

FLY ME TO THE MOON: HOW WILL INTERNATIONAL LAW COPE WITH COMMERCIAL SPACE TOURISM?

STEVEN FREELAND*

The recent confirmation by National Aeronautics and Space Administration scientists regarding the presence of substantial amounts of water on the Moon has further galvanised the aim of humankind to develop ever more ambitious plans for space travel. Central to this ongoing evolution is the development of technology capable of transporting large numbers of passengers into outer space as commercial space tourists. It is increasingly likely that, within the foreseeable future, space will no longer be the sole domain of professionally trained astronauts or the exceptionally wealthy. However, the prospects for both suborbital and orbital private human access to space give rise to some challenging legal and ethical questions and call into question the adequacy of existing international law instruments that are directed towards the regulation of the use and exploration of outer space. It is clear that the existing international legal regimes covering air and space activities are not well suited to large-scale commercial access to space, largely because they were developed at a time when such activities were not a principal consideration in the mind of the drafters. The lack of legal clarity must be addressed as soon as possible, to provide for appropriate standards that will further encourage such activities. This article examines some of the more pressing legal issues associated with the regulation of space transportation of passengers on a commercial basis, and offers some suggestions as to those areas where important principles need to be developed.

CONTENTS

I	Introduction.....	1
II	An Overview of the International Law of Outer Space	5
III	A (Brief) History of Space Tourism	7
IV	What Is ‘Space Tourism’?	9
	A Orbital Space Tourism.....	9
	B Suborbital Space Tourism	9
	C Intercontinental Rocket Transport.....	9
V	What International Law Applies to Space Tourism?	10
VI	What Is the Legal Status of a Space Tourist?	14
VII	What Are the Applicable Rules relating to Liability for Death/Damage?	16
VIII	Does Space Tourism Assume the Need for ‘Celestial Property Rights’?	20
IX	Ethical Considerations	25
	A What Space Tourism Activities Are to Be Regarded as ‘Appropriate’?	25
	B Pollution of the Environment of Outer Space	26
	C Protection of ‘Heritage Sites’ in Outer Space	27
X	Concluding Remarks.....	28

I INTRODUCTION

On 18 June 2009, the United States National Aeronautics and Space Administration (‘NASA’) launched its Lunar Reconnaissance Orbiter (‘LRO’)

* BComm, LLB, LLM (UNSW); Professor of International Law, University of Western Sydney; Visiting Professor of International Law, University of Copenhagen; Member of the Space Law Committee, International Law Association; Member of the Directorate of Studies, International Institute of Space Law; Faculty Member, London Institute of Space Policy and Law. The author acknowledges the comments of the anonymous referees.

and Lunar Crater Observation and Sensing Satellite ('LCROSS') from Cape Canaveral Air Force Station.¹ Almost four months later, on 9 October 2009, the Centaur upper stage of the Atlas V rocket carrying the probes deliberately slammed into the Cabeus Crater at the south pole of the Moon at approximately twice the speed of a bullet,² generating approximately 350 tonnes of debris that rose up to two kilometres from the surface.³ Shortly afterwards, LCROSS followed the initial impact, analysing the debris that had been generated before itself also crashing into the lunar surface.

Despite some initial disappointment, NASA scientists examining the results subsequently declared this experiment to be a major success, explaining that they had found a 'significant amount' of water ice and water vapour in the plume that followed the first crash. Whilst there is still much work to be done to fully analyse the results of the experiment, this discovery has reignited speculation as to the possibility that humans will eventually return to the Moon and remain there for an extended period, utilising these deposits of water for consumption, conversion into breathable air, and even as a base from which to create rocket fuel for subsequent launches. Though it is not clear exactly when this might eventuate — a situation further complicated by US President Barack Obama's call in February to cancel the NASA program to send humans back to the Moon by 2020⁴ — it still seems probable that astronauts and other space travellers will eventually return to the Moon.⁵

In addition, such discoveries can only further encourage those private enterprises that have embarked upon ambitious projects intended to spawn a broad commercial space tourism 'industry', which may themselves ultimately even include visits to, and stays on, the Moon. If this were to eventuate, the development of technology capable of transporting large numbers of paying passengers into outer space on a commercial basis would represent a landmark in the ongoing evolution of humankind's activities in space. Indeed, even when calling for the cancellation of NASA's moon program, Obama was looking for the development of 'game changing' technologies to make long-distance space travel cheaper and faster, so as to encourage future space missions to asteroids and Mars.⁶

The extent of the technological progress that has already been made in respect of human space travel was apparent when, in October 2004, an experimental spacecraft, SpaceShipOne, was successfully 'launched' from its mother plane, White Knight, and went on to safely complete two journeys to an altitude of more than 100 kilometres and back within the space of a week, to claim the

¹ NASA, *LCROSS* <http://www.nasa.gov/mission_pages/LCROSS/launch/index.html>.

² Paul Rincon, *NASA Team Scours Moon Crash Data* (9 October 2009) BBC News <<http://news.bbc.co.uk>>.

³ Jonathan Amos, *'Significant' Water Found on Moon* (13 November 2009) BBC News <<http://news.bbc.co.uk>>.

⁴ Kenneth Chang, *'Obama Calls for End to NASA's Moon Program'*, *The New York Times* (online), 1 February 2010 <<http://www.nytimes.com>>.

⁵ See, eg, Morris Jones, *Moon Exploration is Not Dead* (2 February 2010) Space Travel: Exploration and Tourism <http://www.space-travel.com/reports/Moon_Exploration_is_Not_Dead_999.html>.

⁶ Editorial, *'A New Space Program'*, *International Herald Tribune* (Paris) 10 February 2010, 6.

US\$10 000 000 Ansari X-Prize.⁷ The success of the project demonstrated that, at least from a technical standpoint, short term human suborbital flight had become a reality.

Following the success of SpaceShipOne, entrepreneur and founder of the Virgin group of companies, Richard Branson, announced that he had reached an agreement with its designers for the construction of a larger commercial vehicle, intended to provide 'Virgin Galactic' passengers with a three-and-a-half hour journey into space. In the euphoria of that moment, newspapers reported that over 7000 people had signed on to reserve a US\$200 000 seat on these flights,⁸ although the actual figure appears to be far smaller and, according to Virgin Galactic itself, currently amounts to 'several hundred people' who have reserved their ticket, either directly or 'through [a] global network of specially appointed and highly trained Accredited Space Agents'.⁹ In late 2009, Virgin Galactic rolled out its SpaceShipTwo spacecraft at a gala press conference attended by the Governors of both California and New Mexico.¹⁰

Likewise, in 2007, European aerospace company EADS Astrium unveiled its own plans to provide space tourism flights at an estimated cost of €200 000 per ticket. It was reported that the proposed technology would involve just the one space vehicle, as opposed to the method of launching from a plane as utilised by the Virgin Galactic program.¹¹

Irrespective of the number of people who have financially committed themselves thus far, and the differing technologies that might be utilised, there is no doubt that the prospect of commercial space tourism has captured widespread imagination. The public perception of commercial space travel has undergone a significant change over the past decade — from mere fantasy to possible reality — mirroring an evolutionary process that emerged in the first half of the 20th century, which ultimately led to a global commercial air travel industry. As a result, significant resources are now being directed towards the advancement of Reusable Launch Vehicle ('RLV') technology, a vital element in the development of the space tourism industry.¹² Many companies are developing the capability to provide civilian space tourist flights, particularly suborbital flights.

One commentator has gone so far as to suggest that a traffic level of five million space passengers per year by 2030 is achievable and represents only a conservative estimate of the known demand among potential tourists. His vision for an attainable model contemplates a sophisticated space tourism infrastructure including over one hundred co-orbital hotels and orbital sports

⁷ X Prize Foundation, *Ansari X Prize* (2010) <<http://space.xprize.org/ansari-x-prize>>.

⁸ See, eg, Eddie Fitzmaurice, 'Beam Me Up, Richard', *The Sun-Herald* (Sydney), 24 October 2004, 52.

⁹ Virgin Galactic, *Overview: Space Tickets* (2009) <<http://www.virgingalactic.com/overview/space-tickets/>>.

¹⁰ Virgin Galactic, *SpaceShipTwo Roll Out* (8 December 2009) <<http://www.virgingalactic.com/news/item/spaceshiptwo-roll-out/>>.

¹¹ *Firm Rockets into Space Tourism* (13 June 2007) BBC News <<http://news.bbc.co.uk>>.

¹² Charity Trelease Ryabinkin, 'Let There be Flight: It's Time to Reform the Regulation of Commercial Space Travel' (2004) 69 *Journal of Air Law and Commerce* 101, 103.

centres, as well as daily scheduled lunar flights to a series of lunar orbit and lunar pole hotels.¹³

Certainly at this stage, however, such claims look to be unrealistic. They highlight the fact that, no matter the form in which it ultimately eventuates, the prospect of commercial space tourism gives rise to some conceptually difficult legal issues. As technology is developed to make widespread space tourism a reality, it is incumbent on the law itself to develop in order to meet the demands for proper regulation of such activities. Of course, this phenomenon of ‘technology encouraging law’ or, as might be more accurate in the case of outer space regulation, ‘law chasing technology’, is not confined solely to the area of space-related technology.¹⁴ In the case of space tourism, however, it is obviously an important consideration, even more so given that it will involve humans engaging in what is an inherently ‘risky’ activity.

These questions are all the more complex given the fundamental principles and limitations that are found in the international legal regime that has already been established for outer space, in particular its categorisation as a ‘common asset’ — incorporating within its regulation the concept of the ‘Common Heritage of Mankind’¹⁵ — raising broader ethical questions about space tourism activities.

This article examines some of the more pressing legal issues that must be addressed in order to allow for the appropriate regulation of space tourism activities, without which the prospect of a widespread industry will not be realised. It begins by explaining in broad terms the current international legal framework for the regulation of outer space. It then describes the brief history of space tourism to date, followed by a discussion of what is meant by the concept of ‘space tourism’ and the possible forms that space tourism might take.

Following on from this, the article analyses a number of the complex legal questions that arise, ranging from the applicable legal regime, the legal status of space tourists, what rules apply (and are necessary) with respect to liability issues, and whether fundamental rules relating to the non-appropriation of space may conflict with the creation of any ‘celestial property rights’ that may become necessary for certain space tourism activities to proceed at all. This discussion highlights that there is still much to be done, both at the national and international level, in terms of putting into place an appropriate and comprehensive body of law and regulation to adequately deal with the challenges posed by the advent of widespread commercial space tourism activities.

¹³ Patrick Collins, ‘Towards Space Tourism: The Challenge for British Space Policy’ (2002) 55 *Journal of the British Interplanetary Society* 148, 148–9.

¹⁴ See, eg. Colin B Picker, ‘A View from 40 000 Feet: International Law and the Invisible Hand of Technology’ (2001) 23 *Cardozo Law Review* 149.

¹⁵ The concept of the ‘Common Heritage of Mankind’ was first developed during the course of the discussions leading to the finalisation of the *United Nations Convention on the Law of the Sea*, opened for signature 10 December 1982, 1833 UNTS 3 (entered into force 16 November 1994) (*UNCLOS*). Article 136 of *UNCLOS* declares that: ‘[t]he Area [the sea-bed and ocean floor and subsoil thereof, beyond the limits of national jurisdiction] and its resources are the common heritage of mankind’. In similar terms, art 11 of the *Agreement Governing the Activities of States on the Moon and Other Celestial Bodies*, opened for signature 18 December 1979, 1363 UNTS 3 (entered into force 11 July 1984) (*Moon Agreement*), declares that: ‘[t]he moon and its natural resources are the common heritage of mankind’.

Finally, this article provides some concluding comments that reflect on the need, even at this embryonic stage in the development of specific international rules, to carefully consider exactly what it is that we should seek to achieve in drafting and developing the rules for the regulation of commercial space tourism into the future. Particular focus is to be given to the context of the ‘humanity’ that underpins the legal categorisation of outer space, as well as its relevance for the way in which humankind conducts itself on Earth.

II AN OVERVIEW OF THE INTERNATIONAL LAW OF OUTER SPACE

The law of outer space has developed as a discrete body of law within public international law. Since the launch of Sputnik 1 by the Union of Soviet Socialist Republics in October 1957, this process of evolution has been remarkably rapid, largely driven by the need of states to agree on rules to regulate activities in this new ‘frontier’. There is now a substantial body of international and domestic legal principles dealing with many — but, as is emphasised in this article, not all — aspects of the use and exploration of outer space. These principles are primarily to be found in a number of United Nations-sponsored multilateral treaties, UN General Assembly Resolutions, a wide range of national legislation, decisions by national courts, bilateral arrangements, and determinations by intergovernmental organisations.

There are five main multilateral treaties that have been finalised through the auspices of the UN Committee on the Peaceful Uses of Outer Space (‘UNCOPUOS’), the principal multilateral body involved in the development of international space law.¹⁶ These are:

- 1 *Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies*;¹⁷
- 2 *Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space*;¹⁸
- 3 *Convention on International Liability for Damage Caused by Space Objects*;¹⁹
- 4 *Convention on Registration of Objects Launched into Outer Space*;²⁰ and
- 5 *the Moon Agreement*.

¹⁶ UNCOPUOS was established by the UN General Assembly in 1959, shortly after the advent of the space age brought on by the successful launch of Sputnik 1: see *International Co-operation in the Peaceful Uses of Outer Space*, GA Res 1472 (XIV), UN GAOR, 14th sess, 856th plen mtg, UN Doc A/RES/1472 (XIV) (12 December 1959). It currently has 69 Member States, which, according to UNCOPUOS, means that it is ‘one of the largest Committees in the United Nations’: United Nations Office for Outer Space Affairs, *United Nations Committee on the Peaceful Uses of Outer Space: Members* <<http://www.unoosa.org/oosa/en/COPUOS/members.html>>.

¹⁷ Opened for signature 27 January 1967, 610 UNTS 205 (entered into force 10 October 1967) (‘*Outer Space Treaty*’).

¹⁸ Opened for signature 22 April 1968, 672 UNTS 119 (entered into force 3 December 1968) (‘*Rescue Agreement*’).

¹⁹ Opened for signature 29 March 1972, 961 UNTS 187 (entered into force 1 September 1972) (‘*Liability Convention*’).

²⁰ Opened for signature 14 January 1975, 1023 UNTS 15 (entered into force 15 September 1976) (‘*Registration Agreement*’).

These five treaties deal with various important issues relating to outer space. In general terms, the international legal principles they contain provide for the non-appropriation of outer space by any one state, the freedom of the use and exploration of outer space, the liability regime applicable in the case of damage caused by space objects, the safety and rescue of space objects and astronauts, the prevention of harmful interference with space activities and with the environment, the notification to, and registration of, space activities with the UN, the scientific investigation and exploitation of the natural resources of outer space, and the settlement of disputes arising from outer space activities.

It is also important to bear in mind that these treaties were formulated in the Cold War era, when only a relatively small number of countries had space faring capability. At the time they were finalised, it had certainly not been anticipated that humankind would engage in widespread commercial space tourism and, as a result, these treaties do not deal with such activities in any specific detail.

There are, in addition, five sets of principles adopted by the UN General Assembly, each of which relates to specific aspects of the use of outer space. These are:

- 1 *Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space*;²¹
- 2 *Principles Governing the Use by States of Artificial Earth Satellites for International Direct Television Broadcasting*;²²
- 3 *Principles relating to Remote Sensing of the Earth from Outer Space*;²³
- 4 *Principles relevant to the Use of Nuclear Power Sources in Outer Space*;²⁴
and
- 5 *Declaration on International Cooperation in the Exploration and Use of Outer Space for the Benefit and in the Interest of All States, Taking into Particular Account the Needs of Developing Countries*.²⁵

These sets of principles provide for the application of international law and promotion of international cooperation and understanding in space activities. Further, they facilitate the dissemination and exchange of information through transnational direct television broadcasting via satellites and remote satellite observations of Earth, and promote general standards regulating the safe use of nuclear power sources necessary for the exploration and use of outer space.

It is generally agreed that resolutions of the General Assembly are non-binding,²⁶ at least within the traditional analysis of the 'sources' of

²¹ GA Res 1962 (XVIII), UN GAOR, 18th sess, 1280th plen mtg, UN Doc A/RES/1962 (XVIII) (13 December 1963).

²² GA Res 37/92, UN GAOR, 37th sess, 100th plen mtg, UN Doc A/RES/37/92 (10 December 1982). Note that, unlike other space related resolutions of the United Nations General Assembly, this resolution was not passed unanimously, but rather by a vote, in which most of the major developed (broadcasting) states at the time either abstained or voted against the resolution.

²³ GA Res 41/65, UN GAOR, 41th sess, 95th plen mtg, UN Doc A/RES/41/65 (3 December 1986).

²⁴ GA Res 47/68, UN GAOR, 47th sess, 85th plen mtg, UN Doc A/RES/47/68 (14 December 1992).

²⁵ GA Res 51/122, UN GAOR, 51th sess, 83rd plen mtg, UN Doc A/RES/51/122 (13 December 1996).

international law²⁷ specified in art 38(1) of the *Statute of the International Court of Justice* ('*ICJ Statute*').²⁸ In the context of regulating the use and exploration of outer space, these five sets of principles have largely been considered as constituting 'soft law', although a number of specific provisions may now represent customary international law.²⁹ However, as with the space treaties, they are generally of little direct import with respect to space tourism activities.

III A (BRIEF) HISTORY OF SPACE TOURISM

Since the 1960s, approximately 500 astronauts have gone into outer space. By contrast, only a handful of (very wealthy) individuals have visited space as tourists. Although the range of activities undertaken in outer space has grown exponentially since the launch of Sputnik 1, humankind is only now on the threshold of the next great 'leap' into space. Indeed, the focus for the development of space technology has historically been on military/quasi-military uses of space, although most of these applications have also evolved into very significant commercial activities. As a consequence, it was not until the beginning of the 21st century that the concept of a 'space tourist' has actually become a reality.

In April 2001, US national Dennis Tito, after reportedly paying US\$20 000 000 for the privilege,³⁰ spent six days in the Russian section of the International Space Station ('ISS') following a period of extensive training at Russia's Star City complex. For the first time, a passenger was able to pay for the opportunity of participating in a mainstream space project involving actual orbital travel, including a stay in the world's most expensive 'hotel'. Whilst on

²⁶ See, eg, D J Harris, *Cases and Materials on International Law* (Sweet & Maxwell, 6th ed, 2004) 57–61 and the references referred to therein.

²⁷ A growing body of contemporary academic literature has more recently emerged that questions the traditional understanding of what constitutes a rule of customary international law: see, eg, Iain Scobbie, 'The Approach to Customary International Law in the Study' in Elizabeth Wilmshurst and Susan Breau (eds), *Perspectives on the ICRC Study on Customary International Humanitarian Law* (Cambridge University Press, 2007) 15. That author (at 24) describes various 'revisionist accounts of custom formation'. See also Christiana Ochoa, 'The Individual and Customary International Law Formation' (2007) 48 *Virginia Journal of International Law* 119, 135–142.

²⁸ It is generally asserted by international law scholars that art 38(1) of the *ICJ Statute* lists the so-called 'sources' of international law: see, eg, Georg Schwarzenberger, *International Law* (Stevens, 3rd ed, 1957) vol 1, 25–6; Antonio Cassese, *International Law* (Oxford University Press, 2nd ed, 2005) 156. Article 38(1) of the *ICJ Statute* provides as follows:

The Court, whose function is to decide in accordance with international law such disputes as are submitted to it, shall apply:

- a. international conventions, whether general or particular, establishing rules expressly recognized by the contesting states;
- b. international custom, as evidence of a general practice accepted as law;
- c. the general principles of law recognized by civilized nations;
- d. subject to the provisions of Article 59, judicial decisions and the teachings of the most highly qualified publicists of the various nations, as subsidiary means for the determination of rules of law.

²⁹ See, eg, Ricky J Lee and Steven R Freeland, 'The Crystallisation of General Assembly Space Declarations into Customary International Law' (2004) 46 *Proceedings of the Colloquium on the Law of Outer Space* 122.

³⁰ *Profile: Tito the Spaceman* (28 April 2001) BBC News <<http://news.bbc.co.uk>>.

the ISS, Tito reportedly spent his time ‘photographing the Earth and listening to opera’.³¹

Tito’s trip was only possible following the agreement of all ISS Partners.³² His participation had originally been opposed by NASA, which argued that the presence of an ‘amateur’ on the ISS would endanger the permanent crew. However, following the success of his journey, NASA became more open to the idea of space tourists within the context of the ISS project.³³ Indeed, Tito was subsequently asked to address a US Congress subcommittee on the subject of space tourism.³⁴

In April 2002, the aptly named South African, Mark Shuttleworth, became the world’s second space tourist. Like Tito, he was launched onto the ISS by the Russian Space Agency. This ‘Afronaut’ spent eight days on the ISS conducting scientific experiments, including a number relating to the HIV virus. The symbolic relevance of his work — South Africa is one of the countries worst affected by HIV/AIDS — gave further credibility to the worth of orbital space tourism, even though it was still the sole domain of the exceptionally wealthy. South Africa’s then-President Thabo Mbeki, described Shuttleworth as ‘a courageous pioneer for South Africa and his continent, Africa’.³⁵

Since then, a further five space tourists have visited the ISS (including former senior Microsoft developer Charles Simonyi, who has been twice),³⁶ with the latest being Canadian Guy Laliberté, the founder of the Cirque du Soleil. Whilst there, Laliberté hosted a television program promoting issues related to water shortages on Earth.³⁷ There have, as yet, not been any suborbital (see below) space tourists although the success of the Ansari X-Prize competition has provided a major impetus towards the establishment of that sector of the industry.

³¹ UN Office for Outer Space Affairs, *Highlights in Space 2001*, UN Doc ST/SPACE/8 (2002) 24.

³² The partners in the ISS Project are the US, Russia, Japan, Canada, and 11 Member States of the European Space Agency (Belgium, Denmark, France, Germany, Italy, The Netherlands, Norway, Spain, Sweden, Switzerland, and the United Kingdom): see art 3(b) of the intergovernmental agreement that formalises the relationship between the ISS Partners, the *Agreement concerning Co-operation on the Civil International Space Station*, opened for signature 29 January 1998, TIAS No 12927 (entered into force 27 March 2001) (‘ISS Agreement’).

³³ In September 2001, NASA released its new policy on commercialisation of its manned space activities. This envisaged the opening up of space shuttle flight opportunities, and possibly also crew slots on the ISS, to private-sector personnel: Office for Outer Space Affairs, above n 31.

³⁴ Leonard David, *Dennis Tito Addresses Congress on Future Space Tourism* (26 June 2001) Space.com <<http://www.space.com>>; Evidence to Joint Hearing on Commercial Human Space Flight, House of Representatives Subcommittee on Space and Aeronautics and Senate Subcommittee on Science, Technology and Space, 108th Congress, Washington DC, 24 July 2003, 18 (Dennis Tito) <<http://bulk.resource.org/gpo.gov/hearings/108h/88501.pdf>>.

³⁵ Ben Aris, ‘Net Millionaire Surfs into Space’, *The Daily Telegraph* (London) 26 April 2002, 15; Ministry of Arts, Culture, Science and Technology (South Africa), ‘Minister Ngubane Supports Mark Shuttleworth’s 10-Day Journey to the International Space Station’ (Press Release, 22 April 2002) <<http://www.info.gov.za/speeches/2002/02042212461001.htm>>.

³⁶ William Harwood, ‘Tourist and 2 Others on Way to Space Station’, *The New York Times* (New York) 27 March 2009, 9.

³⁷ ‘Space Clown’ Hosts *Global Show* (10 October 2009) BBC News <<http://news.bbc.co.uk>>.

IV WHAT IS 'SPACE TOURISM'?

The term 'space tourism' has been defined as 'any commercial activity offering customers direct or indirect experience with space travel'.³⁸ A space tourist has been defined as 'someone who tours or travels into, to, or through space or to a celestial body for pleasure and/or recreation'.³⁹ Despite the obvious enthusiasm for, and extent of research associated with, the development of a commercial space tourism industry, it is probably too soon to confidently predict exactly how it will develop. However, it is possible to envision the following possible forms of commercial space tourism 'experience':

A *Orbital Space Tourism*

In orbital spaceflight, such as has been experienced by all space tourists thus far (on the ISS), orbital velocity must be achieved for the vehicle to keep flying along the curvature of the Earth. 'Orbital velocity', the velocity required to stay in an orbit, depends on the altitude of the orbit. For a circular orbit at an altitude of around 200 kilometres, the orbital velocity required is approximately 28 000 kilometres per hour.⁴⁰ Among other things, it is this extremely high speed that makes orbital space flight so technically complex and therefore so much more expensive than suborbital space tourism.

B *Suborbital Space Tourism*

Suborbital spaceflight, which is the type that will be offered by companies like Virgin Galactic and EADS Astrium, is likely to be the most common form of space tourism, at least in the short to medium term. This refers to space trips in which orbital velocities are not achieved and involves spacecraft flights that are more or less straight up and down, attaining an altitude of between 100 and 200 kilometres. After engine shutdown, passengers experience microgravity (weightlessness) for about three to six minutes, after which the vehicle re-enters the atmosphere and returns to Earth.

C *Intercontinental Rocket Transport*

Intercontinental rocket transport implies a transit through space in order to shorten substantially the travel time from one point on Earth to another. It is an idea that has existed for a long time. This concept is attractive for the military, as well as for commercial transportation of passengers and goods. However, the technical challenges are substantial in terms of the required velocity, the amount of propellant required, and the need for a robust thermal protection system ('TPS') for safe re-entry to the Earth's atmosphere. Although it involves different technical considerations, the unfortunate history of the Concorde

³⁸ Stephan Hobe and Jürgen Cloppenburg, 'Towards a New Aerospace Convention? Selected Legal Issues of "Space Tourism"' (2004) 47 *Proceedings of the Colloquium on the Law of Outer Space* 377.

³⁹ Zeldine Niamh O'Brien, 'Liability for Injury, Loss or Damage to the Space Tourist' (2004) 47 *Proceedings of the Colloquium on the Law of Outer Space* 386.

⁴⁰ The orbital altitude of the International Space Station is between 370 and 460 kilometres and its orbital velocity is approximately 27 500 kilometres per hour: European Space Agency, 'International Space Station: Final Configuration' (Fact Sheet No 1, 3 November 2005) 2 <http://www.spaceflight.esa.int/users/downloads/factsheets/fs001_12_iss.pdf>.

aircraft is illustrative of the technical complexities (and risks) that are also involved in ‘point to point’ travel on Earth at very fast speeds.⁴¹

If and when this particular form of tourism becomes technically and commercially feasible, it may well be that it eventually results in the creation of a new branch of international law — ‘Aerospace Law’. The possible form and content of this potentially emerging area of law is beyond the scope of this article. No doubt it will be the subject of more detailed research in the future.

V WHAT INTERNATIONAL LAW APPLIES TO SPACE TOURISM?

All of this discussion does, however, beg a fundamental question — ‘what is outer space?’ Rather surprisingly to some, from a strictly legal perspective, there is as yet no clear definition of outer space. Indeed, it is unclear where (and how) air space ends and outer space begins. While outer space activities have continued to develop notwithstanding this uncertainty, there are important practical reasons why a clear legal distinction between ‘commercial aviation flights’ and ‘commercial space flights’ should now be properly determined.⁴² There is now an even greater imperative for this given the impending advent of space tourism activities, particularly those involving suborbital flights.

The underlying principles upon which air law and outer space law are respectively based are diametrically opposed. The international law of outer space does not allow for claims of sovereignty. The *Outer Space Treaty* provides that ‘[o]uter space ... is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means’.⁴³ In general terms, this fundamental principle confirms that outer space (including the Moon and other celestial bodies) is not to be subject to ownership rights and prohibits, inter alia, any sovereign or territorial claims to outer space.⁴⁴

In the period following the launch of Sputnik 1, there were no significant protests by states claiming that the orbiting trajectory of that space object encroached upon their respective sovereign territories. As indicated by their (in)action and/or acquiescence, states had acknowledged that the fundamental legal character of outer space differed from that of the air space beneath it, and that states have the right to engage in activities in outer space without seeking the prior permission of any other state.

As such, almost immediately after humankind had begun its quest to explore and use outer space, a number of foundational principles of the international law of outer space were born, in particular the so-called ‘common interest’, ‘freedom’ and ‘non-appropriation’ principles. These principles were later

⁴¹ See, eg, *Concorde Crash Manslaughter Trial Begins in France* (2 February 2010) BBC News <<http://news.bbc.co.uk/2/hi/europe/8492561.stm>>.

⁴² R Thomas Rankin, ‘Space Tourism: Fanny Packs, Ugly T-Shirts, and the Law in Outer Space’ (2003) 36 *Suffolk University Law Review* 695, 697, 710–15.

⁴³ *Outer Space Treaty* art II.

⁴⁴ For a detailed discussion of the meaning and implications of art II of the *Outer Space Treaty*, see Steven Freeland and Ram Jakhu, ‘Article II’ in Stephan Hobe, Bernhard Schmidt-Tedd and Kai-Uwe Schrogl (eds), *Cologne Commentary on Space Law, Volume I — Outer Space Treaty* (Carl Heymanns, 2009) 44.

incorporated into the terms of arts I⁴⁵ and II of the *Outer Space Treaty* and therefore constitute binding conventional rules, codifying what already amounted to principles of customary international law. In essence, the community of states, including both of the major space faring states of the time, had accepted that outer space was to be regarded as being similar to a *res communis omnium*,⁴⁶ encompassing these fundamental principles. As Judge Lachs of the ICJ observed:

The first instruments that man sent into outer space traversed the airspace of States and circled above them in outer space, yet the launching States sought no permission, nor did the other States protest. This is how the freedom of movement into outer space, and in it, came to be established and recognized as law within a remarkably short period of time.⁴⁷

In essence, outer space is ‘free’ for use — tourist activities that take place in outer space are not subject to prior consent on the part of any sovereign state, although they will remain subject to the obligation of the ‘appropriate’ state to authorise and continually supervise such private commercial ventures, as specified in art VI of the *Outer Space Treaty*. Of course, any space tourist activities requiring a launch from Earth (or an ‘air launch’ such as with SpaceShipOne) and a return to Earth will also involve a ‘use’ of air space. In this respect, the law of air space may be relevant to the legal position.

These principles of the international law of outer space represent a significant departure from the legal rules relating to air space, which from a legal perspective is categorised as constituting part of the ‘territory’ of the underlying state. The territorial nature of air space is reflected in the principal air law treaties. For example, the *Chicago Convention*⁴⁸ provides that ‘every State has complete and exclusive sovereignty over the air space above its territory’.⁴⁹ The ICJ has concluded that this characteristic of air space also represents customary

⁴⁵ Article I of the *Outer Space Treaty* provides as follows:

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.

⁴⁶ Cassese, above n 28, 95.

⁴⁷ *North Sea Continental Shelf Cases (Federal Republic of Germany v Denmark; Federal Republic of Germany v Netherlands) (Merits)* [1969] ICJ Rep 3, 230 (Judge Lachs).

⁴⁸ *Convention on International Civil Aviation*, opened for signature 7 December 1944, 15 UNTS 295 (entered into force 4 April 1947) (*‘Chicago Convention’*).

⁴⁹ *Ibid* art 1. For the purposes of the *Chicago Convention*, the territory of a state is regarded as ‘the land areas and territorial waters adjacent thereto under the sovereignty, suzerainty, protection or mandate of such State’: *ibid* art 2.

international law.⁵⁰ As a consequence, civil and commercial aircraft only have certain limited rights to enter the air space of another state.⁵¹

Given the distinction in fundamental legal principles between air law and the international law of outer space — which naturally will have implications for issues such as jurisdiction and liability as applied to space tourism activities — it is important to determine ‘what laws apply where’. As mentioned, the legal demarcation between air space and outer space has not been determined. There has, over the years, been some controversy in relation to how far air space extends above the surface of the Earth⁵² and many methodologies have been suggested to resolve this uncertainty. None of these have been accepted as a legal definition by the international community through the UNCOPUOS process, partially in response to the advancing technology in relation to conventional aircraft, but also due to an apprehension that to agree to such a demarcation may formalise the surrendering of future ‘valuable sovereign rights’.⁵³

There have, however, been interesting developments in relation to a possible demarcation in the context of domestic space legislation, lead (coincidentally) by Australia.⁵⁴ This evolutionary process was subsequently given significant impetus by the inclusion of a definition of ‘outer space’ in a high profile international context, in the form of the ‘Draft Treaty on the Prevention of the Placement of Weapons in Outer Space and of the Threat or Use of Force against Outer Space Objects’⁵⁵ (‘PPWT’), which was presented in January 2008 to the

⁵⁰ In *Military and Paramilitary Activities in and against Nicaragua (Nicaragua v US)* (Merits) [1986] ICJ Rep 14, 128 the Court noted that ‘[t]he principle of respect for territorial sovereignty is also directly infringed by the unauthorized overflight of a State’s territory by aircraft belonging to or under the control of the government of another State’.

⁵¹ See *Chicago Convention* arts 5, 6.

⁵² On 3 December 1976, eight equatorial states — Brazil, Colombia, Congo, Ecuador, Indonesia, Kenya, Uganda and Zaire (now the Democratic Republic of the Congo) — signed the *Declaration of the First Meeting of Equatorial Countries* (‘*The Bogotá Declaration*’), reprinted in English in as a special feature in (1978) 6 *Journal of Space Law* 193, which asserted that, in the absence of any legally determined upper limit to air space, those segments of the geostationary orbit (located approximately 36 000 kilometres directly above the equator) above their territory constituted part of their respective sovereign territories. This assertion has not been accepted by other states and is not considered to properly reflect international law.

⁵³ Malcolm N Shaw, *International Law* (Cambridge University Press, 5th ed, 2003) 480. For a discussion of the various theories regarding a demarcation between air space and outer space, see I H Ph Diederiks-Verschoor and V Kopal, *An Introduction to Space Law* (Wolters Kluwer, 3rd ed, 2008) 15–20.

⁵⁴ Australia was the sixth country to introduce specific domestic legislation directed towards space activities. The previous countries were the US, Sweden, the UK, the Russian Federation and South Africa. The *Australian Space Activities Act 1998* (Cth), as amended by the *Space Activities Amendment Act 2002* (Cth), incorporates into the definition of a ‘launch’, a ‘launch vehicle’, a ‘return’, and a ‘space object’ for the purposes of the legislation a reference to ‘the distance of 100 [kilometres] above mean sea level’. This was, as far as this author is aware, the first example of domestic law that refers to a specific ‘demarcation point’ for the purposes of applying space-related regulation. For a discussion of the Australian legislation and its relationship with Australia’s space engagement policy at the time, see Steven Freeland, ‘Difficulties of Implementing National Space Legislation Exemplified by the Australian Approach’, in Stephan Hobe, Bernhard Schmidt-Tedd and Kai-Uwe Schroll (eds), *Project 2001 Plus* — *Global and European Challenges for Air and Space Law at the Edge of the 21st Century* (Carl Heymanns, 2006) 65.

⁵⁵ ‘Draft Treaty on Prevention of the Placement of Weapons in Outer Space and of the Threat or Use of Force against Outer Space Objects’ (Document CD/1839, Conference on Disarmament, 29 February 2008) 2.

65 members attending the Plenary Meeting of the UN Conference on Disarmament in Geneva. Notable is the fact that the PPWT was sponsored at the Conference by Russia and China, two of the major space superpowers. An earlier draft had been informally circulated the previous June, resulting in comments and widespread support from a number of other countries.

Article I(a) of the PPWT defines outer space as ‘space beyond the elevation of approximately 100 [kilometres] above [the] ocean level of the Earth’. Apart from the somewhat curious use of the word ‘approximately’ — in what circumstances would a variation to the 100 kilometres standard apply? — this represents a rather revolutionary suggestion by two major superpowers that, along with the US, have previously tended to stifle attempts to designate a formal demarcation between air space and outer space, primarily for strategic and political reasons. Indeed, it was only a few years ago that, in an offhand comment, a Chinese Foreign Ministry spokesperson reportedly referred to outer space as the ‘Fourth Territory’.⁵⁶

These developments may eventually herald the move towards a more widely recognised demarcation point in the future, although we have not yet reached that point. In the meantime, what laws should apply to space tourism? Should, as appears increasingly to be the view in Europe,⁵⁷ air law apply for part of the journey and space law then be applied at some (undefined) point in the overall space tourism activity? Moreover, should the legal position differ for suborbital flights and orbital flights?

In relation to the launch of space tourism vehicles from Earth, it is contended that the applicability of different laws would represent an unsatisfactory and impractical solution and actually lead to greater uncertainty in the absence of a clear defining point for the ‘boundary’ between air space and outer space. A comprehensive and uniform legal regime that specifically envisages and applies to the complete launch and return journey of private individuals should be preferred. However, given the long lead time that would be required to negotiate and agree to a new multilateral treaty, this is perhaps not a very realistic response for the short term and will not solve the immediate problems of today’s space tourism entrepreneurs.

In the interim, in this author’s view, the most appropriate approach seems to be the application of space law (with appropriate amendment and clarification) to the entire journey, on the basis of the proposed function of the spacecraft carrying tourists — that is, the intention that it involves flight into and in outer space.⁵⁸

The already uncertain legal position is further complicated by ‘hybrid’ circumstances like the SpaceShipOne example, where there is a launch of the space vehicle from another vehicle (an aircraft) in air space. In this case, perhaps the most appropriate way of regulating such flights under existing legal

⁵⁶ See Steven Freeland, ‘The 2008 Russia/China Proposal for a Treaty to Ban Weapons in Space: A Missed Opportunity or an Opening Gambit?’ (2008) 51 *Proceedings of the International Institute of Space Law* 261.

⁵⁷ See Tanja Masson-Zwaan and Steven Freeland, ‘Between Heaven and Earth: The Legal Challenges of Human Space Travel’ (2010) 66 *Acta Astronautica* 1597, and the references therein.

⁵⁸ Bin Cheng, ‘International Responsibility and Liability for Launch Activities’ (1995) 20 *Air and Space Law* 297, 299.

principles would be to apply air law to the ‘combined’ vehicle (that is, before the launch) and then apply space law to SpaceShipOne from the moment it is launched until its return to Earth. White Knight, of course, would always remain subject to air law.

Even this solution, though pragmatic, is somewhat unsatisfactory in that, in the event of an accident during the flight, the applicable legal regime will depend on when the accident occurs. The legal position of the victim will depend on fortuitous circumstances. If anything, this uncertainty further highlights the need for a comprehensive set of rules, based on existing space law principles, to cover all phases of a flight.

VI WHAT IS THE LEGAL STATUS OF A SPACE TOURIST?

The international law of outer space, as reflected in the five space treaties and sets of principles referred to earlier, makes no reference to ‘tourists’, but does contemplate space travel by ‘astronauts’, as well as by ‘personnel of a spacecraft’. The *Outer Space Treaty* does not provide a definition of an astronaut, but stipulates that they are ‘envoys of mankind’,⁵⁹ and obligates states to render ‘all possible assistance’ to astronauts in the event of an ‘accident, distress or emergency landing’.⁶⁰ These obligations are further developed in the *Rescue Agreement* which, despite the use of the term ‘astronauts’ in its full title and preamble, refers in its substantive provisions to the responsibilities of states parties to rescue and return ‘personnel of a spacecraft’.⁶¹ Moreover, the *Moon Agreement* confirms that ‘any person’ on the Moon is to be regarded — at least by states parties — as an astronaut.⁶²

Given the particular legal status accorded to an astronaut under the *Outer Space Treaty*, it is not at all clear whether a commercial space tourist would fall within this classification. It is, however, probable that space tourists would constitute ‘personnel of a spacecraft’, thus bringing them within the rescue and return obligations of the *Rescue Agreement*. Indeed, if this were not the case, then those obligations would only extend to some of those onboard a space tourism flight — for example the crew — but not to the paying passengers. This would be a very strange result and, in any event, since the *Rescue Agreement* is

⁵⁹ Article V of the *Outer Space Treaty* requires states parties to ‘regard astronauts as envoys of mankind’.

⁶⁰ *Outer Space Treaty* art V.

⁶¹ *Rescue Agreement* arts 1–4.

⁶² *Moon Agreement* art 10. The *Moon Agreement* has not been widely accepted and, as at the time of writing this article, had only been ratified by 13 states, none of which are major space-faring states. For a discussion of the history leading to the finalisation of the *Moon Agreement* and the differing views of the treaty by developed and developing countries, see Brian M Hoffstadt, ‘Moving the Heavens: Lunar Mining and the “Common Heritage of Mankind” in the Moon Treaty’ (1994) 42 *UCLA Law Review* 575.

expressly stated to be ‘prompted by sentiments of humanity’,⁶³ it should be interpreted as applying to all persons involved in a space tourism flight.⁶⁴

This is an issue that should be clarified. Specific reference should be made to the various types of people who are engaged in space travel. As an example, in early 2002, the participating Space Agencies in the ISS project reached an agreement as to who was allowed on the ISS. This covered both ‘professional astronauts/cosmonauts’ and ‘spaceflight participants’, which included those on ‘commercial, scientific and other programmes, crewmembers of non-partner space agencies, engineers, scientists, teachers, journalists, filmmakers, or tourists’.⁶⁵ The agreement has not gone so far as to require these participants to sign a code of conduct — as is required for crew members of the ISS — but the inclusion of non-professional persons, such as tourists, on board space vehicles will necessitate acceptance by them of some minimum standard of care.

Another legal issue relating to the status of a space tourist stems from the terms of the *Liability Convention*. This instrument expressly does not apply to damage (see below) caused by a space object to ‘foreign nationals during such time as they are participating in the operation of that space object from the time of its launching or at any stage thereafter until its descent’.⁶⁶

These words are somewhat ambiguous, but it is likely that space tourists would generally not fall within this exception, since they would not normally be performing this type of task. Yet, in certain circumstances, it may fall to a consideration of the specific functions (if any) undertaken by the tourist while aboard the space object — for example, was Mark Shuttleworth participating in this way when he was conducting his experiments on board the ISS? This leads to further uncertainty in the applicability of the *Liability Convention*. This is but one of the many issues to be clarified in the development of an appropriate legal regime for liability arising from space tourism activities, considered below.

⁶³ *Rescue Agreement* Preamble.

⁶⁴ The *Vienna Convention on the Law of Treaties*, opened for signature 23 May 1969, 1155 UNTS 331 (entered into force 27 January 1980) (*VCLT*), sets out clear principles for the interpretation of a treaty. The general rule of interpretation, as set out in art 31(1), provides, inter alia, that: ‘[a] treaty shall be interpreted in good faith in accordance with the ordinary meaning to be given to the terms of the treaty in their context and in the light of its object and purpose’. The ICJ has on several occasions confirmed that both art 31 and art 32 of the *VCLT* (which expands on the rules of interpretation provided in art 31), reflect customary international law: see, eg, *Territorial Dispute (Libyan Arab Jamahiriya v Chad) (Judgment)* [1994] ICJ Rep 6, 21; *Maritime Delimitation and Territorial Questions between Qatar and Bahrain (Qatar v Bahrain) (Judgment)* [1995] ICJ Rep 6, 18; *Legal Consequences of the Construction of a Wall in the Occupied Palestinian Territory (Advisory Opinion)* [2004] ICJ Rep 136, 174. As a consequence, these rules of interpretation might also be applicable to treaties, such as the various space law treaties, which came into force prior to 1980. The preamble of a treaty forms part of the ‘context’ of the instrument: *VCLT* art 31(2).

⁶⁵ The US Congress has passed the *Commercial Space Launch Amendments Act of 2004*, Pub L No 108-492 118 Stat 3974, which provides for amendments to *Commercial Space Launch Act of 1984*, 49 USC § 70101 (2004), in order to permit human space flight by private corporations. The legislation distinguishes between the ‘crew’ of a space vehicle, who in the course of their employment ‘perform activities ... directly relating to the launch, reentry, or other operation of or in a launch vehicle or reentry vehicle that carries human beings’ and a ‘space flight participant’.

⁶⁶ *Liability Convention* art VII(b).

VII WHAT ARE THE APPLICABLE RULES RELATING TO LIABILITY FOR DEATH/DAMAGE?

The stark images of the February 2003 Columbia Shuttle disaster⁶⁷ highlighted both the hazardous nature of space travel and the need for the highest possible (and practical) standards of safety regulation for future commercial human space travel. If the space tourism industry is to develop, every reasonable effort must be taken to ensure the safety of those on board space tourism vehicles, not only in an effort to attract paying passengers but also to minimise the possibility of disaster.

Of course, this should already be the case with all current human space travel activities. Yet, the law of averages suggests that the greater the number of human space flights that take place, the greater the probability that there will be an accident. Nothing can ever be guaranteed to be completely safe. Nonetheless, it would be unacceptable to even begin embarking on the development of a commercial space tourism industry without giving the greatest consideration to the implementation of proper safety standards.

Within this context, however, there are enormous costs associated with trying to address every foreseeable or possible contingency that may arise. The provision of additional protective equipment on a space shuttle, for example, is costly, heavy and may adversely impact on its payload capacity. The reality has thus far been that human space travel has involved a trade-off between the design of the safest possible space vehicle (within the limitations of existing technology), and what are (or should be) deemed as 'acceptable' risks, given the very significant amounts of money that are involved.

Yet it is self-evident that the loss of 40 per cent of the space shuttle fleet (two out of the original five), after only 130 flights,⁶⁸ is itself an unacceptably high failure rate for any type of activity opened to the public, exceeding even NASA's own safety margin requirements.⁶⁹ Once the general public is involved in the activity, the minimum required (and achieved) safety record must be significantly improved — if not, then any realistic possibility for the development of a commercial space industry will disappear even before it has begun. Not only must there be appropriate safety standards pertaining to the design, construction and operation of a space tourism launch vehicle, but a system of responsibility and liability must be established at the international level — supplemented by domestic law — to regulate those circumstances when a space tourist suffers injury, loss or damage, so as to remove current uncertainties surrounding the remedies that may be available, and to ensure that proper risk avoidance procedures are implemented.

In this regard, existing international space law is inadequate. Although it was contemplated that 'national activities in outer space' might be undertaken by non-governmental entities, the *Outer Space Treaty* provides that 'international

⁶⁷ See, eg, 'The Columbia Space Shuttle Tragedy', *The Guardian* (online), 2010 <<http://www.guardian.co.uk/gall/0,,888237,00.html>>.

⁶⁸ Space Shuttle Endeavour Mission STS-130 commenced as this article was being finalised: NASA, *Space Shuttle* (2010) <http://www.nasa.gov/mission_pages/shuttle/main/index.html>.

⁶⁹ Paul Recer and Broward Liston, 'More Shuttles Are Likely to Be Lost, Safety Panel Tells NASA', *The Sydney Morning Herald* (Sydney) 28 March 2003, 16.

responsibility' for such activities rests with states.⁷⁰ This remains the position today, despite the fact that the range of space activities, as well as the number and type of private non-governmental participants involved in these activities, has grown exponentially. Moreover, states are required by the terms of the *Outer Space Treaty* to authorise and continually supervise those national activities in outer space undertaken by non-governmental entities. As these principles also reflect customary international law, they bind all states.

Flowing on from this 'state-oriented' approach to accountability for space activities, art VII of the *Outer Space Treaty*, together with the more detailed liability regime specified in the *Liability Convention*, imposes international liability on a 'launching state' for certain specified damage⁷¹ caused by a space object.⁷² In the absence of specific waivers, or where the various exceptions and exonerations contained in the *Liability Convention* do not apply, all launching states will bear this international obligation of liability on a joint and several basis.⁷³ This has been one of the underlying reasons behind the growing number of national space laws enacted by states.⁷⁴ The terms of these domestic laws enable states to pass on financial responsibility to their private entities, and recover the amount of the damages for which they remain liable at the international level.⁷⁵

Where damage, as defined in the treaty, is suffered by individuals, the procedures under the *Liability Convention* only allow for legal action to be taken

⁷⁰ *Outer Space Treaty* art VI.

⁷¹ Article I(a) of the *Liability Convention* defines 'damage' as follows: 'loss of life, personal injury or other impairment of health; or loss of or damage to property of States or of persons, natural or juridical, or property of international intergovernmental organisations'.

⁷² *Ibid* art II(c) defines a launching state as follows:

- (i) A State which launches or procures the launching of a space object;
- (ii) A State from whose territory or facility a space object is launched.

⁷³ For an analysis of the terms of the *Liability Convention*, see Steven Freeland, 'There's a Satellite in My Backyard! Mir and the *Convention on International Liability for Damage Caused by Space Objects*' (2001) 24 *University of New South Wales Law Journal* 462.

⁷⁴ The development of domestic space legislation has escalated quite dramatically over the past decade, but remains an ongoing process, given that there are still a significant number of space faring countries without any meaningful domestic regulatory regime. However, this 'shortfall' of domestic law is likely to recede over time, and there is no doubt that the development of a significant body of domestic legislation represents one of the real 'growth areas' of space law. The website of the United Nations Office of Outer Space Affairs currently provides links to 20 states that have some form of specific space related national legislation: United Nations Office for Outer Space Affairs, *OOSA Documents Database* (2010) <http://www.unoosa.org/oosadb/browse_all.jsp?level1=countries&level2=none>. There are also a number of countries (including Austria and the United Arab Emirates) that are currently planning to introduce such legislation in the near future.

⁷⁵ For example, the Australian *Space Activities Act 1998* (Cth) establishes a liability regime with this goal in mind. Part 4 of the legislation provides either for absolute liability (s 67) or fault liability (s 68) on the part of the launch operator, in circumstances largely mirroring the terms of the arts II and III of the *Liability Convention*. This regime is applicable where Australia is regarded as a launching state and only during the 'liability period', which is defined as follows (s 8):

- (a) for the launch of a space object — the period of 30 days beginning when the launch takes place, or such other period as is specified in the regulations; and
- (b) for the return of a space object — the period beginning when the relevant re-entry manoeuvre is begun and ending when the object has come to rest on Earth, or such other period as is specified in the regulations.

by a relevant state. This requires political will on the part of that state to present a claim to a launching state. To date, no such claim has been made and it is by no means certain that a state would decide to bring such an action, unless the circumstances were of such magnitude that it would be politically expedient to do so.

Space tourists themselves are unable to claim compensation under the *Liability Convention*. While there may be scope to institute legal proceedings under national laws, there are limitations, such as sovereign immunity protections, that may represent a bar to a claim for compensation.⁷⁶ In addition, given the private contractual nature — between the operator and the tourist — by which most space tourism activities will take place, it is highly likely that carefully crafted ‘exclusion of liability’ clauses for death and injury will be included in the space tourism services agreement, although the domestic law principles in each state will dictate the extent to which such provisions might be enforceable.

Moreover, even though the domestic legislation of different states may seek to regulate the industry and provide for standards and protections, there is a danger that, without a uniform international law liability regime, the lack of uniformity will give rise to further uncertainty in this area.

For all of these reasons it is preferable that, operating over and above the range of any relevant domestic legislation, a uniform and comprehensive regime for passenger liability arising from space tourism activities be developed at the international level. These new rules, developed as part of the international law of outer space, should allow for direct private claims by passengers and should operate from the moment of launch until the safe return to the scheduled final destination.

In this regard, it is necessary to carefully determine the scope of this proposed new liability regime, so as to allow for effective and sufficient private remedies. A starting point would be a consideration of not only the existing space law provisions under the *Outer Space Treaty* and the *Liability Convention*, but also the international regime established in relation to liability of civil airline companies for the death of, or injury to passengers during commercial air travel. However, while an examination of the airline industry represents a useful step, it must always be remembered that that regime was structured specifically to the peculiarities of the industry and, in any event, experience has shown that it would not necessarily be an ideal model to meet the unique characteristics and enormous costs associated with space tourism.⁷⁷

Nevertheless, a consideration of both legal regimes immediately gives rise to a number of fundamental philosophical questions, the answers to which will shape the structure of any new liability regime. Should tourism activities in outer

⁷⁶ As to the application of sovereign immunity in space related cases in domestic courts (United States), see, eg, Lauren S B Bornemann, ‘*This Is Ground Control to Major Tom ... Your Wife Would Like to Sue but There’s Nothing We Can Do ... The Unlikelihood that the FTCA Waives Sovereign Immunity for Torts Committed by United States Employees in Outer Space: A Call for Preemptive Legislation*’ (1998) 63 *Journal of Air Law and Commerce* 517.

⁷⁷ The imposition of limits to liability in relation to aircraft accidents has meant that claimants are often tempted to sue aircraft manufacturers instead of the operator/carrier, in an attempt to obtain a higher level of compensation: Shaw, above n 53, 470.

space be subject to absolute liability, as is the case for certain instances of damage caused by a space object under the terms of the *Liability Convention*,⁷⁸ or should it instead operate under a liability regime based primarily upon principles of negligence, as exists under international air law?⁷⁹

Similarly, should the quantum of the liability be unlimited, as is the case under the *Liability Convention*, or is it appropriate to prescribe upper limits of liability, perhaps similar to that specified in the *Warsaw Convention*?⁸⁰ On the question of unlimited liability, there have already been calls from leading commentators for the establishment of a limited liability regime for launching states under existing international space law.⁸¹ Moreover, some may argue that space tourism passengers should be deemed at law to have voluntarily accepted the inherent risks associated with space travel simply by engaging in that activity and thus that liability should be limited to balance this assumption of risk.

While there is still much work to be done to determine the most appropriate form of regime, what is clear is that the existing international rules of space law, which rely solely on state responsibility and liability, are not appropriate for an industry that will principally be undertaken as a private commercial venture. Moreover, this regime must address not only issues of passenger liability, but

⁷⁸ Article II of the *Liability Convention* provides that: '[a] launching State shall be absolutely liable to pay compensation for damage caused by its space object on the surface of the earth or to aircraft in flight'.

⁷⁹ In this regard, it should be noted that art III of the *Liability Convention* provides that, if the damage is caused 'elsewhere than on the surface of the earth', liability only arises where the damage is due to 'fault' by those responsible for the space object causing the damage.

⁸⁰ *Convention for the Unification of Certain Rules relating to International Carriage by Air*, opened for signature 12 October 1929, 137 LNTS 11 (entered into force 13 February 1933) ('*Warsaw Convention*'). The *Warsaw Convention*, as amended, provides for upper limits for liability in relation to the carriage of passengers and of baggage and cargo, as well as dealing with areas of responsibility and insurance. Article 20(1) exonerates the carrier from liability where it or its servants and agents 'have taken all necessary measures to avoid the damage or that it was impossible for him or them to take such measures'. The *Convention for the Unification of Certain Rules for International Carriage by Air*, opened for signature 28 May 1999, 2242 UNTS 350 (entered into force 4 November 2003) ('*Montreal Convention*') was finalised to 'modernize and consolidate' the *Warsaw Convention*, and provides (art 17(1)) that the carrier is 'liable for damage sustained in case of death or bodily injury of a passenger upon condition only that the accident which caused the death or injury took place on board the aircraft or in the course of any of the operations of embarking or disembarking'.

This is subject to art 21, which provides as follows:

1. For damages arising under paragraph 1 of Article 17 not exceeding 100,000 Special Drawing Rights for each passenger, the carrier shall not be able to exclude or limit its liability.
2. The carrier shall not be liable for damages arising under paragraph 1 of Article 17 to the extent that they exceed for each passenger 100,000 Special Drawing Rights if the carrier proves that:
 - (a) such damage was not due to the negligence or other wrongful act or omission of the carrier or its servants or agents; or
 - (b) such damage was solely due to the negligence or other wrongful act or omission of a third party.

See also Shaw, above n 53, 471–2.

⁸¹ See, eg, International Law Association, 'Final Report on the Review of Space Law Treaties in View of Commercial Space Activities' (Paper presented at the International Law Association's Seventieth Conference, New Delhi, 3 April 2002) 209.

also third party liability.⁸² Instead, a new multilateral treaty should be developed to establish a system of liability that attaches to those private operators conducting space tourism activities.

This will also require the development of an effective space tourism insurance market. There is already a well-established space insurance industry, with approximately 30 insurance providers currently offering coverage for launch and in-orbit operations of government and commercial satellites.⁸³ Most of these insurance providers are large insurance (or reinsurance) companies, which allocate and manage their maximum exposure to the space industry. It is by no means certain that they would have sufficient capacity or enthusiasm to actively enter into another space related insurance market, particularly in the early days of space tourism with (at least in relative terms) untested technology.

In addition, although their level of expertise in relation to current space activities has developed significantly with experience — the space insurance market is now over 20 years old — this does not (yet) extend to space tourism. The advent of commercial space tourism activities available to the public will bring with it the need for new and complex risk management assessment procedures. Past experience has demonstrated that the requisite level of insurance-related expertise for new activities such as this may only emerge on a ‘trial and error’ basis.

Yet, it will be important to ensure that the legal regime for liability for such activities, as well as the terms and conditions of any tourism services agreement between passengers and operators, are matched by the availability of appropriate insurance coverage. Careful attention is required to make sure that there are no ‘gaps’ in the provision of such insurance, both from the perspective of the ongoing commercial viability of the operator, as well as the need to ensure that appropriate compensation will be paid in the event of an accident.

These developments will ultimately allow participants in the space tourism industry, and the governmental and inter-governmental agencies that are charged with regulating them, to be in a position to assess financial risks and exposure, as they seek to develop policies to create a viable and safe long-term industry.

VIII DOES SPACE TOURISM ASSUME THE NEED FOR ‘CELESTIAL PROPERTY RIGHTS’?

The fundamental principle of ‘non-appropriation’, upon which the international law of outer space is based, stems from the desire of the international community to ensure that outer space remains an area beyond the

⁸² The *Convention on Damage Caused by Foreign Aircraft to Third Parties on the Surface*, opened for signature 7 October 1952, 310 UNTS 181 (entered into force 4 February 1958) deals with issues of third party liability in respect of commercial air activities. The Preamble specifies that it is intended

to ensure adequate compensation for persons who suffer damage caused on the surface by foreign aircraft, while limiting in a reasonable manner the extent of the liabilities incurred for such damage in order not to hinder the development of international civil air transport.

⁸³ AON, *Space Insurance Market Report: Second Quarter 2008* (AON Report, 2008) 2.

jurisdiction of any state(s).⁸⁴ Similar ideals emerge from *UNCLOS* (in relation to the High Seas) as well as the *Antarctic Treaty*,⁸⁵ although in the case of the latter treaty, it was finalised after a number of claims of sovereignty had already been made by various states and therefore was structured to ‘postpone’ rather than prejudice or renounce those previously asserted claims.⁸⁶

As noted above, by the time that the *Outer Space Treaty* was finalised, both major space superpowers of the time, the US and the Soviet Union, had already been engaged in an extensive range of space activities; yet neither had made a claim to sovereignty over any part of outer space, including celestial bodies, notwithstanding the planting by the Apollo 11 astronauts of an American flag on the surface of the Moon. As a result, although it was of great importance to formalise this principle of non-appropriation of outer space, the drafting process leading to the finalisation of art II of the *Outer Space Treaty* was relatively uncontroversial, particularly given its early acceptance as a fundamental concept by these two major space faring states.⁸⁷

The exploration and use of outer space is expressed in art I of the *Outer Space Treaty* to be ‘the province of all mankind’, a term whose meaning is not entirely clear, but which has been interpreted by most commentators as evincing the desire to ensure that any state is free to engage in space activities, without reference to any sovereign claims of other states. This freedom is reinforced by other parts of the same article and is repeated in the *Moon Agreement* (which also applies to ‘other celestial bodies within the solar system, other than the earth’).⁸⁸

Even though both the scope for space activities and the number of private participants have expanded significantly since these treaties were finalised, it is still suggested by some commentators that the non-appropriation principle constitutes ‘an absolute legal barrier in the realization of every kind of space activity’.⁸⁹ The amount of capital expenditure required to research, scope, trial, and implement a new space activity is significant. To bring this activity to the point where it can represent a viable ‘stand-alone’ commercial venture takes many years and almost limitless funding. From the perspective of a private enterprise contemplating such an activity, this would quite obviously be an important element in its decision to devote resources to this activity that it is able to secure the highest degree of legal rights for the protection of its investment.

⁸⁴ One should note, however, that, in accordance with art VIII of the *Outer Space Treaty* read together with the *Registration Agreement*, registration of a space object gives the ‘State of registry’ (as defined in art I(c) of the *Registration Agreement*) ‘jurisdiction and control over such object, and over any personnel thereof, while in outer space or on a celestial body’.

⁸⁵ Opened for signature 1 December 1959, 402 UNTS 71 (entered into force 23 June 1961)

⁸⁶ Ibid art IV(2) has the effect of suspending all claims to territorial sovereignty in Antarctica for the duration of that instrument, as well as prohibiting any ‘new claim, or enlargement of an existing claim’. The *Protocol on Environmental Protection to the Antarctic Treaty*, opened for signature 4 October 1991, 30 ILM 1461 (entered into force 14 January 1998), augments the *Antarctic Treaty* by protecting Antarctica from commercial mining for a period of 50 years.

⁸⁷ See also Freeland and Jakhu, above n 44, 44.

⁸⁸ Article 4(1) of the *Moon Agreement* provides that ‘[t]he exploration and use of the moon shall be the province of all mankind’.

⁸⁹ Diederiks-Verschoor and Kopal, above n 53, 26.

Security of patent and other intellectual property rights, for example, are vital prerequisites for private enterprise research activity on the ISS. These rights are specifically addressed by the partners to the project and are applicable to all experiments undertaken on board the ISS.⁹⁰

In relation to space tourism activities, not only intellectual property rights (for example, how does Richard Branson protect the rights to his ‘Virgin’ label in outer space?), but various forms of tangible property rights may also become relevant. To take one example, it is quite foreseeable that as space tourism activities develop, the demand will emerge for the constant presence of tourists on the Moon and other celestial bodies, necessitating the construction of celestial hotels. Naturally, it will be important for the ‘owner’ of such a structure to gain some legal protection in relation to the site of the hotel — perhaps akin to some form of a leasehold (or even freehold) title, with which we are familiar on Earth. Here the problem presents itself: in the absence of ‘sovereignty’, it is not possible under existing international space law to assert that any particular jurisdiction applies to the area on which the hotel is to be constructed, and perhaps even within the hotel, given that ‘jurisdiction and control’ only arises upon the registration of a ‘space object’. The definition of a ‘space object’ is vague⁹¹ and unlikely to include a structure such as a hotel, which is designed as a stationary, (semi-)permanent construction.

Even if it could be interpreted as falling within the meaning of a ‘space object’, this would only solve the jurisdictional questions relating to the *inside* of the hotel but not to the surface of the Moon. Without a right of any state to exercise jurisdiction — that is, to make (and enforce) laws — it is impossible to determine how such a title can be established.

The *Moon Agreement* only provides a partial answer to this lack of a jurisdictional base for such structures, specifying that states parties ‘retain jurisdiction and control over their personnel, vehicles, equipment, *facilities*, stations and *installations* on the moon’.⁹²

This does not, however, provide a legal basis upon which to assert some form of property rights over the area upon which a space tourist hotel would be constructed. In theory, there would remain under current space law a right of free access to that area, and the construction of the hotel — and presumably its location in a specific area — could not interfere with the activities of other parties to the *Moon Agreement*.⁹³ While the *Moon Agreement* does not specify the consequences of a breach of these requirements, it appears that the construction of a hotel on a celestial body raises uncertainties under current international space law principles. Indeed, the *Moon Agreement* expressly provides that the surface (and subsurface) of the Moon ‘shall [not] become property of any State, international intergovernmental or nongovernmental

⁹⁰ Article 21 of the *ISS Agreement* specifically deals with jurisdictional issues relating to intellectual property rights on board the ISS.

⁹¹ Article I(d) of the *Liability Convention* defines a space object as including the ‘component parts of a space object as well as its launch vehicle and parts thereof’. This definition is also contained in art I(b) of the *Registration Agreement*.

⁹² *Moon Agreement* art 12(1) (emphasis added).

⁹³ *Ibid* art 8(3).

organization, national organization or nongovernmental entity or of any natural person'.⁹⁴

Notwithstanding this provision, the *Moon Agreement*, which is largely directed towards the exploitation of the natural resources of the moon, contemplates the development and removal of these resources, albeit under the management of an international regime established for that purpose. This is notwithstanding the fact that it also includes a provision that virtually mirrors art II of the *Outer Space Treaty*.⁹⁵ What this means in the context of the Moon is that what might be termed 'extraterrestrial exploitative rights' in relation to the natural resources of outer space do not contravene the non-appropriation principle, provided that such rights, and the exercise thereof, comply with the principles set out in the space treaties (and any applicable customary international law).⁹⁶

Such rights might be considered, by way of analogy, as similar to terrestrial 'mining rights' allocated by the state to public and/or national or foreign private entities to exploit the natural resources within their territorial jurisdiction. The terms of exploration or mining (exploitation) licences granting these rights will dictate the precise scope of the rights, as well as the conduct to which a licensee must adhere in exercising them. However, in terms of the ownership of the natural resources to be exploited, this remains within the permanent sovereignty of the relevant state, in accordance with long-recognised principles of customary international law.⁹⁷

What this means for future space tourism activities is that there may also be the need for some other form of quasi-property rights associated with the construction of tourism related facilities on celestial bodies that may relate to the (seemingly) exclusive occupation of that part of the surface of a celestial body upon which a privately owned facility is built. Even though, like the extraterrestrial exploitative rights described above, this may (arguably) not be inconsistent with the non-appropriation principle, it is not entirely clear how these rights should be specified and what their legal status and enforceability might be. Clearly, there is a need for careful consideration of precisely how any such rights should evolve.

⁹⁴ Ibid art 11(3).

⁹⁵ Ibid art 11(2).

⁹⁶ See further Freeland and Jakhu, above n 44, 44.

⁹⁷ The principle of 'Permanent Sovereignty over Natural Resources' ('PSONR') was established during the 1960s, and was initially focused on developing countries, although it was subsequently extended to include the rights of 'peoples' to regain effective control over their natural resources. There have been many UN General Assembly Resolutions relating to PSONR: see, eg, *Permanent Sovereignty over Natural Resources*, GA Res 1803 (XVII), UN GAOR, 17th sess, 1194th plen mtg, UN Doc A/5217 (14 December 1962); *Permanent Sovereignty over Natural Resources of Developing Countries and Expansion of Domestic Sources of Accumulation for Economic Development*, GA Res 2692 (XXV), UN GAOR, 25th sess, 1926th plen mtg, UN Doc A/RES/2692 (XXV) (11 December 1970); *Permanent Sovereignty over Natural Resources*, GA Res 3171 (XXVIII), UN GAOR, UN Doc A/9030 (17 December 1973). The PSONR has also been expressly incorporated into significant documents relating to the exploration and use of outer space: see, eg, Principle IV of the *Principles Relating to Remote Sensing of the Earth from Outer Space*, UN Doc A/RES/41/65, which provides, inter alia, that remote sensing activities 'shall be conducted on the basis of respect for the principle of full and permanent sovereignty of all States and peoples over their own wealth and natural resources'.

There are some other instances where it is asserted that, despite the non-appropriation principle, the practice of states has been to accept the allocation of 'quasi-property rights' necessary for specific space activities. The allocation of exploitation rights in the geostationary orbit is governed under an international allotment regime created through the International Telecommunication Union ('ITU'), the oldest specialised agency of the UN.⁹⁸ Besides radio frequencies, orbital slots in the geostationary orbit are indispensable for space systems to work. This equatorial orbit, an integral part of outer space, is an international natural resource that must be shared by all states on an equitable basis.⁹⁹ Its unique value lies in the fact that satellites stationed in the geostationary orbit revolve with the speed and angle of the Earth's rotation and thus appear to remain stationary over a given point on the Earth's surface. This characteristic makes it highly advantageous for telecommunications satellites.¹⁰⁰

The international community, through the ITU, has devised an extensive and complex regulatory regime that ensures equitable allocation of orbital slots to all satellite operators through their respective states. As the demand for geostationary slots increases, the ITU continues to actively update this regime through regularly scheduled intergovernmental conferences (with increasing participation by the private sector), revising its *Radio Regulations*,¹⁰¹ which are incorporated within international treaties that are adhered to and respected almost universally. Detailed rules included in the *Radio Regulations* allow the equitable use (but not the appropriation of) this international resource by all states.¹⁰²

Recent attempts to 'hoard' geostationary slots through registration with the ITU of so-called 'paper satellites',¹⁰³ which might be considered at least as a form of semi-appropriation, are now being controlled by extensive and rigid

⁹⁸ As of 11 January 2010, there were 191 States Members and 719 Sector (mainly non-State) members and Associates of the ITU: International Telecommunications Union, *Membership Overview* (11 January 2010) <<http://www.itu.int/members/index.html>>.

⁹⁹ Article 44(2) of the *Constitution of the International Telecommunication Union* (1992) specifies, inter alia, that

[i]n using frequency bands for radio services, Member States shall bear in mind that radio frequencies and any associated orbits, including the geostationary-satellite orbit, are limited natural resources and that they must be used rationally, efficiently and economically, in conformity with the provisions of the Radio Regulations, so that countries or groups of countries may have equitable access to those orbits and frequencies, taking into account the special needs of the developing countries and the geographical situation of particular countries.

¹⁰⁰ Ram S Jakhu, 'Space Debris in the Geostationary Orbit: A Major Challenge for Space Law' (1992) 17(1) *Annals of Air and Space Law* 313, 314.

¹⁰¹ The most recent edition is ITU, *Radio Regulations* (ITU, 2008 ed, 2008).

¹⁰² See, eg, Ram Jakhu, 'Safeguarding the Concept of Public Service and the Global Public Interest in Telecommunications' (2001) 5 *Singapore Journal of International and Comparative Law* 71, 79–81 for examples of active regulatory updating by the ITU.

¹⁰³ 'Paper-satellites' are those systems that are registered with the ITU for the purpose of acquiring or holding on to the registered radio frequencies and associated geostationary orbital positions, but which, in all likelihood, will not be utilised, at least in the way initially envisaged by the ITU at the time that it allocated the particular orbital position(s); for an example of paper satellite registration see Don Riddick, 'Why does Tonga Own Outer Space?' (1994) 19 *Air and Space Law* 15.

regulations.¹⁰⁴ The ITU regime has adopted new rules incorporating concepts like ‘use it or lose it’ for access to the orbit, and ‘user must pay’ for the advantages it gives rise to. In addition, the state that desires interference free access to a particular orbital position must convincingly show its intention to use the desired position and must actually use it within a predetermined fixed period of time.

However, it could still be argued that the notion of ‘no sovereignty’ in outer space is increasingly challenged by allowing for a system where a part of outer space is allocated to a particular state to the exclusion of all other states (albeit for a specified period of time only). This certainly presents the appearance of some form of property rights, based on a notion of sovereignty, over an area in outer space.

These are very difficult issues to consider and go to the core of the fundamental bases upon which the international law of outer space has been developed. The question of property rights is therefore not peculiar to space tourism activities. However, the development of those types of activities — including the possibility that they will eventually lead to the establishment of permanent settlements or ‘colonies’ in space — highlights the need to ‘update’ international space law in a way that will encourage the full potential of space tourism adventures that lie before humankind. This will require a clear outline of the scope of any formal property rights that can be acquired by private entities seeking to promote their space tourism services.

IX ETHICAL CONSIDERATIONS

Even if we assume that the impending expansion of our universe (quite literally) through space tourism is a positive, inevitable, and perhaps even natural direction for humankind to take, it is not only the hard law provisions that require reassessment. There are complex ethical questions relevant to the direction of future developments of international (and national) space law, particularly as they apply to space tourism. A number of these are briefly raised below, although it is acknowledged that this is an area that should be considered in far greater detail than the confines of this article will permit.

A *What Space Tourism Activities Are to Be Regarded as ‘Appropriate’?*

The ISS represents a first example of humankind’s efforts to make the space environment part of its domain. The Mission Statement of the ISS is predicated on the assumption that it will be permanently inhabited, that is to say, from this point of time onwards, there will always be human beings in outer space.¹⁰⁵ The

¹⁰⁴ See ITU, *Radio Regulations* (ITU, 2004 ed, 2004) res 49, 80; ITU, ‘Final Acts’ (World Radiocommunication Conference, Geneva, 22 October – 16 November 2007) art 9; ITU, *Cost Recovery for the Processing of Satellite Network Filings*, ITU Secretary-General’s Report, Council Doc C08/22-E, 19 June 2008.

¹⁰⁵ Article 1 of the *ISS Agreement* provides, inter alia, as follows:

The object of this Agreement is to establish a long-term international cooperative framework among the Partners, on the basis of genuine partnership, for the detailed design, development, operation, and utilization of a permanently inhabited civil international Space Station for peaceful purposes, in accordance with international law.

evolution of space tourism activities will not only make space more accessible to human beings, but will also reinforce this constant human presence. This is not of itself incompatible with the provisions of the *Outer Space Treaty*, provided that the rules regulating such activities ensure that the general concepts set out in the international space law treaties are properly protected.

In this regard, many questions arise that will influence the way that the international law of outer space should regulate future space tourism activities. For example, what types of space tourism activities are appropriate? Should there be any restriction on the nature of these activities to preserve the ‘integrity’ of outer space? On what basis, if any, should these restrictions be determined? How do space tourism activities correlate with the underlying philosophy of international space law — that the exploration and use of outer space ‘shall be carried out for the benefit and in the interests of all countries’?¹⁰⁶ Would it be acceptable, for example, to allow advertising billboards to be constructed, or casinos or even brothels to be established on the Moon to cater to space tourists?

As the capability of space-related technology advances, these qualitative questions must also be addressed, in order to prioritise those activities that most closely accord with the overall goals associated with humankind’s ongoing endeavours in space.

B *Pollution of the Environment of Outer Space*

The protection of the natural environment of outer space is an important element of the ‘province of all mankind’ philosophy. The international law of outer space makes some reference to environmental protection, though these provisions are neither sufficiently detailed nor rigorous when compared to the international law of the sea.¹⁰⁷ The main provision concerning environmental protection in the *Outer Space Treaty* (art IX) is ill-defined and imposes only minimal obligations on states.¹⁰⁸

In addition, there is currently no express definition of ‘space debris’ and there is no absolute consensus among space lawyers as to whether space debris would even fall within the definition of ‘space object’ for the purposes of the *Liability*

¹⁰⁶ *Outer Space Treaty* art I.

¹⁰⁷ *UNCLOS* provides for an express obligation to protect the marine environment and facilitates this in relation to the High Seas by providing for port-state jurisdiction over pollution offences: see *UNCLOS* pt XII, in particular s 6.

¹⁰⁸ Article IX of the *Outer Space Treaty* provides, inter alia, as follows:

States Parties to the Treaty shall pursue studies of outer space, including the moon and other celestial bodies, and conduct exploration of them so as to avoid their harmful contamination and also adverse changes in the environment of the Earth resulting from the introduction of extraterrestrial matter and, where necessary, shall adopt appropriate measures for this purpose. If a State Party to the Treaty has reason to believe that an activity or experiment planned by it or its nationals in outer space, including the moon and other celestial bodies, would cause potentially harmful interference with activities of other States Parties in the peaceful exploration and use of outer space, including the moon and other celestial bodies, it shall undertake appropriate international consultations before proceeding with any such activity or experiment. A State Party to the Treaty which has reason to believe that an activity or experiment planned by another State Party in outer space, including the moon and other celestial bodies, would cause potentially harmful interference with activities in the peaceful exploration and use of outer space, including the moon and other celestial bodies, may request consultation concerning the activity or experiment.

Convention, at least in most cases. Thus, under international space law, there are no specific mechanisms to adequately regulate space debris. Relatively little has been done to tighten the legal requirements relating to the environmental protection of outer space, principally due to the significant costs associated with ‘clean’ space technology and practice. Nevertheless, progress has recently been made with an agreement on debris mitigation guidelines endorsed by the UN General Assembly in 2007¹⁰⁹ and the Inter-Agency Debris Coordination Committee (‘IADC’) guidelines a few years earlier.¹¹⁰

Space tourism activities will inevitably result in greater pressures on the environment of Earth. There are claims that space tourist vehicles will one day become the world’s primary source of carbon dioxide emissions¹¹¹ — as well as of outer space. They will lead to the pollution of previously pristine areas. The regulation of human activities like littering would cost relatively little in dollar terms. It is imperative that this is done to minimise the impact on the space environment.¹¹²

C *Protection of ‘Heritage Sites’ in Outer Space*

As well as protecting the space environment from pollution, it is also appropriate to consider important sites in outer space that are (and will be) historically significant. Legal regulation will be required to provide for ‘heritage sites’ in order to protect particular areas from accidental or deliberate damage by space tourists, such as the site of the first lunar landing by humans.¹¹³ Similar concerns apply to other space activities that cause damage to outer space and

¹⁰⁹ See *International Co-operation on the Peaceful Uses of Outer Space*, GA Res 62/217, 62nd sess, 79th plen mtg, UN GAOR, UN Doc A/RES/62/217 (22 December 2007).

¹¹⁰ See IADC, ‘IADC Space Debris Mitigation Guidelines’ (Document No IADC-02-01, IADC, 15 October 2002) <http://www.iadc-online.org/Documents/Docu/IADC_Mitigation_Guidelines_Rev1_Sep07.pdf>. The Foreword to these Guidelines (at 3) explains the nature and function of the IADC as follows:

[The IADC] is an international forum of governmental bodies for the coordination of activities related to the issues of man-made and natural debris in space. The primary purpose of the IADC is to exchange information on space debris research activities between member space agencies, to facilitate opportunities for co-operation in space debris research, to review the progress of ongoing co-operative activities and to identify debris mitigation options.

Members of the IADC are the Italian Space Agency (ASI), British National Space Centre (BNSC), Centre National d’Etudes Spatiales (CNES), China National Space Administration (CNSA), Deutsches Zentrum fuer Luft- und Raumfahrt e.V. (DLR), European Space Agency (ESA), Indian Space Research Organisation (ISRO), Japan, National Aeronautics and Space Administration (NASA), the National Space Agency of Ukraine (NSAU) and Russian Aviation and Space Agency (Rosaviakosmos).

¹¹¹ George Monbiot, ‘On Another Planet’, *The Guardian* (London) 13 November 1999, 16. Monbiot speaks of space tourism in the following terms: ‘It is hard to think of a better designed project for maximum environmental destruction’.

¹¹² By way of comparison, the states parties to the *Antarctic Treaty* concluded the *Protocol on Environmental Protection to the Antarctic Treaty* which, in part, imposes a ‘polluter pays’ regime: see Annex III ‘Waste Disposal and Waste Management’. It has been reported that this will also be applied in relation to the 30 000 tourists to the region each year: *Deal Reached on Making Polluters Pay in Antarctica* (17 June 2005) Terradaily <<http://www.terradaily.com/news/antarctic-05h.html>>.

¹¹³ Article 7(3) of the *Moon Agreement* allows the designation of areas of the moon having ‘special scientific interest’ as ‘international scientific preserves for which special protective arrangements are to be agreed upon’.

celestial bodies, such as the deliberate crashes into the Moon's surface that formed the basis of the LCROSS experiment referred to above.

This also gives rise to an even more complex issue that will need to be (re)assessed in the future — whose heritage is space? How should we regard human inhabitants of future space colonies, particularly those who are born and live their entire lives in outer space, perhaps in a settlement on the Moon? What are their rights and how do they relate to (or differ from) those international legal rules for outer space that have evolved on Earth?

These are, obviously, difficult questions and will not arise in the near future, although they represent important elements in the overall planning of an appropriate international legal regime for human activities in outer space, including space tourism. It will be important to develop comprehensive and universal ethical standards and practices to deal with the continued utilisation of outer space in this way.

X CONCLUDING REMARKS

The corpus of existing international space law represents an important base from which to develop the legal tools to properly regulate the next stage of space activities. Yet it is not sufficient even for present purposes, let alone for the coming decades. The advent of space tourism raises many unanswered legal questions, some of which have been highlighted in this article. Other legal issues will also arise. As more space tourism (and other) activities take place, appropriate dispute resolution procedures must be agreed upon in order to deal with conflicts that will inevitably arise, both at the public and private international law level. Detailed traffic management systems must be developed. Moreover, a comprehensive legal framework must be established at the international level to reflect the wishes of the wider (global) community and provide certainty.

At the same time, however, the broader philosophical and ethical aspects of human activities in outer space — indeed the place of human beings in the universe — demand that we continually reassess the 'why' and 'what' in relation to our ongoing exploration and use of outer space.

Moreover, just as the exploration and use of outer space is impacted by terrestrial concerns — including economics, politics, social and fundamental human rights — it also serves as a model for our future activities on Earth. There are many lessons that we can learn from our (over-)exploitation of the Earth's natural resources. Should we adopt this 'efficiency' approach to the exploitation of the resources of outer space, doing it as quickly as we can, irrespective of the longer-term consequences? Or, rather, should our future activities in outer space — and ultimately on Earth — be more considered and measured, taking into account the differing expectations and capabilities of the various countries on Earth?

All of these issues represent considerable challenges as to how international law, incorporating the international legal regulation of outer space, will be able to cope with future activities in space, including the advent of commercial space tourism. The way in which the law is developed and adapted to meet these challenges will be important not only for outer space itself, but also for future generations living on Earth.

Outer space belongs to all of us. Our use of it should reflect underlying notions of cooperation and shared benefit, which must remain as the cornerstones in this next phase of human achievement. International law has a crucial part to play in this regard.