the ownership, usage rights, and benefit-sharing arrangements.<sup>42</sup> This ensures all contributing parties have their interests protected and appropriately recognized.<sup>43</sup> The IGA allows for the commercialization of IP developed on the ISS under the laws and regulations of the nation that holds the IP rights.<sup>44</sup> This is intended to encourage innovation and the practical application of space-related research. The agreement promotes the sharing of data and research findings for non-commercial purposes, which is fundamental for scientific advancement and cooperation.<sup>45</sup> However, specific rights and obligations related to the dissemination of such data can be regulated by each partner state's national laws.<sup>46</sup> Each partner state is responsible for protecting and enforcing IP rights according to its own national laws. This includes acting appropriately against unauthorized use of IP that is developed under the scope of the ISS

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<sup>38</sup>'Patents and Space-Related Inventions', ESA

<sup>39</sup>'Patents and Space-Related Inventions', ESA.

<sup>40</sup>'Patents and Space-Related Inventions', ESA

<sup>41</sup>Patents and Space-Related Inventions', ESA

<sup>42</sup>'Space Station Intergovernmental Agreement', Aerospace

<sup>43</sup>'Space Station Intergovernmental Agreement', Aerospace

<sup>44</sup>'Space Station Intergovernmental Agreement', Aerospace

<sup>45</sup>'Space Station Intergovernmental Agreement', Aerospace

<sup>46</sup>'Space Station Intergovernmental Agreement', Aerospace

activities.<sup>47</sup> The IGA provides mechanisms for resolving disputes related to IP, including consultation and negotiation between the involved parties, and, if necessary, arbitration.<sup>48</sup>

At the ISS there have been particularly important research results for fundamental diseases such as cancer, asthma, Parkinson, and Alzheimer's. By studying cells, organoids, and protein clusters without the influence of gravity can help researchers get a better understanding of their properties, behaviors, and responses to treatments.<sup>49</sup> There has also been a remarkably successful drug development using protein crystals and that has led to new medications and effective treatments.<sup>50</sup> Within the pharmaceutical industry there are a lot of incentives to invest in patents to get exclusive economic rights and therefore the ISS and the research in space is important for their sector.

The increasing activities of private actors in the exploration and use of outer space has led to a need for national space law and regulations. This can be complex because they are not directly bound by international treaties and other norms of public international law, so it is necessary to implement national law which is applicable to space activities that are carried out by private actors.<sup>51</sup> The advantage with national legislation is that it is applicable and enforceable in that state, but it does not exist in all states and there could be big differences between the states that collaborate in space. This has been a problem at the ISS regarding patentable inventions made onboard which has needed clarification in the International Agreement concluded by participating states.<sup>52</sup> It points out the need for a comprehensive international regime that could potentially harmonize relevant national regulations and approaches.<sup>53</sup>

Regarding the Tiangong space station there is only one state that controls the entity therefore it is easier to apply Chinese national legislation and the issues

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<sup>47</sup> 'Space Station Intergovernmental Agreement', Aerospace.

<sup>48</sup> 'Space Station Intergovernmental Agreement', Aerospace.

<sup>49</sup> NASA, '20 Breakthroughs from 20 Years of Science Aboard the International Space Station'.

<sup>50</sup> NASA, '20 Breakthroughs from 20 Years of Science Aboard the International Space Station' <https://www.nasa.gov/feature/nasa-20-breakthroughs-from-20-years-of-science-aboard-the-international-space-station>.

<sup>51</sup> Von der Dunk, F. Tronchetti *Handbook of Space Law* p.128

<sup>52</sup> Von der Dunk, F. Tronchetti *Handbook of Space Law* p.950

<sup>53</sup> Von der Dunk, F. Tronchetti *Handbook of Space Law* p.95

that need to be managed at the ISS are not addressed at the Tiangong. China was excluded from the ISS program mostly because of the links with the People's Liberation Army, the military branch of the ruling Communist Party<sup>54</sup>, so they built their own space station.

## 2.5 Space Agencies

There are seventy-seven space agencies and sixteen which have launch capabilities.<sup>55</sup> The European Space Agency (ESA) is an intergovernmental organization, and its aim is to shape the development of Europe's space capability and ensure that investment in space continues to deliver benefits to the citizens of Europe and the world.<sup>56</sup> ESA's activities are focused on ensuring that space technology and applications are developed and used for peaceful, scientific purposes across Europe.<sup>57</sup> ESA was established in 1975 and has twenty-two member states which contributes to the funding and decision-making. This is different from the National Aeronautics and Space Administration (NASA) which is under direct control from the US government and their interests.<sup>58</sup> NASA is the biggest space agency, with an annual budget of more than \$22 billion for 2020.<sup>59</sup> One of the next big future missions of NASA is the Artemis mission which aims to establish a permanent base on the moon by 2028.<sup>60</sup> NASA has developed "THE ARTEMIS ACCORDS PRINCIPLES FOR COOPERATION IN THE CIVIL EXPLORATION AND USE OF THE MOON, MARS, COMETS, AND ASTEROIDS FOR PEACEFUL PURPOSES".<sup>61</sup> Intellectual property is being mentioned in article 2 (1) b and there is also so called "safety zones", to avoid harmful interference.<sup>62</sup> To be noticed, this is a non-binding bilateral arrangements between the US government and other world governments that

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<sup>54</sup> 'Tiangong Space Station', Space.com.

<sup>55</sup> 'Space Agencies Around the World', Space Crew.

<sup>56</sup> European Space Agency, 'ESA Facts' (6 May 2024)

<sup>57</sup> European Space Agency, 'ESA Facts' (6 May 2024)

<sup>58</sup> 'NASA Organization', NASA .

<sup>59</sup> 'Space Agencies Around the World', Space Crew.

<sup>60</sup> 'Space Agencies Around the World', Space Crew.

<sup>61</sup> 'Artemis Accords', NASA

<sup>62</sup> 'The Artemis Accords', Wikipedia para 7

works in space.<sup>63</sup> However, there has been critics regarding the “safety zones” that breaches against article 2 in the Outer Space Treaty.<sup>64</sup> ESA's structure inherently involves a higher level of international cooperation due to its multi-nation membership. ESA often collaborates with other nations on specific projects, like the development of the Ariane launch vehicle or the ExoMars rover with Russia.<sup>65</sup> There are other important space agencies in: Russia, China, Europe, Canada, Japan, and India.<sup>66</sup>

## 2.6 EU Law and Space

According to EU primary law TFEU Article 189:

“1. To promote scientific and technical progress, industrial competitiveness and the implementation of its policies, the Union shall draw up a European space policy. To this end, it may promote joint initiatives, support research and technological development and coordinate the efforts needed for the exploration and exploitation of space.

2. To contribute to attaining the objectives referred to in paragraph 1, the European Parliament and the Council, acting in accordance with the ordinary legislative procedure, shall establish the necessary measures, which may take the form of a European space program, excluding any harmonisation of the laws and regulations of the Member States.

3. The Union shall establish any appropriate relations with the European Space Agency.

4. This Article shall be without prejudice to the other provisions of this Title.”<sup>67</sup>

The EU want to develop a European space policy to support scientific and technological progress and industrial competitiveness. This includes promoting joint initiatives, supporting research and technological development, and coordinating efforts in the exploration and exploitation of space. This means that the Parliament and the Council have the power to legislate on space-related matters to support and implement European space policy, but it does not mean harmonizing Member States' laws and regulations on these matters. Therefore, it is up to each member state to retain its national

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<sup>63</sup> 'The Artemis Accords', Wikipedia

<sup>64</sup> 'The Artemis Accords', Reddie & Grose

<sup>65</sup> 'Ariane', ESA

<sup>66</sup> 'Space Agencies Around the World', Space Crew

<sup>67</sup> Article 189 TFEU

legislation and it is also applicable in the matter of patents if it is to be interpreted according to primary law. It specifies that the EU shall establish appropriate relations with the European Space Agency and they recognize ESA's role as a key player in Europe's space activities and the need for cooperation between the EU and ESA.

A document from the council of the European Union dated in 2020 named "Orientations on the European contribution in establishing key principles for the global space economy" had as a main purpose to support the developing European space economy after the Covid-19 crisis.<sup>68</sup> They highlighted the importance of innovation, particularly by facilitating access to finance and funding opportunities to start-ups.<sup>69</sup> They also called for space entrepreneurship and building a globally competitive and strong European economy.

However, there is a new strategy from the EU now regarding space legislation where security and environmental perspectives are in prior. The proposal "European Union Space Strategy for Security and Defense" highlights space as a strategic domain for the EU and its member states, focusing on protecting space infrastructure against growing threats.<sup>70</sup> The strategy calls for increased resilience and protection of EU space systems and services through closer cooperation and information sharing among member states and strengthened technological sovereignty within the EU's space sector. It also addresses the need to develop the ability for EU autonomous access to space and enhance the use of space for security and defense.<sup>71</sup> The approach that has been set up for a new space legislation does not address issues with focus on exclusive rights and intellectual property.

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<sup>68</sup> Council of the European Union, 'Special meeting of the European Council (1 and 2 October 2020)

<sup>69</sup> Council of the European Union, 'Special meeting of the European Council (1 and 2 October 2020) – Conclusions' (2 October 2020) ST 12851 2020 INIT

<sup>70</sup> European Commission and High Representative of the Union for Foreign Affairs and Security Policy, 'Joint Communication to the European Parliament and the Council on the Update of the EU Maritime Security Strategy and its Action Plan' JOIN(2023)

<sup>71</sup> European Commission and High Representative of the Union for Foreign Affairs and Security Policy, 'Joint Communication to the European Parliament and the Council on the Update of the EU Maritime Security Strategy and its Action Plan' JOIN(2023)

## 2.7 National Space Law

Even though there are several states that ratified the "Big Five" treaties and conventions, it is important to note the existence of national space law.<sup>72</sup> States have different structures for their space legislation and some states have adapted their national legal frameworks according to the specific needs and practical considerations of the range of space activities conducted and the level of involvement of non-governmental entities.<sup>73</sup> Some states have just added unified acts or have a combination of national legal instruments.<sup>74</sup> It is also important to know that Extra-territorial application of national laws and the question whether space craft or a space station can be deemed as part of the territory of a country also plays a role.<sup>75</sup> This divergence can primarily be attributed to variations in levels of space activity among states, depending on if they have the capacity to invest in space or have a necessity to protect national security interests. Some prominent examples of that are the US, Germany, France, and Italy.

Potential problems and disputes which States may consider when enacting regulatory frameworks for national space activities range, for example, from the launch of objects into and their return from outer space, the operation of a launch or re-entry site and the operation and control of space objects in orbit to the design and manufacture of spacecraft, the application of space science and technology, and exploration activities and research.<sup>76</sup> On the other hand, with national space law making for the view of increasing participation of non-governmental entities in space activities, appropriate

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<sup>72</sup> United Nations Office for Outer Space Affairs, 'National Space Law

<sup>73</sup> United Nations Office for Outer Space Affairs, 'National Space Law'

<sup>74</sup> United Nations Office for Outer Space Affairs

<sup>75</sup> World Intellectual Property Organization, 'The Legal Status of Inventions Made and Used in Outer Space'

<sup>76</sup> United Nations Office for Outer Space Affairs, 'National Space Law'



action at the national level is needed, with respect to the authorization and supervision of space activities.<sup>77</sup>

## **2.8 Summary and Conclusions**

Space law has grown in importance because of increased activities in outer space by both governmental and private entities, necessitating complex legal frameworks to address new challenges. The main principles of space law centered on peace, accessibility, and non-appropriation of outer space, originate from international treaties dating back to the 1960s. At first these principles were established when space activities were limited to a few countries, but it has changed a lot with numerous private companies now venturing into space, stimulating by its potential economic benefits. The expansion of the space industry, estimated to grow to 1 trillion USD, introduces complicated legal issues that are addressed through a combination of international treaties, conventions, and national laws.

The definition of outer space and space objects is an important key, but there is no universally accepted legal definition of outer space, it encloses the area beyond Earth's atmosphere where air space law stops to apply. Space objects include anything launched into orbit or beyond, with international obligations requiring registration and continual supervision by the launching state.

Historical developments in space law arose during the Cold War, when only the USA and USSR had the capability for space exploration. This era highlighted the need for international agreements to manage a potential militarization of space and ensure peaceful exploration. The 1967 Outer Space Treaty, a cornerstone of space law, emphasizes that space exploration must be for the benefit of all humankind, prohibiting national claims on

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<sup>77</sup> United Nations Office for Outer Space Affairs, 'National Space Law'

celestial territories and requiring state responsibility for space activities, including those by private or international entities.

Further issues in space law include the management of intellectual property rights, as the treaties primarily focus on exploration and use but do not address commercial aspects like patents and exclusive rights. The Liability Convention and the Registration Convention provide mechanisms for accountability and identification of space objects, key factors for managing potential damage or disputes. Agreements like the 1968 Rescue Agreement and the 1979 Moon Agreement regulate activities on celestial bodies, encouraging peaceful purposes and the protection of the environment. The moon agreement declares the Moon and its resources as the common heritage of humankind.

The ISS and China's Tiangong Space Station illustrate two different current practices in space governance. The ISS, managed through international collaboration, involves complex jurisdictional issues regarding ownership and territorial affiliation. In contrast, Tiangong operates solely under Chinese jurisdiction, presenting a simpler legal framework but with its own set of challenges. At the national level, countries have developed their own space laws to accommodate specific needs, influenced by their capacities and interests in space activities. These laws can vary, reflecting the diverse approaches to addressing the security, economic, and scientific aspects of space activities. In conclusion, space law is a dynamic law field that must adapt to its nature of space activities. With the increasing involvement of private enterprises and the ongoing development of space technology, there is a huge need for a comprehensive international legal regime that can harmonize the different national laws and ensure that space remains a realm for peaceful and non-discriminating exploration and use and still encourage investment in Research and Development(R&D) and economic growth.

## 3 Different Interests in Space

### 3.1 Introduction

To understand the complexity of whether patents apply in space, it is important to understand what it is that attracts patents in space and what conflicting interests that exist. Patents are strongly associated with R&D and private actors who make investments in exclusive rights that they can use, sell, or license out. However, with the current legislation in space, *res communis* prevails. One of the foundational motivations for the Outer Space Treaty was the concern over military uses in space, a fear that still exists. At the same time, the national interests are in great focus to ensure the security of all states. These arguments are, in a sense, intertwined with the legal preparations that exist for the outer space treaty whose aim was to use space for peaceful uses.

### 3.2 R&D and Economic Interests in Space

R&D are the main incentives for filing for patents and are used in many sectors such as chemical engineering, computer technology, medical technology, and IT methods for management.<sup>78</sup> In space, scientific research is ongoing with examples such as solar and space physics, exploration of the planets, study of the origin, microgravity and observing earth. Many of the benefits of the research so far is within the field of combating climate changes.

One of the reasons that the Outer space treaty was founded was due to the fear of militarization of space with many of these fears still present today. Today's armed forces rely on space-based assets for reconnaissance, weather tracking, communication, navigation to name a few examples.<sup>79</sup> Regular

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<sup>78</sup> World Intellectual Property Organization, 'WIPO Director General Underlines Commitment to Sustainable Development on World IP Day 2023'

<sup>79</sup>Space.com, 'Military Space'

launches of GPS and missile-defense tracking satellites are made by the U.S Air Force.

The benefits of finding new uses and innovating in space has made it to a large growing business for new space related companies. It is very costly and related to high-risk activity. However, there is a lot to win as well, because space provides conditions that cannot be replicated or are difficult to replicate on Earth: microgravity, vacuum, extreme temperature, and intense radiation.<sup>80</sup> The private companies invest a lot of money, but it is still a cheaper alternative to reach space.

Collaboration between research and technology development has also led to the fact that it will soon be possible to land on different celestial bodies.<sup>81</sup> The interest from collecting samples has shifted to experiments on extracting raw materials from the celestial bodies to produce new inventions.<sup>82</sup> It is difficult to say what will happen in the future, but it is one too certain that research is moving very quickly in space technology.

Space science and exploration remains a key mission for agencies in about fifty countries and was estimated to 250 billion euros in 2019 and more than one million people are employed worldwide in the space sector.<sup>83</sup>

From an economic perspective, the incentives to file for patents in space is heavily influenced by R&D and it is an especially key factor for further investment. The collaborative connection between research and technology development in space is setting the way for future missions that could include landing various celestial bodies. Since the late 1950's, humans in space have, with very few exceptions, been restricted to highly trained astronauts. In the future there is an increasing expectation that technologies will make it possible for the public to visit and vacation in space.<sup>84</sup> The potential space tourism experiences include destinations such as space stations, moons,

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<sup>80</sup>Institute for Defense Analyses, 'Study on [Defense an.] p.2

<sup>81</sup> 'En Ny Rymdlag SOU 2021:91',

<sup>82</sup> 'En Ny Rymdlag SOU 2021:91'

<sup>83</sup> European Patent Office, 'Space

<sup>84</sup> 'Space Tourism', NASA

planets, and asteroids.<sup>85</sup> This sector's growth not only highlights the ongoing interest and investment in space technologies but also emphasizes the critical role of international cooperation and innovation in shaping the future of space exploration and utilization. It is also important to see that as this new industry develops, companies are finding creative ways to use outer space activity to increase their profits and productivity on Earth as well.<sup>86</sup>

### 3.3 National Interests in Space

On the one hand there are several incentives to drive economic interest with innovation and R&D in space which can result in patents and exclusive rights. On the other hand, space and its legislation are based on peaceful uses and where there is no ownership, because space and celestial bodies belong to all humankind. The focus that has been the last years in both international and national legislation regarding space is to secure national security. It is clearly noticeable that the budget for military and national security is increasingly prioritized given that there are ongoing wars around the world. Space operations have always had significant elements of national foreign, security and defense policy interests.<sup>87</sup> The role that space plays in security issues is important and it is crucial in missile warning and tracking, precision navigation, and global communication.<sup>88</sup> The legislation stipulates that everything that is launched into space must be registered and that the states themselves are always responsible for what happens, regardless of whether it is a private or public actor that is sent out. It provides additional incentives for national interests to come first and in this case, it may happen that the economic interests must stand aside. What also comes up in this question is whether a state can own or stop an innovation or invention that they consider to be a threat to the nation. With proposals in various states and in the EU, national security interests are prioritized. There

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<sup>85</sup> 'Space Tourism', NASA

<sup>86</sup> Joshua J. Schroeder, 'The Regulation of Space Weapons: Ensuring Stability and Security in Outer Space' (2020) 18 Santa Clara Journal of International Law 1.

<sup>87</sup> En Ny Rymdlag SOU 2021:91' p.68

<sup>88</sup> 'Defense News', U.S. Department of Defense

is a threat that some states will advance their space technology and use them for military purposes. There is also a concern that inventions involving national security might be disclosed in foreign countries by way of filing patent applications abroad.<sup>89</sup> If such a requirement is imposed in relation to international cooperation activities in an international space station, it might have a negative effect on the sharing of elements for research and on the collaboration of researchers from different countries.

### **3.4 Public Interest in Space**

Within the public interest there is an interest in access to knowledge and information derived from space activities and in terms of the freedom of exploration and use of outer space. This collides with the importance of intellectual property for the exploration of outer space and further R&D of science and technology.<sup>90</sup> The public interest goes in line with the space treaty and *res communis*, that space should be common to all. If there is an important innovation invented in space there usually is a huge public interest, and it could also be very connected to a discovery which is not covered by patent law. One example could be if there is an invention made in space that will solve the climate change on earth or if there is a medicine that can cure an autoimmune disease. Then it can be a matter of compulsory licenses, and it is up to national courts to decide whether there will be a compulsory license and which remuneration it will be. According to the outer space treaty space activities are a part of the global public interest, meaning they should benefit humanity, not just individual nations, or entities.<sup>91</sup> The public interest in space faces challenges such as the dominance of state and private economic interests that may not always be

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<sup>89</sup> 'Defense News', U.S. Department of Defense

<sup>90</sup> 'WIPO: Patents and Space', WIPO

<sup>91</sup> J. Fawcett, 'Outer Space: A New Dimension in the Law' (1995) 11(2) Space Policy

profitable with the global good according to critics.<sup>92</sup> De lege lata is more in line with the public interest, but that can change if there will be a new space legislation.

### **3.5 Summary and Conclusions**

In the complex interplay between different interests in space, the concepts of economic, national, and public interest are central to the issue of space and patents. Public interest includes the peaceful use of space with the principle of *res communis*. Economic interest, on the other hand, focuses on R&D in space which are the main incentives for investment in patents. It addresses the benefits of research mechanisms and how it relates to patents. The aim is primarily to promote economic growth through innovations and R&D. The connection between research and technological development in space is important for future missions, including space tourism. This growing sector not only reinforces continued interest and investment in space technology, but also highlights the critical role that international collaboration and innovation play in shaping the future of space exploration and use. The national interest, which includes the strategic priorities that protect a nation's sovereignty and security, is increasingly prioritized in both European and national legislation. This means with other words that national interests comes first and the economic interests and the issue of patents in space comes secondary according to the legislators

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<sup>92</sup> J. Fawcett, 'Outer Space: A New Dimension in the Law' (1995) 11(2) Space Policy 111

## 4 Patents in Space

### 4.1 Introduction

The legal status of tangible assets, such as spaceships and satellites, in outer space has often been addressed in United Nations agreements, bilateral and multilateral treaties, national declarations, intergovernmental organization resolutions, international commission efforts, and research by nongovernmental organizations. However, there is still no global consensus regarding the status of intangible assets, particularly intellectual property, and patents.

Patents are an economic exclusive right and play a significant role in protecting inventors and promoting innovation.<sup>93</sup> There are a few diverse ways to describe the problems with patents in space. On the one hand, there are those innovations which have patents in one or more jurisdictions on earth, but which do not apply in space, for example a spacesuit. On the other hand, there are innovations that are created and even made in space, that cannot be patented because there are no intellectual property rights in space. If there were only governmental space activity or a few private actors in space there would not be such a need for such regulations for patents in space, but it has grown to a fast-growing business and new complex patent issues arise.

In fast-growing sectors such as the space industry, there is often an unwillingness to start legal disputes with competitors, as this can under-stimulate innovation and future business opportunities. Patents are more important for adding value to a company's portfolio rather than the use of tools for litigation.<sup>94</sup> But how can patents be applied in space? And can an inventor be protected against the unauthorized use of a patented invention made in space?

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<sup>93</sup> WIPO Magazine Article', WIPO

<sup>94</sup> HGF, 'Investing in Patents for Space Tech: Safeguarding Innovations in the Space Sector'



## 4.2 The Patent Space Scenarios

There are many patents legal challenges in the space that follows, but initially the primary criterion is that a patent is territorial and if that requirement is not fulfilled then novelty, inventive step and industrial applicability cannot either. There can also be challenges with whether it is a discovery or an invention, because discoveries are not applicable on patents, but that is another question, and it is not something that the thesis aims at. Territoriality does not fit the space industry as it is terrestrial construct with state borders and other boundaries.<sup>95</sup> Generally, except for the Unitary Patent, a patent is always valid in a certain country depending on where the inventor or the right holder applied for the patent. National patent offices examine the applications and grant the patents. Infringement and invalidity disputes are ruled by national courts.<sup>96</sup> It is important to know how to file patent applications in different jurisdictions because there are differences.

De lege lata is that it is possible to patent and protect innovations on Earth and implement it on the innovation before launch. There are three scenarios regarding patents in space.

An Earth invention with space application: there are examples of that such as the solar panels on the ISS which illustrates an idea produced on earth that was implemented in space.<sup>97</sup> But it must be clarified before launching with a license, however, there still can be issues regarding the ownership in space as there is no patent protection or ownership in space.

The second scenario is a space invention and an Earth application which is a much more complex question, because it is not realistically feasible to establish which jurisdiction will have applicability on innovations connected to outer space when they are made outside of the geographical borders of the nation.<sup>98</sup> Even though the US has their own patent legislation for patents in

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<sup>95</sup> Talbot D'Alemberte, 'The International Lawyer's Changing Role in Space Law Development' (1982) 5 Washington International Law Journal 493

<sup>96</sup>B.Domeij *Patenträtt* p. 15

<sup>97</sup> 'IP Rights and Outer Space', Global Patent Filing

<sup>98</sup>Harsha Parakh, 'IP Rights and Outer Space'

space that, is only one state that has legislation for patents, and it is not compatible with other international space law and treaties.

The third scenario is a space invention made and used in space, a space application which will fall under no jurisdiction and where there is no legal framework that is applicable.

The relationship between innovations in space and their applications on Earth presents a complex legal challenge, particularly when it comes to determining jurisdictional authority over inventions created beyond any nation's territorial limits. For the moment, there is no clear answer on how to legally manage these space-based innovations.<sup>99</sup> However, there are some leading questions that could be asked: (1) what is classified as a space invention (2) which nation's patent law applies to activities in space; (3) what qualifies as infringing activity<sup>100</sup>. The question of what is classified as a space invention is more important than we think because a discovery for example does not fall under the scope of patentability.

### **4.3 The Rightsholder to the Patent**

Once a rightsholder of a patent has exclusive rights, they can do what they want with their patents such as preventing third parties not having the owner's consent from the acts of making, using, offering for sale, selling, or importing for these purposes the patented invention.<sup>101</sup> The rightsholder can get 20 years of exclusive rights from the filing date.<sup>102</sup> In return the rightsholders are obliged to publicly disclose information on their invention to enrich the total body of technical knowledge in the world and it promotes further creativity and innovation by others.<sup>103</sup> Patents are territorial titles and that the exclusive rights granted are only valid and enforceable in the

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<sup>99</sup> Harsha Parakh, 'IP Rights and Outer Space'

<sup>100</sup>Max S Oppenheimer, 'Is the Sky the Limit?: Patent Implications of Discoveries Made in Outer Space' (2019) 84 Brooklyn Law Review

<sup>101</sup> World Intellectual Property Organization, 'Intellectual Property and Space Activities' (WIPO, 2019)

<sup>102</sup> World Intellectual Property Organization, 'Intellectual Property and Space Activities'

<sup>103</sup> World Intellectual Property Organization, 'Intellectual Property and Space Activities'

jurisdiction(s) where the patent has been secured.<sup>104</sup> The definition of a territory is an area of land under the jurisdiction of a ruler or state.<sup>105</sup>

In general, patents are enforceable only within the territorial boundaries of the countries designated. Outer space, like the high seas and Antarctica, is not subject to national appropriation and does not fall under any national sovereignty, therefore, it cannot be appropriated by use, claim or any other means.<sup>106</sup> The most recognized agreement regarding the high seas is the United Nations Convention on the Law of the Sea (UNCLOS) (1982).<sup>107</sup>

Regarding the applicability of national patent regulations, problems occur when an invention is used or infringed in outer space, because these regulations are applicable only on the territory of the specified state which, by definition, excludes the extraterritorial domain of outer space.<sup>108</sup> Therefore, the exclusive rights to the patents are not valid in space and neither is a patented innovation protected from infringement in space. Problems occur with states collaborating in different space projects and that it is not always clear who the rightsholder to the patent is. Even if the thesis does not discuss the intervention of the states, it cannot be avoided that what happens in space is the liability of the states for both governmental and private actors. Then the rightsholder cannot get exclusive rights but not either get sued for an infringement unless there is an agreement that says it can. For a rightsholder it is crucial to have a valid ownership to secure exclusive rights.

#### **4.4 International Patent Law Perspective**

On an international level the basic principles governing patent protection are to be found in the Paris convention for the Protection of Industrial Property which is accepted in 195 nations worldwide<sup>109</sup> and has 180 member states.<sup>110</sup> It codifies the national treatment principle as well as the rules on priority of

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<sup>104</sup> Intellectual Property Helpdesk', European Commission

<sup>105</sup> Oxford English Dictionary

<sup>106</sup> European Space Agency, 'Patents and Space-Related Inventions'

<sup>107</sup> 'WIPO Magazine Article', WIPO

<sup>108</sup> European Space Agency, 'Patents and Space-Related Inventions'

<sup>109</sup> World Intellectual Property Organization, 'Paris Convention for the Protection of Industrial Property'

<sup>110</sup> World Intellectual Property Organization, 'Paris Convention for the Protection of Industrial Property'

filing the invention.<sup>111</sup> However, the Paris Convention does not contain the criteria for patentability of inventions, this is a matter to the national legislation of the contracting parties. That is why it may have some differences in various jurisdictions in the absence of relevant rules adopted and accepted internationally.<sup>112</sup> That is why there is a need for either national patent law or ad hoc agreements to make a successful project or mission when it is an international participation.<sup>113</sup>

“Patents: Patented Devices Forming Part of Vessels, Aircraft, or Land Vehicles

In any country of the Union the following shall not be considered as infringements of the rights of a patentee:

(I) the use on board vessels of other countries of the Union of devices forming the subject of his patent in the body of the vessel, in the machinery, tackle, gear and other accessories, when such vessels temporarily or accidentally enter the waters of the said country, provided that such devices are used there exclusively for the needs of the vessel.

(II) the use of devices forming the subject of the patent in the construction or operation of aircraft or land vehicles of other countries of the Union, or of accessories of such aircraft or land vehicles, when those aircraft or land vehicles temporarily or accidentally enter the said country.”<sup>114</sup>

There is a problem with clarity as to applicability to space activities of the exception in Article 5ter of the Paris Convention regarding passage of ships, aircraft and land vehicles carrying potentially infringing equipment through territories of states where such equipment or its parts are subject to patent protection.<sup>115</sup> There are several problems with this exception, and it is also called the “flag of convenience” registries and it raises concerns about patent enforcement. The way of avoiding global patent infringement liability by using the temporary presence exception is to take advantage of "flag of convenience" registries.<sup>116</sup> This can be done by registering in countries into which a vessel never enters or by registering in a state with a weak patent

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<sup>111</sup> Handbook of Space Law Von der Dunk, F. Tronchetti 2015 Elgar p.973

<sup>112</sup> Handbook of Space Law Von der Dunk, F. Tronchetti 2015 Elgar p.973

<sup>113</sup> Handbook of Space Law Von der Dunk, F. Tronchetti 2015 Elgar p.973

<sup>114</sup> Article 5ter of the Paris Convention

<sup>115</sup> Handbook of Space Law Von der Dunk, F. Tronchetti 2015 Elgar p.981

<sup>116</sup> George S. Robinson, ‘The Impact of the International Space Station on the Development of Outer Space Law’ (2000) 6 Michigan Telecommunications and Technology Law Review 69 .p.37

system.<sup>117</sup> For the purposes of this example, a weak patent system refers to systems in which judicial enforcement of patent rights is ineffective or in which the scope of patents is less than strong.<sup>118</sup>

The Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS Agreement) does not specifically address the question of outer space as such.

In addition to the principle of national treatment in Article 3.1 that says: “Each Member shall accord to the nationals of other Members treatment no less favorable than that it accords to its own nationals with regard to the protection....”<sup>119</sup>

Article 4 provides: “With regard to the protection of intellectual property, any of any other country shall be accorded immediately and unconditionally to the nationals of all other Members”.<sup>120</sup>

It is the “most-favoured-nation treatment” principle. That means that there must be total equality between the member states.

According to Article 27.1 in the TRIPS agreement patents must be available and patents rights must be enjoyable without discrimination as to the place of invention. Therefore, national law must ensure that, with respect to inventions also created in outer space, patent must be granted and enforceable in the territory in which it applies under the same conditions applicable to inventions created as in any other place.<sup>121</sup> It makes Article 27.1 of TRIPS contradictory, but at the same time it is not the invention as such that is not patentable but rather that the territory of the invention that is not valid.

The only two international instruments that are focusing on IP are the Third UN Conference that is the Vienna Declaration of 1999 and the Declaration of International Exploration of Outer Space for Peaceful Purposes for the

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<sup>117</sup>George S. Robinson, ‘The Impact of the International Space Station on the Development of Outer Space Law’ (2000) 6 Michigan Telecommunications and Technology Law Review 69 p.37

<sup>118</sup> George S. Robinson, ‘The Impact of the International Space Station on the Development of Outer Space Law’ (2000) 6 Michigan Telecommunications and Technology Law Review 69 .p.37

<sup>119</sup> TRIPS Agreement Article 3.1

<sup>120</sup> TRIPS Agreement Article 4

<sup>121</sup> ‘WIPO Patent Law’, WIPO p.7

Benefit of All the Countries taking into account the Needs of Developing Countries.<sup>122</sup> The latter point two says: “States are free to determine all aspects of their participation in international cooperation in the exploration and use of outer space on an equitable and mutually acceptable basis. Contractual terms in such cooperative ventures should be fair and reasonable and they should be in full compliance with the legitimate rights and interests of the parties concerned as, for example, with intellectual property rights”.<sup>123</sup>

However, this is a declaration and not a legally binding document and it has been criticized for being failure of defining the key terminology and the use of a broad language.<sup>124</sup>

From an international perspective there is no legislation for patents in space, there is only protection on Earth, and this leads to complex situations for the ownership in space.

What is needed to consider is that each country has its own national patent laws, and it includes what can be patented and how patents are enforced.<sup>125</sup> These differences arise because patent holders usually only get patents in countries where they will benefit economically. A patent is only useful in the country where it is issued.

#### **4.5 European Patent Law Perspective**

Patents is a territorial right, but within the European Patent Office (EPO) there is since recently a possibility to register for a Unitary patent. EPO is an international organization with thirty-eight contracting states and is not a part of the EU itself.<sup>126</sup> However, EPO has been established under the European Patent Convention (EPC) of 1973 and the power to revise the EPC lies with the Contracting States themselves when meeting at a Conference of the

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<sup>122</sup>Girish K. Dwivedi and Kanika Sood, ‘Legal Implications of Space Tourism’ (2012) NLUJ Law Review

<sup>123</sup> UNGA Res 51/122 (13 December 1996) UN Doc A/RES/51/122.

<sup>124</sup> Cologne Commentary on Space Law Hobe, Schmidt-Tedd Schrogl p.315 2015 Heymanns

<sup>125</sup> George S Robinson, ‘The Impact of the International Space Station on the Development of Outer Space Law’ (2000) 6 Michigan Telecommunications and Technology Law Review 69 p.36

<sup>126</sup>European Parliament, ‘Space, Sovereignty and European Security: Building European Capabilities in an Advanced Institutional Framework’

Contracting States and they are mostly EU member states.<sup>127</sup> The EPO's Espacenet database has a lot of published space-related European patent applications - with more than 4800 related to sat nav technologies.<sup>128</sup>

The fundamental territorial right is to be found in EPC Article 3 :

“Territorial effect, the grant of a European patent may be requested for one or more of the Contracting States”.<sup>129</sup>

With a unitary patent there is extending protection territorial because it includes twenty-four contracting member states. This means in practice that if an inventor obtains a unitary patent the patent owner gains the right to claim infringement by citizens of the Agreement on a Unified Patent Court (UPCA) member States as well as over space objects launched under the control of the member States.<sup>130</sup> Additionally, the Registration Convention also applies by retaining jurisdiction of space objects to the country from which it was launched.<sup>131</sup> If there is an opportunity to obtain a unitary patent, it facilitates and expands the territorial scope and reduces costs.

However, the EPC has the same provisions as the Paris Convention regarding the principle of territoriality and that means that there are no articles in the EPC that are applicable to patents in space. That also means that there is no legal protection for patent infringement in space under the EPC because the requirement of territoriality cannot be fulfilled because of that outer space is *res communis*.

The EU is a fast-growing region when it comes to space technologies and much of the increase from European operators are from Germany and France – and approximately 85% of the patents are owned by private companies.<sup>132</sup> In the EU charter of fundamental rights there is Article 17.2 that says that intellectual property shall be protected. However, even though the EU encourages innovation and R&D to grow within all member states, there are

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<sup>127</sup> European Parliament, ‘Space, Sovereignty and European Security: Building European Capabilities in an Advanced Institutional Framework’

<sup>128</sup> European Patent Office, ‘Space and Satellites’

<sup>129</sup> EPC Article 3

<sup>130</sup> ‘Extraterrestrial Law: Protecting Patents in Outer Space and on Celestial Bodies’, IP Watchdog

<sup>131</sup> ‘Extraterrestrial Law: Protecting Patents in Outer Space and on Celestial Bodies’, IP Watchdog

<sup>132</sup> European Patent Office, ‘New Report Reveals Global Patenting Trends in Space Technologies’ (4 May 2024)

also national and regional threats regarding security and defense which are being prioritized in space law making. The proposal also states that The EU recognizes outer space as a global common<sup>133</sup> and in such way establishes and acknowledges the public interest.

#### **4.6 National Patent Law Perspective**

According to 35 U.S. Code §105, the following applies:

(a)

“Any invention made, used or sold in outer space on a space object or component thereof under the jurisdiction or control of the United States shall be considered to be made, used or sold within the United States for the purposes of this title, except with respect to any space object or component thereof that is specifically identified and otherwise provided for by an international agreement to which the United States is a party, or with respect to any space object or component thereof that is carried on the registry of a foreign state in accordance with the Convention on Registration of Objects Launched into Outer Space.

(b) Any invention made, used or sold in outer space on a space object or component thereof that is carried on the registry of a foreign state in accordance with the Convention on Registration of Objects Launched into Outer Space, shall be considered to be made, used or sold within the United States for the purposes of this title if specifically so agreed in an international agreement between the United States and the state of registry”.<sup>134</sup>

The US wants to stop infringement of American patents in space, but the question is whether it is possible to litigate when space is a territory that belongs to all, the so-called *res communis*. There is a risk that it will lack the ability to achieve the intended effect and that it is not possible to sue an infringement made in space. Therefore, there is a concern that there is a big legal gap between states that collaborate in space-related or space-generated innovations regarding the ownership of the patent. An US patent right can

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<sup>133</sup> European Commission and High Representative of the Union for Foreign Affairs and Security Policy, ‘Joint Communication to the European Parliament and the Council on the Update of the EU Maritime Security Strategy and its Action Plan’ JOIN(2023) 9 final

<sup>134</sup> 35 U.S. Code §105



also be avoided if the invention is not patented in a state outside of the US. Then the possible scenario could be that a space company based in a State in which the invention is not patented, and they procure the launch of a space object, even if the launch takes place from the US, then the space object may be registered outside of the US and so avoid the provisions of 35 USC 105.<sup>135</sup>

That is why the patent law of the United States of America provides a quasi-territorial effect on a space object that executes the registry of the state that unless otherwise agreed with an international agreement.<sup>136</sup> The patent law related to space objects was established in 1990 and one reason for the US patent law was regulated was because the US has consistently refused to recognize a demarcating of outer space.<sup>137</sup>

Germany also made some adjustments in their national legislation before signing the IGA on the ISS because they wanted to ensure that the German patent law can be applicable to inventions created onboard an ESA registered module.<sup>138</sup> Section 52 of the German Patent Act states that: “a patent application containing a state secret (Section 93 of the Criminal Code) may only be filed, outside the territory to which this Act applies, with the written consent of the competent highest federal authority.”<sup>139</sup>

It is very complex because on the one hand Germany and USA can relate to their national legislation and claim that there has been an infringement on a patented invention in space, but on the other hand there is no international law that support their claims because space is res communis and is an erga omnes that has an obligation towards the international community. This could also lead to other problems when there are states which have their own patent legislation for space objects and at the same time being a member of other international organizations. The United States patent law does not either apply to any space object that is executed to the registry of a foreign country in accordance with the Registration Convention and this creates a loophole.

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<sup>135</sup> 'Outer Space: The High Seas and the Flags of Convenience Problem', Reddie & Grose

<sup>136</sup> World Intellectual Property Organization, 'Intellectual Property and Space Activities' p.11.

<sup>137</sup> 'WIPO Magazine Article', WIPO

<sup>138</sup> European Space Agency, 'Patents and Space-Related Inventions'

<sup>139</sup> German Federal Ministry of Justice, 'Patent Act (Patentgesetz, PatG)'

A more harmonized legislation or an international agreement for patents in space would be recommended to avoid major legislative differences.

However, there are possibilities to have a patent protection in space, but without using the invention in space. It seems complicated but it is completely feasible if the invention has an Earth-based patent such as a patent that focuses on elements of a method which interact with space technologies from Earth and in such a way, there will be a protection from a potential infringement.<sup>140</sup> Another way to protect innovations is by applying patent laws on Earth, where the innovations are implemented on objects before launch.<sup>141</sup>

There are not so many cases regarding patents in space but there is one that can show the complexity of these kinds of issues and that is *Hughes Aircraft Co. v. United States* 29 Fed. Cl. 197 (1993). In this case, the Hughes Aircraft Company sued the United States government for patent infringement on its technology for controlling the orientation of spin-stabilized spacecraft, a patent issued in 1973 that expired in 1990.<sup>142</sup> The company claimed that its patented technology had been infringed and used unauthorizedly in 108 spacecraft, and they wanted economic compensation of over four billion dollars.<sup>143</sup>

During the trial, which spanned several years with extensive evidentiary hearings in many cities, arguments focused on whether certain spacecraft, including Galileo and the Atmosphere Explorer, infringed the patent under the doctrine of equivalents. The court found that these spacecraft's control systems did not constitute infringement under this doctrine.<sup>144</sup>

The case highlighted not only the technical and legal complexities of patent infringement cases in the aerospace industry, but also the difficulty in assessing compensation and damages when advanced technology is involved. Discussions also included methods for determining reasonable royalties and how a license agreement might affect such assessments. This case clearly

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<sup>140</sup>Verdict, 'Sigfox Gets Grant for Method for Message Retransmission in Wireless Communication System'

<sup>141</sup> Verdict, 'Sigfox Gets Grant for Method for Message Retransmission in Wireless Communication System'

<sup>142</sup> *Data General Corp v. Grumman Systems Support Corp* 717 F.2d 1351 (1983)

<sup>143</sup> *Data General Corp v. Grumman Systems Support Corp* 717 F.2d 1351 (1983)

<sup>144</sup> *Data General Corp v. Grumman Systems Support Corp* 717 F.2d 1351 (1983)

shows the challenges and complexities involved in litigating intellectual property rights in high-tech fields.

Another interesting case is the WESTERNGECO LLC v. ION GEOPHYSICAL CORP. No. 16–1011 June 2018 case. Western Geco LLC owned a patent for a system used to survey the ocean floor. ION Geophysical Corp. began selling a competing system built from components manufactured in the United States, which were then shipped to companies overseas for assembly. WesternGeco sued ION for patent infringement under 35 U.S.C. §§271(f)(1) and (f)(2).<sup>145</sup>

The Supreme Court assessed whether WesternGeco damages for lost profits were a permissible application of §284 of the Patent Act. The Court held that damages for lost profits were a permissible domestic application of §284.<sup>146</sup>

Justice Thomas delivered the opinion of the court: "Under the Patent Act, a company can be liable for patent infringement if it ships components of a patented invention overseas to be assembled there. See 35 U. S. C. §271(f)(2). A patent owner who proves infringement under this provision is entitled to recover damages".<sup>147</sup>

National laws usually apply only within the borders of the United States, but the court can decide whether there is a permissible domestic application of a law.<sup>148</sup>

The court found that §271(f)(2) governs the domestic act of supplying components from the United States with the intent that they be combined abroad.<sup>149</sup>

The court's conclusion was that because the acts causing the infringement (delivery of components from the United States) occurred within the United States, there is a domestic application of the law, even if lost profits arose internationally. This means that rightsholders of the patent can claim damages

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<sup>145</sup> WesternGeco LLC v ION Geophysical Corp No 16–1011 (Supreme Court of the United States)

<sup>146</sup> WesternGeco LLC v ION Geophysical Corp No 16–1011 (Supreme Court of the United States)

<sup>147</sup> WesternGeco LLC v ION Geophysical Corp No 16–1011 (Supreme Court of the United States)

<sup>148</sup> WesternGeco LLC v ION Geophysical Corp No 16–1011 (Supreme Court of the United States)

<sup>149</sup> WesternGeco LLC v ION Geophysical Corp No 16–1011 (Supreme Court of the United States)

for lost foreign profits if the infringement involves acts performed within the United States.<sup>150</sup>

Even though this case regards high seas it shows that a company can be liable for patent infringement of a patented invention and that this could be applicable on space-related infringement made in space, but only if all parties and components are from the United States.

When analyzing many national patent laws, it points out the ethical concerns by including a provision that prohibits patenting inventions whose commercial use is necessary to safeguard public order or morality.<sup>151</sup> Additionally, these laws often have legal requirements to limit potential abuses of patent rights.<sup>152</sup> To prevent misuse of the exclusive rights a patent grants, the laws may allow for the issuance of a non-voluntary license and that license can be granted to a third party or the government without the consent of the patent owner, although the owner must be remunerated.<sup>153</sup> There are other situations such as a national emergency or other urgent circumstances, this type of non-voluntary license may also be permitted.<sup>154</sup>

#### **4.7 Solutions for Patent in Space- De Lege Feranda Perspective**

Even though there is no jurisdiction for patents in space that is covered by all states, there are solutions although they are not ultimate. One of the solutions is to keep an invention as a trade secret. A trade secret is defined as any information that is: (1) not known to the relevant business circles or to the public; (2) confers some sort of economic benefit on its owner. This benefit must derive specifically from the fact that it is not known, and not just from the value of the information itself; and (3) the subject of reasonable efforts to maintain its secrecy. A trade secret continues for as long as the information is maintained as a trade secret. Anything that is

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<sup>150</sup> *WesternGeco LLC v ION Geophysical Corp* No 16–1011 (Supreme Court of the United States)

<sup>151</sup> World Intellectual Property Organization, ‘Intellectual Property and Space Activities’ p.69.

<sup>152</sup> World Intellectual Property Organization, ‘Intellectual Property and Space Activities’ p.69.

<sup>153</sup> World Intellectual Property Organization, ‘Intellectual Property and Space Activities’ p.69.

<sup>154</sup> World Intellectual Property Organization, ‘Intellectual Property and Space Activities’ p. 69.

easily and completely disclosed by the mere inspection of a product put on the market cannot be a trade secret.<sup>155</sup> Investors in outer space development are driven by the potential of microgravity experiments leading to valuable commercial products. Since many industrial processes cannot be patented, trade secret protection becomes important. However, maintaining secrecy in space is challenging with the aspects of registration and state liability. Trade secrets in space might involve proprietary technology, processes, or information that companies or governments want to keep confidential for competitive advantage.<sup>156</sup> Not to forget that patents are usually built on other patents. That is why public disclosure is thought to be of greater benefit to society than trade secret use, because it allows others to learn from the invention and build on it.<sup>157</sup>

Another solution is to apply private contract law with the use of contracts and other legal agreements to protect intellectual property rights in space. For example, space-related companies may enter into agreements with partners or customers that specify how their intellectual property and patents will be used and protected during space-related activities and in which court they should provide settlement of disputes.<sup>158</sup> When inventions or other objects of intellectual property are expected to be produced in the execution of the collaborative activities, it is important that the following issues be agreed upon beforehand: (1) the extent to which any inventions or other technology developed during the collaborative activity will not be published or disclosed before patents are applied for, or before all parties agree to publish or disclose the technology; (2) the entitlement to rights, what is included; and (3) the entitlement to benefit from any technology developed during that activity.<sup>159</sup> However, the latter can be more difficult to specify. It is the same if the partners to a collaborative project should agree on a system that suits their interests for the purposes of protecting confidential

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<sup>155</sup>World Intellectual Property Organization, 'IP Panorama: Learning Points'

<sup>156</sup> World Intellectual Property Organization, 'IP Panorama: Learning Points'

<sup>157</sup> Susan J. Herman, 'A New Era of Cyber Surveillance and Censorship' (2015) 80 Brooklyn Law Review 41 p.47.

<sup>158</sup> 'Patents in Space', Potter Clarkson

<sup>159</sup>World Intellectual Property Organization, 'Intellectual Property and Space Activities'

information shared by them in a cooperative international project like in the ISS. With other words, when there is a lack of reliable international legal regime it requires the parties to negotiate intellectual property clauses in each international cooperation agreement, which may include, for example, issues regarding ownership, rights of use, rights of distribution and licensing of data, information capable of legal protection and confidentiality.<sup>160</sup> When such a contractual agreement is valid among the parties concerned, it does not bind third parties. In general, the development of distinct public-sector intellectual property management skills and policy mechanisms are important for effective implementation of public funds. Since space activities are supported by public investment and other public resources, establishing policies for managing intellectual property from public funded research is crucial for successful public-private partnership models.<sup>161</sup>

If there could be an international agreement or a treaty that constitutes that space is the same territory for all states, that could facilitate for private companies to get a patent or other exclusive rights, with the same qualification and requirements to be valid in space. One option is to amend the UN- agreements for the space industry to recognize the increased role of private actors in outer space and institute methods for resolving disputes concerning intangible property to complement existing understandings about ownership of physical property and for assessing damages.<sup>162</sup> However, this could be a complex task, as there is a risk of unclarity with space-related definitions and the role of private actors in space. It is important for the legislators to be precise in their requisites, otherwise there is a risk that the language will be vague and difficult to interpret. On the other hand, it would be a more equal solution for all states with one space territory. Then it would be the same conditions for all countries to obtain a patent for an invention in space and there would presumably be a unified control body for all patent applications in space territory. If there will be any potential new space territory, then it will not be compatible with the res

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<sup>160</sup> World Intellectual Property Organization, 'Intellectual Property and Space Activities'

<sup>161</sup> World Intellectual Property Organization, 'Intellectual Property and Space Activities'

<sup>162</sup> American Bar Association, 'Intellectual Property Law in Outer Space'

communis principle, and the space treaties must be modified or replaced. A following question could also be if there will be a space territory as an exception, is it possible that other res communis such as the Convention of the High sea and Antarctica will be affected too?

The WTO(World Trade Organization) focuses on trade specifically on trade to facilitate and regulate international trade and resolve trade disputes between countries.<sup>163</sup>The WTO is specialized in economic and trade-related issues and the WTO does not have a direct role for patents in space, but through the TRIPS agreement and its requirements on intellectual property it has an indirect role.<sup>164</sup> It is possible that the WTO may have a greater role in the future in space patents as the need grows as the commercialization of space increases and new disputes arise and remain unresolved.<sup>165</sup>The WTO could also participate in the development of new international agreements or protocols that specifically address intellectual property rights and patents in space and that means that the WTO could cooperate with other international organizations such as UNOOSA and WIPO to develop guidelines and standards for patents in space. Such cooperation could lead to a more coordinated and efficient management of space patents on a global level. If global trade policy evolves to include space resources and space-related services, the WTO may need to adapt its rules and dispute settlement mechanisms to cover these new areas of trade, and this would mean that space patents take on a more central role in the WTO.

However, The WTO's absence is noticeable and in recent decades they have due to political deadlocks stifled new international agreements. The WTO would be a good forum for discussions regarding the territoriality and patents in space, to conduct dialogue and negotiations on an international level. However, there are critics of the WTO being passive and leaving the

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<sup>163</sup> World Trade Organization, 'What We Do'

<sup>164</sup> World Trade Organization, 'What We Do'

<sup>165</sup> Gene Quinn, 'Utomjordisk lag: Skydd av patent i yttre rymden och på himlakroppar' IPWatchdog

question to the future without any solutions.<sup>166</sup> The critics that have been put forward as if there are no authorities that take control of the legal patent issues in space, there are concerns that companies and states gradually can evaluate the limits of the Liability convention.<sup>167</sup> Compared to the WTO, the UN has a broader and more comprehensive mandate that includes peace, security, human rights, and development.<sup>168</sup> The UN works through many different bodies and programs that cover a wide range of global issues, including space issues.<sup>169</sup>

WIPO is a self-funding agency of the UN and the global forum for intellectual property services, policy, information, and cooperation.<sup>170</sup> WIPO administers PCT and promotes international collaboration in the field of IP<sup>171</sup> which gives them a crucial important role for IP and patents on an international level. WIPO brought up the issue of patents in space already in 1997 but have not been so active in this question even if they raise the issue and state that there are unresolved issues.<sup>172</sup> WIPO is a great forum to work with other international organizations such as the WTO and UNOOSA to develop standards and guidelines for IP protection in space, so called soft law. This includes addressing issues such as the jurisdiction of patents in outer space and the protection of inventions used in space missions.

## 4.8 Summary and Conclusions

There are three different space-scenarios presented in the chapter and the main questions that are recommended to be asked are: (1) what is classified

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<sup>166</sup> Talbot D'Alemberte, 'The International Lawyer's Changing Role in Space Law Development' (1982) 5 Washington International Law Journal 493

<sup>167</sup> Talbot D'Alemberte, 'The International Lawyer's Changing Role in Space Law Development' (1982) 5 Washington International Law Journal 493

<sup>168</sup> Swedish United Nations Association, 'Förenta Nationerna'

<sup>169</sup> Swedish United Nations Association, 'Förenta Nationerna'

<sup>170</sup> World Intellectual Property Organization, 'About WIPO'

<sup>171</sup> World Intellectual Property Organization, 'Patent Cooperation Treaty (PCT)'

<sup>172</sup> World Intellectual Property Organization, 'Outer Space'



as a space invention (2) which nation's patent law applies to activities in space; (3) what qualifies as infringing activity.

These questions must be answered first to be able to proceed whether it is a question regarding a potential infringement of patents in space.

The legislative perspectives that have been analyzed are international, European and national. Article 5ter of the Paris Convention provides exceptions for the use of patented devices on vessels, aircraft, and land vehicles entering another country temporarily or accidentally. This exception's applicability to space activities is unclear, raising concerns about patent enforcement in space. According to Article 27.1 in the TRIPS agreement an invention should without regard to the place of the invention be patentable. It suggests with other words that inventions made in outer space must be patentable and enforceable under the same conditions as the ones made on Earth. However, this is not compatible with the territory of outer space.

The Unitary Patent extends the patent protection to 24 member states and makes patents more cost-effective. However, the EPC, like other international patent agreements, does not address patents in space, leaving a loophole in the legal protection for space-based inventions.

The U.S. is the only state that has legislated inventions made in outer space on U.S. registered or controlled space objects. However, this protection is limited by international agreements and is not protectable against a third party or by registering space-related objects in states with weak patent systems. Germany is the only European country that has adapted its national legislation to ensure patent applicability for inventions created on ESA-registered modules.

Parallels are often drawn between the high seas and Antarctica and outer space because all three are *res communis* and have no territoriality, and the court case highlights the problematic nature of a patent infringement made where there is no territoriality. In the *WESTERNGECO LLC v. ION GEOPHYSICAL CORP* case, the rightsholder was assessed for his damages. It was only possible because all the components and parties came from the USA as it could be decided in the US Supreme Court. Hughes

Aircraft Co. v. United States 29 Fed. Cl. Case 197 demonstrates the technical and legal complexity of aerospace patent infringement cases, but also the difficulty of assessing compensation and damages when advanced technology is involved.

There are a lot of challenges and potential solutions presented in the *de lege feranda* subchapter for managing patent rights in outer space, a domain without a universally accepted jurisdiction for intellectual property rights. The challenges of patent jurisdiction in space necessitate innovative and flexible legal solutions. Trade secrets and private contract law offer interim solutions but are complicated by issues of secrecy and legal enforceability. An international treaty or agreement led by WTO, UN or WIPO could potentially offer a more vigorous framework, but this requires careful diplomatic negotiation and legal precision to ensure its effectiveness and fairness. Strengthening intellectual property management in the public sector is critical to supporting sustainable space ventures. Overall, addressing these challenges requires a combination of legal innovation, international cooperation, and strategic policy development.

## 5. Final Summary and Conclusions

As it is today, there is no jurisdiction in space, it belongs to all humankind and space is to be used for peaceful purposes. Space law is based on the “big five” treaties from the 60’s during the Cold War era when there was a fear that the USA and the USSR would have their arms race in space. At that time there were no private actors in space at all and there was a need for states to register launching space-related objects. While the treaties focus on peace, exploration, access and non-appropriation they do not address commercial aspects like patents.

In the recent decades, the commercialization of space has been rapid, and we are in a completely different situation. With private companies in space achieving significant milestones, the shift from government-led to commercial space activities raises new legal challenges, particularly concerning patent rights. There are many advantages to having private actors in space that invest in other research areas that the state does not, but it is a high-risk investment. R&D can solve complex problems in different areas thanks to the different conditions that prevail in space, but the rightsholders want to be able to protect their inventions and patents with exclusive rights to get revenues. However, there are other interests that have been prioritized, such as the protection of a nation's sovereignty, security and the public interest. It gives us an indication of what the legislator puts first, but on the other hand, the political situation in the world is affected by the decisions that are being made.

There is no universally accepted legal definition of outer or where it begins, however the main rule is that space begins where air space ends. Patent law in space faces unique challenges due to the lack of universally accepted jurisdiction for intellectual property rights and patent law is territorial, while

space law is non-territorial. The US is the only state that has patent legislation on its inventions made in space, but it proves ineffective against infringement from third parties. For it to be applicable it requires that the space-related object is registered and controlled by the US to be valid. The Unitary Patent system extends patent protection across member states but does not address the unique challenges of space, leaving a loophole in legal protection for space-based inventions.

It is very uncertain how the development of patents in space will look in the future and whether there will be any new legislation in this area soon. In many international organizations such as the WTO and WIPO, questions regarding the territoriality for patents in space remain unanswered. The territorial nature of patent law and the non-territorial nature of space law are not easy to reunite. The indications from the EU's latest space proposal are that they focus more on national and regional security and sustainability rather than economic and intellectual property perspectives. It is necessary to fill in the legal gaps for patents and intellectual property to avoid infringements and disputes in space.

The absence of an international legal framework that regulates private companies in space is to be recommended either if space remains *res communis* or not. It could be through soft law instruments and guidelines which would also be beneficial for every state to ensure national security and interest in space. In the long term an international agreement or treaty led by the WTO, WIPO or UN is to be recommended, but it needs careful diplomatic negotiation and legal precision. Therefore, it would have been suitable to have a regime in place that considers the unique features of international law of recognition and protection of patent rights. The same applies to international cooperation both on the space stations and among private actors, even if there already exist multi- and bi-lateral agreements. There are some difficulties between space law and intellectual property

laws, but they are not impossible to solve. A well-developed internationalized patent protection regime for activities in outer space will be a prerequisite to increase private investment. A patent protection according to international instruments dealing with the protection of patents are necessary in space. Inventions happen increasingly often in outer space and the curiosity for exciting new areas to explore in space. The goal for patents to be applicable in outer space will help us develop a favorable environment for space activities in the future. To solve it, the scope of territoriality for patents in space needs to be resolved. While we are waiting for actions to be taken, Earth is calling...for Patents.

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Convention on Registration of Objects Launched into Outer Space

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Agreement Governing the Activities of States on the Moon and Other Celestial Bodies

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