

Introduction

The space era commenced with the successful launch of Sputnik I by the Soviet Union into outer space on 4 October 1957, followed by the first US satellite, Explorer I, a few months later.¹ Since then, states have been interested in exploring and exploiting this spatial area. Joining the United States and Russia as another space-faring nation, China has increased its technological capability and plans to send its first international space station into outer space in 2020.² Space technology has been developed aggressively and space applications have proved very beneficial for mankind. Outer space has been explored not only for scientific purposes but also for commercial uses. Private enterprises have gradually expanded their involvements in space venture during the last decades.³ Commercial revenue and government budgets for the global space industry jumped to US\$304.31 billion in 2012, representing growth of 6.7 per cent from the total of US\$285.33 billion in 2011 and in 2013, the space economy grew by 4 per cent, reaching a new record of US\$314.17 billion and continued to grow to the total of US\$330 billion in 2014.⁴ The global space

¹ Christopher M. Hearsey, 'A Review of Challenge to Corporate Expansion into Outer Space' (AIAA Space 2008 Conference & Exposition, San Diego, September 2008) 2. <http://www.astrosociology.org/Library/PDF/Hearsey_CorporateExpansion.pdf> (accessed 5 July 2015).

² 'Chinese Space Station to Benefit World', Xinhua News Agency (16 June 2012) <http://news.xinhuanet.com/english/china/2012-06/16/c_123293484.htm> (accessed 12 March 2016).

³ David J. Salt, 'Space Operations for a New Space Era' in Craig A. Cruzen, et al. (eds), *Progress in Astronautics and Aeronautics*, vol. 236: Exploration, Scientific Utilization, and Technology Development (American Institute of Aeronautics and Astronautics, Inc. 2011) 4.

⁴ 'Space Foundation's 2013 Report Reveals 6.7 Percent Growth in the Global Space Economy in 2012', Space Foundation Press Release (2 April 2013) <<http://www.spacefoundation.org/media/press-releases/space-foundations-2013-report-reveals-67-percent-growth-global-space-economy>> (accessed 16 June 2013); Space Foundation, *The Space Report, 2014* <http://www.spacefoundation.org/sites/default/files/downloads/The_Space_Report_2014_Overview_TOC_Exhibits.pdf> (accessed 5 July 2015); Space Foundation, *The Space*

industry experienced a significant growth of 37 per cent between 2007 and 2012.⁵

Space tourism transitioned from science fiction to reality when the first space tourist travelled on a Russian spaceship to the International Space Station in April 2001.⁶ Shortly after that, the world's second space tourist travelled to the International Space Station and spent eight days there conducting scientific experiments including those relating to the HIV virus.⁷ These two space tourists paid up to US\$20 million for their space journey.⁸ The Virgin Galactic company plans to send tourists into outer space in the near future and more than 500 people have already booked its first space trip.⁹ Once vehicles are available for paying space tourists, the space tourism industry will probably be the most profitable industry for suborbital flights.¹⁰ In addition to these existing space industries, new space projects are being developed. These new projects include space hotels, orbital laboratories (providing zero-gravity biotech manufacturing), solar satellites (with the potential to convert solar radiation into usable electricity), space elevators (less costly than conventional rocket launches and premised upon raising an elevator car along a cable extending 62,000 miles above earth) and solar sails (collecting and utilizing solar radiation instead of conventional rocket fuel to propel spaceships and weather satellites).¹¹

In addition, the special 'weightless' characteristic of the environment in outer space has proven to be enormously advantageous in the

Report, 2015 https://www.spacefoundation.org/sites/default/files/downloads/The_Space_Report_2015_Overview_TOC_Exhibits.pdf (accessed 29 December 2015).

⁵ 'Space Foundation's 2013 Report' (n 4).

⁶ Nikhil D. Cooper, 'Circumventing Non-Appropriation: Law and Development of United States Space Commerce' (2009) 36 *Hastings Constitutional Law Quarterly* 457, 457; 'First Space Tourist Sets Sights on a Mars Mission', National Public Radio (27 February 2013) <<http://www.npr.org/2013/02/27/173056144/first-space-tourist-sets-sights-on-a-mars-mission>> (accessed 5 July 2015).

⁷ Steven S. Freeland, 'Up, Up ... Back: The Emergence of Space Tourism and Its Impact on the International Law of Outer Space' (2005–2006) 6 *Chicago Journal of International Law* 1, 3.

⁸ *Ibid.*

⁹ Elizabeth Howell, 'Virgin Galactic: Richard Branson's Space Tourism Company', Space.com (17 February 2016) <<http://www.space.com/18993-virgin-galactic.html>> (accessed 31 January 2016).

¹⁰ Salt (n 3) 13.

¹¹ Cooper (n 6) 477.

manufacture of commercially valuable products in various fields, particularly in the pharmaceutical and electronics industries. The study of biochemical protein structure is enhanced and cheaper medicine can be produced effectively under zero gravity.¹² The purified atmosphere in space also enhances the production of silicon or gallium arsenide crystals for semiconductor manufacture.¹³ These valuable industrial processes are definitely of great importance and arguably need intellectual property protection to encourage the necessary investment.

Space activities require sophisticated technology, which results in high operating costs and significant ongoing investment. Therefore, at the start of the space age, space activities were the exclusive reserve of governmental agencies. At that time, space activities were mainly for exploration and experiment, including military operations. However, with advances in technology, space activities have become more commercialized and privatized. The United States, for example, began to privatize its space industry some decades ago by implementing statutory and regulatory changes to encourage private entrepreneurs.¹⁴ Thus, the trend in many areas of space activities is a marked shift towards more participation by private entities. Some people may not realize how these outer space activities, including remote sensing data from space, satellite broadcasting and telecommunication services, have become part of our daily lives. Since the development of space activities needs huge investment, states now encourage private entrepreneurs to participate in space activities. Such private entity participation depends upon their ability to generate a return on their investment.

The protection of the intellectual property rights in outer space activities is one potential way to serve and guarantee the interests of private enterprise in return for their investment.¹⁵ However, the scope and application of principles of 'freedom of exploration', 'use' and 'non-appropriation' of outer space provided for in the 1967 Outer Space Treaty raise concerns for any space investor. These principles imply that benefits and information derived from outer space activities will be shared; but those who own space technologies are likely to be reluctant and unwilling to share such technology without first obtaining a reasonable return. In addition, the underlining principles in outer space and intellectual property laws are different. The main principles of outer space law

¹² Dan L. Burk, 'Protection of Trade Secrets In Outer Space Activity: A Study in Federal Preemption' (1992–1993) 23 *Seton Hall Law Review* 560, 565.

¹³ *Ibid* 567.

¹⁴ *Ibid* 563–564.

¹⁵ *Ibid* 577.

aim to secure benefits for all mankind whereas the tenet of intellectual property law is the protection of private property. Due to the commercialization and privatization of space activities, the underlining principles in the existing space treaties are considered to be a key hindrance to space development. It is arguably unfair for the party who has invested his effort and resources to exploit space activities to be unprotected and lose his control of the benefit of his output. Therefore, a protection regime is necessary to guarantee an investment in outer space. But what is the best way to balance the public benefits of space activities with the interests of private entities regarding intellectual property protection in outer space activities?

RESEARCH QUESTIONS

Despite the different approaches between space law and intellectual property law, current state practice shows that intellectual creation resulting from space activities is being protected.¹⁶ Questions arise whether this application of intellectual property law to outer space activities is a breach of the state's obligation under the existing space treaties. Should right holders be made to relinquish intellectual property protection in works or inventions created or made in outer space as a result of the 'non-appropriation' and the 'common heritage of mankind' principles in outer space treaties? What exactly do these space law 'benefit' principles mean and to what extent do they apply to the intellectual property protection in space activities?¹⁷ These questions will be analyzed in more detail in this book.

With regard to intellectual property protection, there are various forms of intellectual property rights which can be applied to space activities. Nevertheless, at present, only patents and copyright play a potential role in space industry.¹⁸ However, both types of intellectual property protection pose questions and problems as to their applications to outer space activities in terms of subsistence and enforcement. Thus, it is necessary

¹⁶ See Chapter 3, p. 56.

¹⁷ For instance, in the case of geostationary satellite orbit where the allocation of this limited orbit is based on the first-come-first-serve basis, it is questionable that the utilization of such orbit is contrary to the non-appropriation principle in the 1967 Outer Space Treaty. Or whether medicine produced in a zero gravity environment meets the requirement of patentability. See Section 5 in Chapter 1 and Section 1.2.1 in Chapter 3, respectively.

¹⁸ WIPO Doc (n 118).

to examine whether space activities are well-protected under present patent and copyright regimes.

Moreover, intellectual property law is based upon territoriality, whereas outer space falls outside the scope of any sovereignty. Currently there is no global or international form of intellectual property (IP) protection which enables a right holder to gain protection without any territorial limitation; rather, it is necessary to seek protection in any individual protecting country. Thus, questions arise when applying national IP law in outer space where there is no law available. Moreover, the question of jurisdiction in outer space is also legally challenging. Can a state extend its jurisdiction for any act which occurred in outer space? What are the legal grounds for asserting jurisdiction? Should territoriality or nationality or any other principles be adopted in determining jurisdiction over outer space activity? In addition, can the state of registration assert its jurisdiction on the principle of quasi-territorial jurisdiction if an incident occurs in the International Space Station (ISS)? These questions lead to issues of appropriate jurisdiction and applicable law, as well as recognition and enforcement of foreign judgments, which all need deeper investigation.

METHODOLOGY

Since this legal research relates to intellectual property law and space law, the main objective is to determine how these two legal regimes, with their distinct characteristics, may be best integrated for the optimum benefit of both rights holders and the public. Thus, the doctrinal approach, which examines the principles enshrined in the relevant laws through both statutes and cases, plays a dominant role in most parts of this research. However, due to general limitations of the doctrinal approach (in terms of investigating possible 'real world' answers), and more specifically since in this subject area there is limited statutory and case law for investigation, it is important to draw upon other approaches. Therefore, this work is based on a comparative study of law.

The study of comparative law begins by setting a question or a hypothesis.¹⁹ The next step is to investigate other legal systems to find out how these deal with the same problem.²⁰ Given the lack of available case law relating to intellectual property rights in outer space activities,

¹⁹ Konrad Zweigert and Hein Kotz, *An Introduction to Comparative Law* (Oxford: Clarendon Press 1998) 34.

²⁰ *Ibid.*

hypothetical cases will be examined and discussed in order to propose appropriate solutions. This comparative legal study of intellectual property law and space law draws from the United States and the United Kingdom, cases chosen for several reasons. Firstly, both of them are space-faring nations. Although the United Kingdom may not be directly comparable to the United States in term of space technology, the United Kingdom is one of the founding members of the European Space Agency (ESA), an intergovernmental organization and a major leader in the space industry today. Also, both the United States and United Kingdom (by ESA) are participants in the International Space Station (ISS) project. Secondly, the intellectual property laws of the United States and United Kingdom have been developed consistently to keep pace with new technologies. In addition, as a result of EU harmonization of law in this field, intellectual property law in the United Kingdom is generally similar to – or the same as – equivalent laws of other European Union countries.

OUTLINE OF THE BOOK

This book consists of seven parts. After the introduction, Chapter 1 will deal with the international space law treaties. The main principles, namely the province of all mankind, the common heritage of mankind and the non-appropriation principles, will be examined to find out how these principles are applied to space activities and to assess whether these principles might prevent an assertion of intellectual property protection in space activities.

Chapter 2 will deal with the international conventions relating to intellectual property rights. Attention will be paid only to the major and relevant conventions. In this chapter, the principles embedded in these IP conventions (national treatment, the territoriality of IP rights and the most-favored nation provisions, as well as the priority rights of the Paris Convention) will be researched to investigate whether there is any obstacle when applying these conventions to outer space activities, e.g., how and to what extent do these main principles apply to the outer space activities in issue?

Chapter 3 focuses on patents in outer space, including patentability issues such as patentable subject matter. The chapter will seek to answer a number of specific questions. Do the characteristics of space activities hinder the results from being patented? How should the patentability requirements of novelty, non-obviousness and industrial application be assessed in relation to space activities? Do they need to have different assessment standards compared to earth-based inventions? In addition,

the so-called temporary presence exception will be examined to determine whether this rule would apply to space vehicles or not. Attention will also be paid to the International Space Station (ISS), its legal structure and any implications which might result in respect of IP rights, especially patents, in outer space activities which take place on board.

Chapter 4 will investigate the application of copyright law to outer space activities. The discussion will focus on space telecommunication and satellite remote sensing to determine to what extent these activities are copyrightable. In the case of remote sensing data, the analysis will cover an understanding of whether the difference in character between ‘unenhanced’ and ‘enhanced’ data will require different levels of protection.

Chapter 5 will be devoted to the private international law matter which will come to fill the gap of the non-availability of specific remedies for intellectual protection of outer space activities. This chapter begins with a discussion on the competency of courts, followed by analysis of the applicable law. The recognition and enforcement of foreign judgments will be discussed in the last part of this chapter. Hypothetical cases will be introduced and used as parts of the discussion in this chapter.

Based upon the findings in previous chapters, the solutions or alternatives which would better suit for the protection of intellectual property rights in outer space activities will be proposed in the conclusion as the last part of this research.

LIMITATIONS

The study of this research is limited to the application of two forms of IP rights to outer space activities – patents and copyrights. This is because at present only patents and copyrights play a significant role to the protection of IP rights in outer space activities. While this book focuses on US and UK law, EU law will be addressed when necessary and relevant as a result of the UK’s membership of the European Union. Case laws primarily cover the two jurisdictions, whereas case law from other jurisdictions will be examined when they are relevant to the research topic (e.g., Chapter 4). The main literature is from the US, UK and Europe, although other resources will be taken into account if necessary. The court cases used in this book are from several databases²¹ as updated until 31 May 2014.

²¹ Westlaw, LexisNexis and the Thai Supreme Court database.