JOURNAL

OF

SPACE

LAW

VOLUME 36, NUMBER 1

Spring/Summer 2010

JOURNAL OF SPACE LAW

UNIVERSITY OF MISSISSIPPI SCHOOL OF LAW

A JOURNAL DEVOTED TO SPACE LAW AND THE LEGAL PROBLEMS ARISING OUT OF HUMAN ACTIVITIES IN OUTER SPACE.

VOLUME 36 **SPRING/SUMMER 2010** **NUMBER 1**

All correspondence with reference to this publication should be directed to the JOURNAL OF SPACE LAW, P.O. Box 1848, University of Mississippi School of Law, University, Mississippi 38677; jsl@olemiss.edu; tel: +1.662.915.6857, or fax: +1.662.915.6921.

JOURNAL OF SPACE LAW. The subscription rate for 2010 is $100 U.S. for U.S. domestic/individual; $120 U.S. for U.S. domestic/organization; $105 U.S. for non-U.S./individual; $125 U.S. for non-U.S./organization. Single issues may be ordered at $70 per issue. For non-U.S. airmail, add $20 U.S. Please see subscription page at the back of this volume.

 Suggested abbreviation: J. SPACE L.
ISSN: 0095-7577

JOURNAL OF SPACE LAW

UNIVERSITY OF MISSISSIPPI SCHOOL OF LAW
A JOURNAL DEVOTED TO SPACE LAW AND THE LEGAL PROBLEMS ARISING OUT OF HUMAN ACTIVITIES IN OUTER SPACE.

VOLUME 36 **SPRING/SUMMER 2010** **NUMBER 1**

CONTENTS

— In Memoriam —
This volume is dedicated to the memory of

Gretchen J. Harris, J.D.

1977 - 2010

It is with great sadness that we are informing the space law community of the sudden loss of Ms. Gretchen Jeanette Harris, a 2009 graduate of the University of Mississippi School of Law and member of the second place team in the 2009 North American Round of the Manfred Lachs Space Law Moot Court Competition. Her team mates attribute their winning the 2009 Best Brief award to Ms. Harris' work. Ms. Harris was a superb student, finishing at the top of her class, a member of law review, an editor on the Journal of Space Law, and an excellent moot court competitor. She was a multifaceted, artistic, energetic young woman. In addition to law, her interests ranged from weaving, organizing benefits, and financial advising. Ms. Harris worked hard on fundraising events to help her town, Pass Christian, MS, recover from Hurricane Katrina. Just last week, I recommended her to the State of Missouri Bar Examiners and she was at the beginning of what would have been a very promising career. She was a good friend and colleague to all of us at the Center. She will be missed.

-Prof. Joanne Irene Gabrynowicz
Director, National Center for Remote Sensing,
Air, and Space Law

It is often in the darkest hour of loss that we become most acutely aware of the brilliant beauty of a life well-lived. Such was the case with the passing of Gretchen J. Harris, a promising young attorney who—for the last three and a half years—I had the distinct privilege and honour of calling my colleague, confidant, and friend.

I am certainly not the first—nor will I be the last—to praise Gretchen's tremendous work ethic or the sheer magnitude of her formidable intellectual powers. These were an important part of Gretchen's personality, to be sure, but she was also a wise advisor, a witty conversationalist, and an excellent friend. On numerous occasions, I had the opportunity to observe her staying late after school to help a fellow classmate memorize the rules of civil procedure or to assure a group of struggling 1L students that life truly got better after the first year. As a co-editor with Gretchen of this and another academic law journal, I always knew that she could be counted on to have the right answer about a challenging formatting question or to assist in finding a particularly-obscure article source. Outside the classroom, Gretchen could also be found helping others through her charity work or simply listening to their life struggles over a cup of coffee. Gretchen's brilliance was magnified through her kindness, and her example was an inspiration to us all.

The legal community has lost one of its brightest rising stars. Although we who knew her mourn her passing, the true loss belongs to the world.

- Jason A. Crook

FOREWORD

Joanne Irene Gabrynowicz[1]

Since the last issue of the JOURNAL OF SPACE LAW was published, there have been a number of significant events in space activities. The U.S. space shuttle *Atlantis* took its final flight and moved the entire shuttle program closer to retirement. A new space transportation company, SpaceX, successfully launched its *Falcon 9* that may become a vehicle capable of bringing cargo and personnel to the *International Space Station*. The *Hubble Space Telescope* had its 20th anniversary. China, Europe, and Russia began a collaborative research experiment in which six people will spend 18 months in a simulated interplanetary vehicle as preparation for a Mars mission. The U.S. *Lunar Reconnaissance Orbiter* continued to send back enormous amounts of data from the moon. South Korea launched, and lost, its *Naro* rocket carrying a climate observation satellite.

In aggregate, these events signal a changing space environment worldwide. They include endings to long-standing activities and practices as well as new beginnings, new actors, and new alliances. In short, the Cold War era space programs and activities have given way to the programs and activities of the globalization era. While the contours of future activities may be dimly discerned on the far horizon, it is still far from clear what the near and long-term future holds. It is a time when the first generation of space activities is receding into the past and the current generation activities are being prepared.

The voices that are heard in this issue of the JOURNAL OF SPACE LAW are the voices of the new generation's participants. This issue contains only papers from law students and recent

---

[1] Joanne Irene Gabrynowicz is the Editor-in-Chief of the JOURNAL OF SPACE LAW. She is also a professor of space law and remote sensing law and the Director of the National Center for Remote Sensing, Air, and Space Law at the University of Mississippi School of Law. Prof. Gabrynowicz was the recipient of the 2001 Women in Aerospace Outstanding International Award and is a Director of the International Institute of Space Law and a member of the American Bar Association Forum on Air and Space Law.

graduates around the world. They are from China, India, the United Kingdom, and the United States. Some of them have other degrees in addition to their law degrees or previous professional experience in related fields. Some provide a fresh look at old issues; others seek to apply entirely new ideas to enduring issues.

In this last category are articles offered by three awardees of research scholarships from the National Center for Remote Sensing, Air, and Space Law of the University of Mississippi School of Law. Mr. Nicholas D. Welly applies the ideas of 2009 Nobel Laureate in Economic Sciences, Elinor Ostrom, regarding economic governance of a commons to space, a legal global commons in his article, *Enlightened State-Interest—A Legal Framework for Protecting the "Common Interest of All Mankind" from Hardinian Tragedy.* Mr. Paul Ordyna considers an activity with virtually no track record—commercial human spaceflight—in light of practices employed by a centuries-old industry by closely examining track records in his article, *Insuring Human Space Flight: An Underwriter's Dilemma.* Also considering the application of new ideas to old problems is Mr. Surya Gablin Gunasekara's article, *The March of Science: Fourth Amendment Implications on Remote Sensing in Criminal Law*. He traces the use of 20th Century technology to the two-century old Fourth Amendment of the U.S. Constitution.

Mr. Theodore W. Goodman and Mr. C. Brandon Halstead both consider an issue that has been on and off the agenda of the Legal Subcommittee for the U.N. Committee on the Peaceful Uses of Outer Space for more than three decades: the definition and delimitation of outer space in their respective articles, *To the End of the Earth: A Study of the Boundary between Earth and Space* and *Prometheus Unbound? Proposal for a New Legal Paradigm for Air Law and Space Law: Orbit Law*.

The business and profit-making aspects of space activities in the era of globalization are raised by Sandeepa Bhat B. in *Inventions in Outer Space: Need for Reconsideration of the Patent Regime* and by Shane Chaddha in *U.S. Commercial Space Sector: Matured and Successful*. In her article, *High Hopes and Low Estimates: New Space's Rocky Contractual Road,* Ms. Marielle Elisabet Dirkx examines how the high entry costs to 21st

century space commerce can be devastating for companies unprepared to realistically account for them in business plans.

Finally, one of humanity's oldest conditions—conflict—is addressed as it applies to space in the era of globalization by Mr. Shang Kuan in *Legality of the Deployment of Anti-Satellite Weapons in Earth Orbit: Present and Future* and by Mr. Jinyuan Su in *Use of Outer Space for Peaceful Purposes: Non-Militarization, Non-Aggression and Prevention of Weaponization*.

In all, this issue of the Journal of Space Law demonstrates that new voices are ready, willing, and able to engage in the law for the new era of space activities.

CALL FOR PAPERS

JOURNAL OF SPACE LAW
UNIVERSITY OF MISSISSIPPI SCHOOL OF LAW

A JOURNAL DEVOTED TO SPACE LAW AND THE LEGAL PROBLEMS ARISING OUT OF HUMAN ACTIVITIES IN OUTER SPACE.

Volume 36, Number 2

The National Center for Remote Sensing, Air, and Space Law of the University of Mississippi School of Law is delighted to announce that it will publish Volume 36, issue 2 of the JOURNAL OF SPACE LAW in the second half of 2010.

Authors are invited to submit manuscripts, and accompanying abstracts, for review and possible publication in the JOURNAL OF SPACE LAW. Submission of manuscripts and abstracts via email is preferred.

Papers addressing all aspects of international and national space law are welcome. Additionally, papers that address the interface between aviation and space law are also welcome.

Please email manuscripts and accompanying abstracts in Microsoft Word or WordPerfect to:

jsl@olemiss.edu

Or, alternatively, a hardcopy of the manuscript and abstract, along with a computer diskette containing them in Microsoft Word or WordPerfect format may be sent to:

JOURNAL OF SPACE LAW
P.O. Box 1848
University, MS 38677
1-662-915-6857 (office)
1-662-915-6921 (fax)

To be considered for the next issue, submissions should be received on or before October 15, 2010. However, the JOURNAL OF SPACE LAW will continue to accept and review submissions on an ongoing basis.

INVENTIONS IN OUTER SPACE: NEED FOR RECONSIDERATION OF THE PATENT REGIME

Sandeepa Bhat B.[*]

I. INTRODUCTION

The twentieth century evidenced tremendous developments in intellectual property law (IP) as well as in the law governing outer space.[1] Though IP law started to develop much earlier than space law, substantial growth in both fields took place almost in the same period of time, i.e. in the second half of twentieth century. The technological developments relating to outer space has resulted in the establishment of stations in outer space[2] and future plans for the establishment of similar stations on the Moon and other celestial bodies.[3] With this, human ac-

---

[*] LL.M., Ph.D. (Space Law). Assistant Professor of Law, The WB National University of Juridical Sciences, Salt Lake, Kolkata, INDIA. Member, International Institute of Space Law (IISL), France. E-mail: sandeep_nls@yahoo.com

[1] The launch of *Sputnik I* on 4 October 1957 marked the beginning of the space era. The legal developments in the field started soon after the entry of *Sputnik* into outer space.

[2] Mir and the currently operative *International Space Station* (*ISS*) are the examples of stations in outer space. The Inter-Governmental Agreement on the International Space Station was initially signed on 29 September 1988 by the United States, Japan, Canada and members of European Space Agency. *See* Agreement Among the Government of the United States of America, Governments of Member States of the European Space Agency, the Government of Japan, and the Government of Canada on Cooperation in the Detailed Design, Development, Operation, and Utilization of the Permanently Manned Civil Space Station, Sept. 29, 1988, *available at* 1992 WL 466295 [hereinafter 1988 IGA]. The members of the European Space Agency at the time of the signing of the 1988 IGA were: Belgium, Denmark, France, Germany, Great Britain, Italy, the Netherlands, Norway and Spain. With the Russia's inclusion in the project on 17 December 1993, new negotiations took place between the former participants and Russia. It resulted in the new Inter-Governmental Agreement on the *International Space Station*, which was signed on 29 January 1998. *See* Memorandum of Understanding Between the National Aeronautics and Space Administration of the United States of America and the Russian Space Agency Concerning Cooperation on the Civil International Space Station, Jan. 29, 1998, *available at* ftp://ftp.hq.nasa.gov/pub/pao/reports/1998/nasa_russian.html. The construction work is still going on and it is expected to be completed by 2010.

[3] The recent US plans also reveal its willingness to go beyond the ISS and to establish similar stations on the Moon and on Mars. *See* T. S. Subramanian and Y. Mallikar-

tivities in outer space have expanded rapidly resulting in the possible intellectual creations in outer space, which are entitled to IP protection. In other words, the IP regime is going to overlap with the regime of outer space in the near future. Three important types of intellectual property rights (IPR) that have direct connection with the activities in outer space are patents,[4] trade secrets[5] and copyrights[6]. Unfortunately, as the present IPR regime fails to clarify the issue of its applicability for activities in outer space, there is a legal vacuum in the field. This article, being confined to the inventions in outer space, looks into the problems associated with the patent regime in outer space.

II. AN INSIGHT INTO THE ROOT OF CONFLICTS

The overlap between the patent regime and the outer space regime has recently become a matter of debate. The large-scale diversities found in these two regimes have brought forward some critical legal questions. The major source of conflict is the difference in origin and applicability of the patents regime and the regime governing outer space. Patent law is fundamentally national in its origins and scope of application, notwithstanding

---

jun, *First human being will land on Mars in 2037, says NASA official*, HINDU DAILY, Sept. 25, 2007, at 13, *available at* http://www.hinduonnet.com/thehindu/thscrip/print.pl?file=2007092556871300.htm&date=2007/09/25/&prd=th&.

[4] A patent is a monopoly right granted to an inventor to ripe the benefit out of his intellectual work for a limited period of time. The basic purpose is to encourage the public disclosure of the invented subject matter. *See* PAUL TORREMANS ET AL., INTELLECTUAL PROPERTY LAW 39 (2008). *See also* NARAYANAN, INTELLECTUAL PROPERTY LAW 12 (2005).

[5] Trade secrets are transferable technical information, which are not generally known and not patented. AKHIL PRASAD & ADITI AGARWALA, COPYRIGHT LAW: DESK BOOK 25 & 26 (2009). It includes ideas, concepts, inventions, manufacturing processes and other confidential information. *See* DAVID W. QUINTO & STUART H. SINGER, TRADE SECRETS: LAW AND PRACTICE 4 – 6 (2009). As these trade secrets give an added advantage to the industrialists in competing with others and in increasing their returns, they (industrialists) do not want to disclose it to others. Article 39 of the Agreement on Trade-Related Aspects of Intellectual Property Rights makes it clear that such trade secrets are entitled to protection as intellectual property. *See* Agreement on Trade-Related Aspects of Intellectual Property Rights, art. 39, Apr. 15, 1994, Marrakesh Agreement Establishing the World Trade Organization, Annex 1C, Legal Instruments-Results of the Uruguay Round, 33 I.L.M. 1125 (1994) [hereinafter TRIPs Agreement].

[6] Copyright is a set of exclusive rights that regulate the use of a particular expression of an idea or information. TINA HART & LINDA FAZZANI, INTELLECTUAL PROPERTY LAW 139 (2000).

efforts towards international harmonization.[7] The regime governing outer space is essentially extraterritorial in its origin and application.[8] The strong national root of patent regime has three major consequences. First, the patented invention is protected only in the country or countries where it is registered and not outside. Second, the law of the State where the invention is said to have been infringed shall be applicable for the determination of the infringement of patents. Third, the jurisdiction shall be exercised by the courts of that State where the invention is said to have been infringed. On the other hand, the strong international roots of space law favour uniform law to govern activities in outer space. It also tends towards the recognition of interests of everyone as opposed to the individual interest recognized by the patent regime.

The legal vacuum created by the interrelationship between the patent regime and the outer space regime is noticed very recently by the international community, especially after the establishment of the *International Space Station* (*ISS*). Now it is also well known that outer space, the Moon, and other celestial bodies can be used for conducting some important experiments, which cannot be conducted on the Earth with such a great effect.[9] Therefore there is every possibility of the investment of huge sums in such experiments. Though at present there is no reported instance of conflict relating to patents in outer space, the pace of technological development is showing its potentiality to bring forward such problems in the near future. Therefore, this seems to be the appropriate time to clarify the patent regime to avoid future conflicts.

---

[7] *See* Anna-Maria Balsono & Bradford Smith, *Intellectual Property and Space Activities: A New Role for COPUOS?*, *in* OUTLOOK ON SPACE LAW OVER THE NEXT THIRTY YEARS 363 (Gabriel Lafferranderie & Daphne Crowther, eds., 1997).

[8] *See* Ruwantissa Abeyratne, *The Application of Intellectual Property Rights to Outer Space Activities*, 29 J. SPACE L. 1 (2003).

[9] It is possible to achieve greater level of purity in the pharmaceutical products in outer space, the Moon, and other celestial bodies. Sa'id Mosteshar, *Intellectual Property Issues in Space Activities*, *in* RESEARCH AND INVENTION IN OUTER SPACE - LIABILITY AND INTELLECTUAL PROPERTY RIGHTS 192 (Sa'id Mosteshar, ed., 1995).

III. PATENTS MONOPOLY VIS-À-VIS FUNDAMENTAL SPACE LAW CONCEPTS

Outer space and patents are subject to two different schools of jurisprudence, and their regimes do not go hand in hand.[10] Conferment of patent rights is based on the principle that every invention needs to be rewarded by providing protection in order to stimulate intellectual creations.[11] The patent regime advocates for monopoly rights for the person using the intellectual labour.[12] The inventor would be entitled to reap the benefits of his or her invention by getting exclusive rights to use it for a limited period of time. Space law on the other hand has some fundamental principles like the "province of all mankind,"[13] "common heritage of mankind,"[14] benefit of all countries,[15] among others, that advocate for common benefits. Therefore, when the patent regime is applied to activities in outer space, it always comes in conflict with these fundamental concepts of space law.[16] Particularly, the province of all mankind and common heritage of mankind advocate for sharing of benefits, which is not a part of individualistic patents regime. Therefore, one of the important questions in the field is, can a patent be granted at all for an invention created in outer space?

The strict application of province of all mankind and common heritage of mankind would clearly deny any claim of patent

---

[10] The former is subject to the idealistic school and the latter to the realistic school.

[11] *See generally* Taking it Global, *Creative Commons*, http://issues.takingitglobal.org/intprop?gclid=CLyp5_mivpACFQssewod8zrEPQ (last visited Jan. 5, 2010).

[12] It prevents others from freely using them and consequently restricts the competition. Alejandro Piera, *Intellectual Property in Space Activities: An Analysis of the United States Patent Regime*, XXIX AIR & SPACE L. 42, 46 (2004).

[13] *See* Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies art. I, *opened for signature* Jan. 27, 1967, 18 U.S.T. 2410, 610 U.N.T.S. 205 [hereinafter Outer Space Treaty].

[14] *See* Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, G.A. Res. 34/68, 18 INT'L LEGAL MAT'S. 1434 (1979).

[15] Outer Space Treaty, *supra* note 13..

[16] Bradford Lee Smith, *Towards a Code of Conduct for the Exercise of Intellectual Property Rights (IPR) in Space Activities - Moderation of the Monopoly?*, *in* PROCEEDINGS OF THE THIRTY-NINTH COLLOQUIUM ON THE LAW OF OUTER SPACE 176 (1997) [hereinafter *Towards a Code of Conduct*].

monopoly for the invention conducted in outer space.[17] But again the question is whether it is justifiable to extend the scope of space law concepts to such an extent so as to deprive an inventor from deriving benefit from his or her intellectual labour? The answer seems to be negative. The obvious reason for conflict between the patent regime and the outer space regime is that the space treaties were entered into at the time when States were the only actors in the field of outer space, and the concept of patent or invention in outer space was virtually unknown. Therefore States are the major subjects of space law, and consequently the rights conferred upon space activities are public in nature.[18] The space treaties are not oriented towards the protection of any private rights. Now with increased private space activities, we are confronted with the challenge of striking a delicate balance between private rights and the public rights. If private rights are not guaranteed, no one would be willing to conduct innovative activities in outer space, which would in turn adversely affect the scientific and technological development.[19]

Developing a fair scheme to strike the balance between private interests, which generate innovation, and the wider interests of humankind is not easy. Any solution to the problem would involve some compromise in both fields. Therefore, a viable solution to the problem is to grant a restricted patent monopoly with some sort of compulsory licensing scheme under the fair and reasonable terms and conditions.[20] The scope of the idealistic space law concepts should be limited to physical property while intellectual property, like patents, must be kept out of their ambit.

---

[17] Sa'id Mosteshar, *Introduction: Research and Invention in Outer Space and their Commercial Exploitation: Liability and Intellectual Property Rights*, *in* RESEARCH AND INVENTION IN OUTER SPACE - LIABILITY AND INTELLECTUAL PROPERTY RIGHTS XVI (Sa'id Mosteshar ed., 1995).

[18] S. G. Sreejith, *The Pertinent Law for Outer Space Related Intellectual Property Issues: An Odyssey into TRIPS*, 45 INDIAN J. INT'L L. 180, 183 (2005).

[19] *See generally* Anna Maria Balsano, *Intellectual Property within Public International Research Organizations. The Example of European Space Agency*, *in* PROCEEDINGS OF THE THIRTY-SIXTH COLLOQUIUM ON THE LAW OF OUTER SPACE 3, 4 (1994).

[20] *See generally* Bradford Lee Smith, *Recent Developments in Patents for Outer Space*, *in* PROCEEDINGS OF THE FORTY-SECOND COLLOQUIUM ON THE LAW OF OUTER SPACE 190, 197 (2000).

Now, if we assume that intellectual creations in outer space can be subject to the patent regime, a related question for consideration is, who has the right to patent protection? Is it the one who has first invented or the one who has first filed an application for patent?[21] Both these patent systems are strongly supported by different countries of the world.[22] Therefore at present, identification of the patent rights' holder depends on the nationality of the inventor.[23] This would create problems in cases where the invention in outer space is conducted or sponsored by a group of people belonging to different States. Each of them would go to their respective countries and seek the registration of patent in their name either on the basis of first invention or on the basis of first filing. The problem becomes further complicated if the invention is partly carried out on the Earth and partly in outer space. In such a situation, the people carrying on the part of invention on Earth would be in an advantageous position to "first file" the application for registration of patents. At the same time, in a first to invent jurisdiction, the determination of first inventor would become a complicated question to answer. The only possible solution to this complication is the agreement of all the States on one specific system of patenting.

IV. INFRINGEMENT OF PATENTS IN OUTER SPACE

Another important problem regarding a patents regime in outer space is the question of availability of remedies in case of

---

[21] Anna Maria Balsano, *Intellectual Property Rights and Space Activities,* 11(3) SPACE POL'Y 204 (Aug. 1995), *available at* http://esapub.esrin.esa.it/ecsl/ecsl15/ecsl15ba.htm.

[22] The United States follows the "first to invent" system and therefore whoever proves that they were the first to develop the invention has priority in obtaining the patent, even if someone else files first. C. Heather Walker, *Potential Patent Problems on the ISS*, *in* PROCEEDINGS OF THE FORTY-SECOND COLLOQUIUM ON THE LAW OF OUTER SPACE 60, 61 & 62 (2000). The rest of the world follows the first to file priority system. *See id.*

[23] If the inventor belongs to United States, he should be the first person to invent, and if he belongs to other States, he should be the first person to file an application for getting patent rights. *See* Bradford Lee Smith, *Intellectual Property Issues for the Galileo Project*, *in* PROCEEDINGS OF THE FORTY-FOURTH COLLOQUIUM ON THE LAW OF OUTER SPACE 207, 210 & 211 (2002).

the infringement of Earthly patents[24] in outer space. The strong national roots of patent regimes have confined their protection only to the States in which they are registered.[25] Moreover, as already mentioned, in case of infringement, the courts of the State where violation takes place exercise the jurisdiction, and the law of that State becomes applicable. As outer space does not belong to any one State, the complicated question of jurisdiction and applicable law comes into play in every case of infringement of Earthly patents.

A. Jurisdiction

In any case of infringement of Earthly patents in outer space, the first task is to ascertain the jurisdiction.[26] The Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies (Outer Space Treaty)[27] read with the Convention on Registration of Objects Launched into Outer Space (Registration Convention)[28] provides a special regime for the exercise of jurisdiction. Article VIII of the Outer Space Treaty[29] expressly confers the jurisdiction and control over the objects launched into outer space and the personnel thereof to the State of registry.[30] Article

---

[24] A patent registered in any State on the Earth.

[25] G. Lafferranderie, *The United States Proposed Patent in Space Legislation - An International Perspective*, 18 J. SPACE L. 1, 2 (1990).

[26] States cannot be allowed to exercise concurrent jurisdiction. Exercise of concurrent jurisdiction would result in absolute uncertainty as to the research activities in outer space, the Moon and other celestial bodies. Pierre M. Martin, *The Legal Regime of Inventions in Outer Space*, *in* PROCEEDINGS OF THE THIRTY-SECOND COLLOQUIUM ON THE LAW OF OUTER SPACE 366, 367 (1990).

[27] Outer Space Treaty, *supra* note 13.

[28] Convention on Registration of Objects Launched into Outer Space, *opened for signature* Jan. 14, 1975, 28 U.S.T.
695, 1023 U.N.T.S. 15 [hereinafter Registration Convention].

[29] Outer Space Treaty, *supra* note 13, at art. VIII:

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

[30] The principles of territoriality and nationality have received widespread recognition in international law as grounds for the exercise of jurisdiction. The Outer Space

II (1)[31] of the Registration Convention supplements the above provision by imposing an obligation on the launching State to register, nationally and internationally, any object launched by it. In case of a joint launching, the States must jointly determine which one of them would register the object.[32] Accordingly, the registering State exercises jurisdiction and control.

The jurisdiction provided under the space treaties is different from the flag State jurisdiction[33] under law of the sea. Flag State jurisdiction confers quasi-territorial jurisdiction to the Flag State over the ships of its nationality. Its application is limited to the activities conducted on board of the ship. Whereas, the jurisdiction under the Outer Space Treaty is not only confined to space object registered with the State, but also extends over any personnel thereof, while in outer space or on a celestial body. In other words, the State of registry exercises jurisdiction on the personnel even when such personnel are outside the space object.[34] Therefore any patent infringement in outer space, whether inside the space object or outside in outer

---

Treaty has adopted the principle of territoriality for the exercise of jurisdiction. *See* V. S. Vereshchetin, *Legal Status of International Space Crews*, III ANNALS OF AIR & SPACE L. 545, 548 & 549 (1978).

[31] Registration Convention, *supra* note 28, at art. II(1).

> When a space object is launched into Earth orbit or beyond, the launching State shall register the space object by means of an entry in an appropriate registry which it shall maintain. Each launching State shall inform the Secretary-General of the United Nations of the establishment of such a registry.

Id.

[32] *Id.* at art. II(2).

> Where there are two or more launching States in respect of any such space object, they shall jointly determine which one of them shall register the object in accordance with paragraph 1 of this article, bearing in mind the provisions of article VIII of the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, and without prejudice to appropriate agreements concluded or to be concluded among the launching States on jurisdiction and control over the space object and over any personnel thereof.

Id.

[33] S.S. Lotus Case, (Fr. v. Turk.), 1927 P.C.I.J. (ser. A) No. 9, (Sept. 7).

[34] *See* Bin Cheng, *Liability Regulations Applicable to Research and Invention in Outer Space and their Commercial Exploration*, *in* RESEARCH AND INVENTION IN OUTER SPACE - LIABILITY AND INTELLECTUAL PROPERTY RIGHTS 75 (Sa'id Mosteshar, ed., 1995).

space, on the Moon, or other celestial bodies is subject to the jurisdiction of the State where the space object is registered.

Such a type of jurisdiction under Article VIII of the Outer Space Treaty has brought forward the problem of conflicting jurisdiction. The rapid technological development has resulted in the establishment of the *ISS* and also in the plans to construct stations on the Moon and other celestial bodies. With this, the conflict of jurisdiction would arise in a case where the space station or a station on the Moon or other celestial body is registered in one State and the space vehicle carrying the astronauts conducting the inventions therein is registered in another State. By virtue of Article VIII, the State registering the space station would undoubtedly exercise jurisdiction over the activities in the space station. Similarly, the State registering the space vehicle carrying the astronauts would exercise jurisdiction over any activity conducted by those astronauts in outer space, since Article VIII also confers personal jurisdiction, which extends to an activity conducted outside the space object. The same problem would arise in case of exchange of crew among two or more space stations.[35]

Without any doubt, we can conclude that provisions of the space treaties relating to jurisdiction have become outdated. In the wake of private space activities, the jurisdictional issue needs to be clarified immediately. Otherwise, it might ultimately result in forum shopping by private entities. The void in the law would provide an opportunity for the private entities to register their objects under the most favorable regime to defeat the purpose of the law.[36]

B. Applicable Law

The second essential element in seeking a remedy for patent infringement in outer space is the determination of applica-

---

[35] IMRE ANTHONY CSABAFI, THE CONCEPT OF STATE JURISDICTION IN INTERNATIONAL SPACE LAW 112 (1971).

[36] *See* Bradford Lee Smith and Elisabetta Mazzoli, *Problems and Realities in Applying the Provisions of the Outer Space Treaty to the Intellectual Property Issues*, *in* PROCEEDINGS OF THE FORTIETH COLLOQUIUM ON THE LAW OF OUTER SPACE 169, 171 (1998).

ble law. It is not susceptible to an easy answer.[37] The principle of *lex situs*[38] cannot be applied, as there is no national or international law governing every infringement of patents in outer space. Though the territoriality principle prevents the extraterritorial application of the municipal laws, the only solution to the problem is the transposition of municipal patents law to outer space. But again the question is how to determine which municipal law has to be transported? The answer to this question is pertinent because of the fact that the strong national root of patent regime is associated with the difficulty of dissimilarity in the laws of different countries. We find a large-scale difference in the determination of patentability, determining the person entitled to patent rights, procedure for registration and enforcement, and so on. Though the Agreement on Trade-Related Aspects of Intellectual Property Rights[39] makes an attempt to harmonize IPR laws, including patent laws, of different countries, it is more oriented towards providing minimum standards rather than unifying their laws. The developed countries are more interested in keeping control over their intellectual creations by subjecting them to their strong IPR regimes, and there is no reason to expect change in this attitude.[40] Therefore, the problem of difference in the patent laws of the States is continuing, and this makes the determination of the applicable patent law difficult when it is associated with activities in outer space.

---

[37] Dieter Stauder, *Issues of Intellectual Property in Relation to Research and Invention in Outer Space: European Community Perspective*, *in* RESEARCH AND INVENTION IN OUTER SPACE - LIABILITY AND INTELLECTUAL PROPERTY RIGHTS 143 (Sa'id Mosteshar, ed., 1995).

[38] The place where the infringement takes place is the major decisive element for the determination of applicable law in case of infringement of patents on the Earth. *See* R. Oosterlinck, *The Intergovernmental Space Station Agreement and Intellectual Property Rights*, 17 J. SPACE L. 23, 27 & 28 (1989).

[39] TRIPs Agreement, *supra* note 5. TRIPs, being one of the WTO Agreements, is the most comprehensive multilateral agreement on the IPR as of yet. It covers almost all the types of IPR that are related to trade. *See generally*, Adrian Otten & Hannu Wager, *Compliance With TRIPs: The Emerging World View*, 29 VAND. J. TRANSNAT'L L. 391 (1996).

[40] O. Vorobieva, *Intellectual Property Rights with Respect to Inventions Created in Space*, *in* RESEARCH AND INVENTION IN OUTER SPACE - LIABILITY AND INTELLECTUAL PROPERTY RIGHTS 180 (Sa'id Mosteshar, ed., 1995).

Whatever may be the difficulty in the determination of applicable municipal patents law, the only option in the absence of *lex situs* is resorting to municipal law. However, choosing such municipal law cannot be done randomly, but only on the basis of some connecting factors. This leads to another question, what should be appropriate connecting factors in determining the applicable law? There is again a wide-ranging debate over the issue between the group supporting nationality[41] and the group supporting registration[42] as a connecting factor.

The supporters of nationality as a connecting factor argue that the applicable law must be the law of the State to which the person(s) infringing inventions in outer space belong. However the use of nationality as a connecting factor for the determination of applicable law may result in absurd consequences. Complications would arise in the case where the infringement of patents is done by a group of persons having different nationalities. In a hypothetical case, where a patent is registered in India, the United States, Japan, France, and Germany, the application of nationality as a connecting factor would mean that a national of any State, other than the above five, could infringe the patents in outer space without attaching liability. This is the consequence of the fact that the application of nationality as a connecting factor would lead to the determination of infringement under the law of that State of which the infringer is a national, and under that law there is no infringement at all. Even if the nationals of the above five States infringe a patent, they would be subject to different laws, resulting in different sanctions. For the collective infringement of a registered patent, imposing different quanta of punishment for different persons seems unreasonable.

Similar problems can also be seen in cases where activities are conducted by multinational firms. Since it is very difficult to establish the nationality of firms in most cases, determination of

---

[41] *See* Sa'id Mosteshar, *Issues Arising in Determining the Legal Regime Applicable to Intellectual Property Rights in Outer Space*, *in* RESEARCH AND INVENTION IN OUTER SPACE - LIABILITY AND INTELLECTUAL PROPERTY RIGHTS 135 (Sa'id Mosteshar, ed., 1995).

[42] *See* Oosterlinck, *supra* note 38, at 30.

applicable law also becomes difficult. In addition, nationality as the connecting factor completely discards the place of infringement in the determination of applicable law. This is not justifiable, as the place of infringement is the most relevant factor in determining patent infringement on Earth. Therefore, the nationality principle cannot be accepted as a decisive factor.

Registration as the connecting factor for determination of applicable law finds support from juristic writings,[43] in the Patents in Outer Space Act of 1990[44] and also in the *ISS* Intergovernmental Agreement (IGA).[45] The Patents in Outer Space Act of 1990[46] added section 105 to U.S. patent legislation,[47] which states that any invention made, used, or sold in outer space on a space object or component thereof under the jurisdiction and control of the United States must be considered to be made, used, or sold within the United States.[48] As discussed above, Article VIII of the Outer Space Treaty confers jurisdiction and con-

---

[43] Carl Q. Christol, *Protection of Intellectual Property Rights in Outer Space*, *in* RECENT TRENDS IN INTERNATIONAL SPACE LAW AND POLICY 366 (V.S. Mani, S. Bhatt & V. Balakista Reddy eds., 1997).

[44] Patents in Outer Space Act, Pub. L. 101 – 580, Sec. 1(a), 104 Stat. 2863 (Nov. 15, 1990).

[45] *See* 1988 IGA, *supra* note 2. *See also* Stephen Gorove, *Legal Problems of Manned Space Flight*, *in* THE USE OF AIRSPACE AND OUTER SPACE FOR ALL MANKIND IN THE 21ST CENTURY 249 (Chia - Jui Cheng ed., 1995).

[46] Patents in Outer Space Act , *supra* note 44.

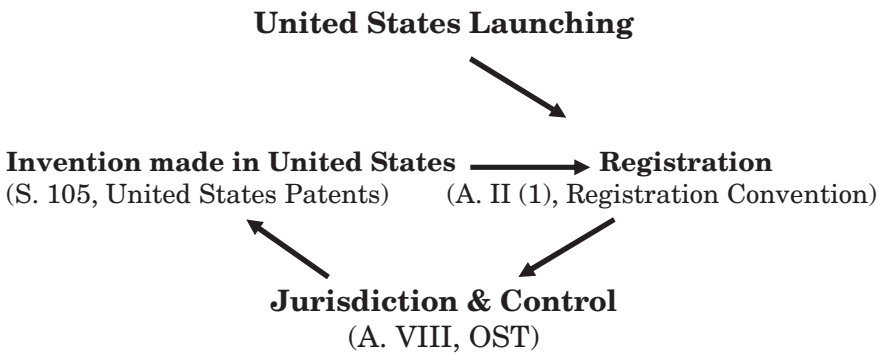
[47] *Towards a Code of Conduct*, *supra* note 16, at 177.

[48] *See* 35 U.S.C. § 105.

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

Id.

trol over space objects and personnel thereof to the State of registration.[49] This leads to a series of consequences. If the United States launches any object into outer space, it must register the object on its national registry according to Article II of the Registration Convention.[50] Once the object is registered on the national registry, the United States exercises jurisdiction and control over that object and personnel thereof.[51] Once the United States exercises jurisdiction and control over the space object and personnel thereof, any activity conducted in the object or by the personnel thereof is subject to United States laws.[52]



The above diagram better illustrates the United States situation. One thing to be noted here is that the United States legislation points towards registration as a connecting factor and not launching. This is due to the fact that in case of joint launching, the United States may not essentially be the State of registry and if it is not, it cannot exercise jurisdiction and control under Article VIII of the Outer Space Treaty. Consequently, Section 105 of the patent legislation would not be applicable.

The *ISS* IGA also supports the above view by stating that an activity occurring in any part of the *ISS* complex is deemed to have been conducted in the territory of the State in which that element is registered.[53] However, this does not solve the

---

[49] Outer Space Treaty, *supra* note 13, at art. VIII.
[50] Registration Convention, *supra* note 28, at art. II.
[51] Outer Space Treaty, *supra* note 13, at art. VIII.
[52] *See* 35 U.S.C. § 105.
[53] 1988 IGA, *supra* note 2, at art. 21.

problem completely. First, the *ISS* IGA is based on the legal fiction that the European States constitute a single territory subject to the same regulations. But in reality they do not form a single territory and are subject to different laws.[54] Second, and more importantly, the *ISS* consists of different elements contributed by different member States, and these elements are registered on the national registry of the respective contributing State.[55] In effect, different national laws govern the activities conducted in different elements of the *ISS*. If an activity infringing a patent right is conducted collectively in the laboratories situated in different elements of the *ISS*, the determination of applicable law by using registration as the connecting factor would fail.

Another issue associated with the use of registration as a connecting factor is the question of the status of the activities in unregistered objects found in outer space. These unregistered objects may be those that are naturally found in outer space, like celestial bodies, or those that are launched from the Earth. It is worth noting here that although the Registration Convention imposes an obligation on the States to register the objects launched by them,[56] it is binding only on the parties to the Convention.[57] To date, not every State is party to the Registration Convention. Therefore, if registration is considered as the connecting factor, the question of applicable law remains unsolved in cases of unregistered objects.[58] Moreover the place of registration would remain ambiguous, when future plans for launching objects from one celestial body to another are realized. This is the direct consequence of limited coverage of the Registration Convention, which speaks only of those objects that are launched into outer space from Earth and not of the objects launched from one celestial body to another.[59]

---

[54] Anna Maria Balsano, *The European Space Agency: Intellectual Property Rights and International Cooperation*, *in* RESEARCH AND INVENTION IN OUTER SPACE - LIABILITY AND INTELLECTUAL PROPERTY RIGHTS 162 (Sa'id Mosteshar, ed., 1995).

[55] 1988 IGA, *supra* note 2, at art. 5.

[56] *See* Registration Convention, *supra* note 28.

[57] *Id.*

[58] Bin Cheng, *supra* note 34, at 75 & 76.

[59] *See* Registration Convention, *supra* note 28, at art. II (1).

The factors discussed above clearly indicate that the patent regime in outer space is far from satisfactory. This is not something unknown to the world community. In 1999, an attempt was made to find solutions to problems relating to the IPR regime in outer space by convening a *Workshop on Intellectual Property and Space Activities* at UNISPACE III, under the auspices of the United Nations Committee on the Peaceful Uses of Outer Space (UNCOPUOS).[60] The participants in the Workshop made a recommendation for the harmonization of the IPR regime with the space law principles.[61] It was also recommended that UNCOPUOS, in collaboration with World Intellectual Property Organization, should take up the initiative to investigate the legal uncertainties existing in the field. Unfortunately, no further progress has been made to solve the existing problems.

V. A NOTE ON INDIAN PERSPECTIVE

India has recently joined the elite club of the very few States who are actively involved in the exploration of the Moon.[62] Plans are also being devised for carrying humans to outer space, the Moon, and other celestial bodies. So it is evident that India's entry into outer space inventions is not a far-fetched dream. However, there has not been much lateral thinking in the direction of developing a comprehensive national law to govern activities in space. The only attempt made by the Indian Space Research Organization (ISRO) in association with the National Law School of India University, Bangalore has not been successful to date.[63] Even though India is a State-Party to

---

[60] *See* Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space, G.A. Res. 54/68, U.N. Doc. A/RES/54/68 (July 19 – 30, 1999).

[61] *See generally* Encyclopedia of the Nations, *Peaceful Uses of Outer Space – UN Conferences on Outer Space*, http://www.nationsencyclopedia.com/United-Nations/Peaceful-Uses-of-Outer-Space-UN-CONFERENCES-ON-OUTER-SPACE.html (last visited Jan. 30, 2010).

[62] India achieved this feat by launching *Chandrayaan - I*. There is also a likelihood of *Chandrayaan - II* in 2011. *See Chandrayaan II launch likely in 2011: ISRO official*, HINDU DAILY, Jan. 3, 2008, at 17, *available at* http://www.thehindu.com/2008/01/04/stories/2008010456001500.htm.

[63] The draft space legislation prepared by the National Law School of India University, Bangalore has not come into force. *See generally* K. R. Sridhara Murthi, V. Gopal-

the Outer Space Treaty, the Rescue and the Return Agreement, the Liability Convention, and the Registration Convention, the provisions of these space treaties are not directly enforceable at the municipal level due to the fact that India follows the theory of specific adoption.[64]

The Indian Patents Act,[65] like its counterparts in other parts of the world, is restricted in its application to Indian territory.[66] Therefore, all the above-mentioned problems relating to granting of patents rights, jurisdictional problems, and the dilemma as to what law would be applicable law in case of an invention in outer space by the Indians, are relevant to India.

VI. CONCLUSION

The patent regime and the outer space regime, at present, are diametrically opposite due to some foundational conceptual differences. This should not be a reason for depriving patent rights from persons creating inventions in outer space. However, once we agree on the preliminary issue of granting of patents for inventions in outer space, the more complicated problem of infringement of Earthly patents in outer space arises. While the nationalistic patent regimes are diversified, international space law is completely outdated in this regard. This has ultimately resulted in complete chaos as to the determination of jurisdiction and applicable law in case of patent infringement.

The uncertainty in the patent regime governing outer space has made it not conducive to attract the much-needed private investment for activities in outer space including the Moon and other celestial bodies. The individualistic national responses have been a major source of contention in the patent regime. Therefore, this is high time for having an international framework to govern the patent regime in outer space. Undoubtedly,

---

krishnan and Partha Sarathi Datta, *Legal Environment for Space Activities*, 93 CURRENT SCI. 1823, 1827 (2007), *available at* http://www.ias.ac.in/currsci/dec252007/1823.pdf.

[64] The treaties are not binding upon Indian Courts unless they have been implemented by legislation. *See* H. O. AGARWAL, INTERNATIONAL LAW AND HUMAN RIGHTS 51 (2005).

[65] Patents Act, No. 39 of 1970 (Amended 1999), *available at* http://indiacode.nic.in/.

[66] *Id.* § 1.

UNCOPUOS must take the lead in this direction. To conclude, the author is of the view that it is the responsibility of the legal community to see to it that the saying "science soars like an eagle and law drags on like a turtle"[67] is not applicable in the field of outer space inventions.

[67] Carl Q. Christol, *Space Stations; A Lawyer's Point of View*, 4 INDIAN J. INT'L L. 488 (1964).

U.S. COMMERCIAL SPACE SECTOR: MATURED AND SUCCESSFUL

Shane Chaddha[*]

I. INTRODUCTION

The United States has laid down a space infrastructure that offers affordable human and robotic space services to government and commercial enterprises, including individuals, and that economically sustains its private space industry. One landmark event that encouraged the United States to seize a new and potentially thriving industry in commercial space transportation, occurred on June 21, 2004. In a competition for the Ansari X Prize, with the winning competitor receiving U.S. $10 million, the pilot and first astronaut, Mike Melvill, launched and flew a privately funded spacecraft, *SpaceShipOne*, to outer space.[1] Bromberg takes the view that "[this] historic flight highlighted the ability of innovative entrepreneurs to overcome historical impediments to meet the growing public demand for low-cost access to space."[2] According to a report by the U.S. Federal Aviation Administration (FAA), the economic impact of the private space industry on the United States economy has seen a significant rise from 1999 to 2006.[3] Growth is particularly evident from 2004 to 2006, however.[4] In other

---

[*] MPhil Candidate from the School of Law, University of Manchester (UK). LLB (University of the West of England, Bristol. UK).

[1] Frans von der Dunk, *Passing The Buck To Rogers: International Liability Issues In Private Spaceflight*, 86 NEB. L. REV. 400, 405 (2007). Further details as to the nature of the X Prize are provided by the organisers on the XPrize website. *See* XPrize Foundation, *Ansari XPrize*, http://space.xprize.org/ansari-x-prize (last visited Jan. 6, 2010). *See also*, Spencer H. Bromberg, *Space Travel – 2005: A Legal Odyssey into the Current Regulatory Environment for United States Space Adventures Pioneering the Final Frontier*, 70 J. AIR L. & COM. 639, 640 (2005).

[2] Bromberg, *supra* note 1.

[3] FAA, ECONOMIC IMPACT OF COMMERCIAL SPACE TRANSPORTATION ON THE US ECONOMY, at 22 (April 2008), *available at* http://www.faa.gov/news/updates/media/EcoImpactReport2008.pdf [hereinafter ECONOMIC IMPACT].

[4] *See* OFFICE OF SPACE COMMERCIALIZATION, TRENDS IN SPACE COMMERCE (June 2001), *available at* http://www.space.commerce.gov/library/reports/2001-06-trends.pdf

words, the landmark event of a privately-funded space actor entering outer space and embarking on a space endeavour ushered in an era now referred to as the New Space Age. In 1999, the economic activity from the private space industry generated U.S. $61,313,711 to the economy and supported 497,350 job opportunities.[5] The commercial space transportation and enabled industries contributed U.S. $98,086,960 and 551,350 employment opportunities were supported in 2004.[6] From 1999 to 2004, the United States has seen consistent growth in the commercial space sector. A more significant economic impact occurred in 2006. In that year, a total of U.S. $139,262,027 in economic activity was generated from the commercial space transportation and enabled industries and supported 729,240 jobs.[7] The FAA concludes that, "[d]uring the period from 1999 to 2006, the total economic activity impact of commercial space transportation and enabled industries increased 127 percent, the earnings impact grew about 117 percent, and the number of jobs supported rose about 47 percent."[8]

II. FOCUS OF ARTICLE

This article shall argue that there are two stages of development within the space industry. Each stage has its own identifiable and different actors, and has laid down influencing factors that formed an infrastructure for the United States to seize and nurture the growth of its private space sector. The first stage shall be referred to as the Space Age, wherein the primary actor was the Nation-State. Here, the International Geophysical Year (IGY) and the creation of the National Aeronautics and Space Administration (NASA) acted as catalysts for United States policymakers to initiate space programmes, and succeed in its race

---

(detailing current, and predicting future, growth of major segments in the space industry, and identifying how much revenue each segment contributed to the US economies from 1996 to 2002. The segments evaluated are satellite communications, space transportation, global positioning system, and remote sensing. US Department of Commerce's Office of Commercialization).

[5] ECONOMIC IMPACT, *supra* note 3, at 22.

[6] *Id.*

[7] *Id.*

[8] *Id.*

against the then Soviet Union to launch a human spacecraft to the Moon. It was through changes in presidential leadership from the post-*Sputnik* programmes that the private space industry was conceived and stimulated. The New Space Age is the second stage of development. Owing to political and legislative support, including the creation of a single regulatory body, commercial enterprises have become the main actors in space exploration and exploitations since 2004, in some instances superseding NASA's role to "plan, direct, and conduct aeronautical and space activities."[9] Six key factors will be identified as forming a platform that developed United States space commerce. These factors are: (1) the IGY, (2) the creation of a space agency – NASA, (3) Presidential leadership, (4) private competitions and bold space pioneers, (5) political and legislative support, and (6) the creation of a single regulatory authority.[10] The White House Office of Science and Technology's review of United States human space flight and its implications for the private industry shall also be discussed.[11] This article concludes that, owing to these galvanising factors, the United States has a mature, successful and economically viable private space industry.

III. THE SPACE AGE

A. The International Geophysical Year

It was during the era of the IGY which acted as a catalyst through which the fantasy of entering the "final frontier" and

---

[9] National Aeronautics and Space Act of 1958, Pub. L. 85-568, § 203(a)(1), 72 Stat. 426, 429 (unamended) (codified as amended 42 U.S.C. §§2451-2487g [hereinafter Space Act].

[10] It could be argued that the commercialisation of the orbiting space station, the *International Space Station*, is a seventh factor. This writer takes the view, however, that such a factor has not contributed to the development and success of the private space industry in the US. According to Bromberg, the Russian Federal Space Agency holds poll position in public space travel, or "space tourism". He says, "[n]o other nation in the world has put private citizens into orbit, much less offered accommodation in orbiting space stations, something the Russians have done for over a decade". Bromberg, *supra* note 1, at 666.

[11] Review of the U.S. Human Space Flight Plans Committee, *Summary Report of the Review of the US Human Space Flight Plans Committee.* 8 (Sept. 8, 2008) *available at* http://www.nasa.gov/pdf/384767main_SUMMARY%20REPORT%20-%20FINAL.pdf [hereinafter Augustine Committee].

travelling into space became a reality. The IGY was initiated by the International Council of Scientific Union in 1952.[12] That Union declared that from July 1, 1957 through December 31, 1958, a number of geophysical activities and research programmes where to be undertaken by named nations.[13] Collaboration and the exchange of observations, research findings, and related data were continuing obligations imposed on participating countries.[14] The IGY was responsible for the first artificial satellite to be successfully launched into space, and gave birth to the Space Age.[15] Odish entertains this view, also. He said, "[t]he successful launching of artificial satellites in the IGY program is a pioneering and historical event per se. it has ushered in the space age. It will inevitably lead to greatly increased knowledge of the earth and the solar system."[16]

On October 4, 1957, *Sputnik I* was launched by the then Soviet Union. Equivalent to the size of a basketball,[17] with a spherical shape of 58 centimetres and a weight of 83.6 kilograms,[18] the satellite travelled to an altitude of 900 kilometres above the surface of the Earth, and took one hour and thirty-five minutes to complete an elliptical orbit around the Earth.[19] A radio beacon built onto it beeped at regular intervals allowing scientists and the international community to determine its exact location around the Earth by telemetry.[20] Three months after its launch, *Sputnik I* fell back from orbit on January 4, 1958.[21]

---

[12] National Aeronautics and Space Administration, *Sputnik and the Dawn of the Space Age* (Oct. 10 2007), *available at* http://history.nasa.gov/sputnik/index.html.

[13] *Id*. For a comprehensive interpretation for the meaning of the IGY, *see generally* Hugh Odish, Executive Director, U.S. Nat'l Comm. for IGY, Address before the National Press Club: U.S. National Committee for IGY: "The Meaning of the International Geophysical Year" (Dec. 4, 1958), *available at* http://history.nasa.gov/sputnik/dec58.html.

[14] *Sputnik and the Dawn of the Space Age, supra* note 12.

[15] *Id.*

[16] Odish, *supra* note 13.

[17] Bromberg, *supra* note 1, at 640, n. 4.

[18] *Announcement of the First Satellite*, *in* F.J. KRIEGER, BEHIND THE SPUTNIKS 311 (Washington, DC: Public Affairs Press, 1958), *available at* http://history.nasa.gov/sputnik/14.html.

[19] *Id*.

[20] Roger D. Launius, *Sputnik and the Origins of the Space Age*, http://history.nasa.gov/sputnik/sputorig.html (last visited Jan. 6, 2010).

[21] *Id.*

In the aftermath of the successful *Sputnik* programmes, the United States adopted an aggressive space flight strategy to restore, *inter alia*, its national prestige and international demeanour as "a nation of technological system builders who could use this ability to create great machines and the components of their operation, of wonder."[22] Such a space programme led to the first successful launch of an artificial satellite by the United States. *Explorer I*, designed by Wernher von Braun, was launched from Cape Canaveral, Florida, on January 31, 1958.[23] Scientific discoveries were made by the *Explorer*. It confirmed the existence of Earth's magnetic field and the "Van Allen Radiation Belt," named after the physicist James A. Van Allen who built the attached Geiger counter on the satellite to measure the levels of radiation in Earth's outer atmosphere.[24] It is suggested that this aggressive space policy spurred the "space race" between the Soviets and the United States to reach the Moon in a human spacecraft.

A brief account of the landmark events which led to the exploration and exploitation of space during the IGY reveals that the Nation-State was the primary actor in space-related activities. An assumption entertained by the international community was that private enterprises would not operate commercial ventures in outer space. Such sentiments are conveyed by American Hudgin and British academic Jenks, respectively. Hudgin provides that, "[f]rom the beginning of the Space Age most American Policy makers assumed that [the] government[] would be the actor[] operating in space and thus made no allowance for private actors."[25]

In 1956, Jenks wrote, "it [would be] probable that only States, and perhaps only large States or specially constituted international bodies established by States, would be in a position to undertake the exploration and exploitation of the resources of space."[26] These views held from the outset of the

---

[22] *Id.*
[23] *Id.*
[24] *Id.*
[25] Bromberg, *supra* note 1, at 644.
[26] C. Wilfred Jenks, *International Law and Activities in Space*, 5 INT'L & COMP. L.Q. 99, 104-105 (1956).

Space Age were reasonable. As provided by Jenks, "[t]he scale of the capital investment involved, the considerable area necessary for a launching station [and] the degree of preparation required" would be such as to deter private bodies from undertaking private space endeavours.[27] These factors listed by Jenks did not, however, prevent the movement of United States private actors to enter space for commercial purposes during the Space Age. Although its launch was carried out by NASA at Cape Canaveral, this view is demonstrated by the example of *Telstar*. Here, American Telephone & Telegraph (AT&T) privately-funded, at a cost of U.S. $170 million, the first communications satellite which was launched into space on July 10, 1962. This satellite provided, *inter alia*, direct television transmissions; with the first international transmissions viewed by more than half of the United Kingdom population.[28]

Bromberg argues that "[t]he launch of *Sputnik I* solidified the conclusion that governments, not entrepreneurs, should lead [...] the United States effort in space..." and this is the primary reason for stagnation in the development of the private space industry.[29] It is suggested that this argument could be displaced by the *Telstar* example. This example galvanised the creation of a new industry open for commercial entities offering space services. Further, the United States government recognised the emergence of that new private industry and promoted its growth and economic viability. With respect to AT&T, the government agreed to facilitate the launch of the *Telstar* satellite at its federal spaceport.[30] Also, in the aftermath of the launch, the Communications Satellites Act of 1962 (Comsat Act) was enacted on August 31, 1962, under the Kennedy Administration.[31] The purpose of the Comsat Act was to create an improved communications network internationally, serving the communication needs of the United States and other countries

---

[27] *Id.*

[28] HELEN GAVAGHAN, SOMETHING NEW UNDER THE SUN: SATELLITES AND THE BEGINNING OF THE SPACE AGE, ch. 18 (Springer-Verlag New York Inc, New York 1998).

[29] Bromberg, *supra* note 1, at 645 – 646.

[30] GAVAGHAN, *supra* note 28.

[31] Communications Satellites Act of 1962, Pub. L. 87 – 624, 76 Stat. 419 (codified as amended in scattered sections of 47 U.S.C.).

with the better, new technology and quality of services.[32] A provision provided that, "[i]n order to facilitate this development and to provide for the widest possible participation by private enterprise, United States participation in the global system shall be in the form of a private corporation, subject to appropriate governmental regulation."[33]

The passage of the Comsat Act, therefore, supports strongly the policy of the United States government of encouraging the development of the private space sector by providing statutory ownership and operation of the international communications network for private undertakings. In doing so, this invited new space services operators to enter the industry, created competition and encouraged foreign investments.

B. Creation of a Space Agency – NASA

The creation of a space agency, NASA, along with its recently expanded role, has facilitated an infrastructure to foster and nurture the growth and economic sustainability of the private space industry. Some commentators, like Bromberg, do not hold this opinion with the same conviction, however. One commentator reflects on the historical background and argues that the social and political reasons for the establishment of NASA discharge the possibility that this Agency has promoted free enterprise in space and eliminated barriers for new actors to offer commercial space services.[34] NASA was created almost exactly a year after the launch of *Sputnik I* following the enactment of the National Aeronautics and Space Act of 1958 (NAS Act).[35] NASA was a direct response to the impact *Sputnik* had on American public opinion, the competition in science and technology against the Soviets and the challenge the launch presented to democracy. Launius comments that *Sputnik I*, being the first artificial satellite to elliptically orbit the Earth, had a "Pearl Harbor" effect on public opinion. It revealed the techno-

---

[32] *Id*. § 102(a) – (b).
[33] *Id.* § 120(c).
[34] Bromberg, *supra* note 1.
[35] Space Act, *supra* note 9.

logical inferiority of the United States and questioned the country's military might.[36] Political scrutiny and criticism was focused on the failure of President Eisenhower and his Administration to comprehend the adverse implications of the launch the *Sputniks* had globally, which had allowed the Soviets to beat the United States in the race to space. Launius states that, "[t]he Sputnik crisis reinforced for many people the popular conception that Eisenhower was a smiling incompetent; it was another instance of a 'do-nothing', golf-playing president mismanaging events."[37]

Rosholt believes that the events during the twelve months following the launch of *Sputnik I* could be interpreted as a challenge to democratic principles. He says, "[t]o some [the events] indicated the inability of a democracy to move ahead quickly when faced by novel and difficult problems. To others [the events] indicated the ability of a democracy to choose the best long-term alternatives through the deliberate and systematic working of the democratic process."[38] NASA succeeded the National Advisory Committee for Aeronautics (NACA) which was a civilian agency known for its competence in technology, its close working relationships with military services and its engagement in aeronautics research.[39] Under its new title, NASA was granted legislative responsibilities to "plan, direct and conduct aeronautical and space activities."[40] Bromberg concludes:

> . . . the sole reason for NASA's creation was to restore national pride by beating the Soviets to the moon. While NASA's goals were admirable, the organization lost many of its characteristics that had fostered entrepreneurial efforts in the commercial aviation industry. The newly formed NASA did not seek to support a commercial space industry, . . . [as] NASA, at the very least, pitted a powerful governmental bureaucracy against private industry. Finally, NASA's objectives became

---

[36] Launius, *supra* note 20.

[37] *Id*.

[38] ROBERT L. ROSHOLT, AN ADMINISTRATIVE HISTORY OF NASA, 1958 – 1963 16 (NASA SP-4101, 1966).

[39] Launius, *supra* note 20.

[40] *See supra* note 9.

> political in nature, as the entire nation rested its hopes on the government's efforts to beat the Soviets.[41]

Another commentator, on the other hand, claims that NASA's contractual agreements with industrial leaders in commercial space services, like Lockheed Martin and Boeing, have shown the Agency's inability to exploit the commercial potential of space.[42] That writer argues that such industrial partners do not benefit from, and so do not promote, an economically stable and competitive commercial sector. They wield their tremendous influence over NASA's decisions to serve their own interests and preserve their lucrative contracts with the Agency.[43] In light of the Augustine Committee, it is suggested that this view could be countered. The composition of that Committee's members was diverse and represented a number of bodies, both from the United States government and the commercial industry. The Chairman of the Committee, for example, Norman Augustine, was formerly the Chief Executive Officer of Lockheed Martin, served on the President's Council of Advisors on Science and Technology, and many other national commissions and committees.[44] Members of the Augustine Committee, considering the best interest of the country, unequivocally stated that the existing and future human space flights plans can be sustained by engaging the services of the private space industry. [45]

Amendments to the Space Act have led to the extension of the role of the Agency. The Congress amended the 1958 Act to attach an additional legislative function. The relevant provision states, "[t]he Congress declares that the general welfare of the United States requires that [NASA] . . . seek and encourage, to

---

[41] Bromberg, *supra* note 1, at 646.

[42] *Commercialisation of Space Commercial Space Launch Amendments Act of 2004,* 17(2) HARV. J.L. & TECH. 619, 622 – 624 (2004).

[43] *Id.*

[44] Press Release, The Office of Science and Technology Policy, US Announces Review of Human Space Flights Plans (May 7, 2009), http://www.whitehouse.gov/files/documents/ostp/press_release_files/NASA%20Review.pdf.

[45] The Augustine Committee, *supra* note 11, at 1.

the maximum extent possible, the fullest commercial use of space."[46]

It is argued that following this extended statutory duty, NASA has demonstrated an on-going commitment and supportive role in nurturing the growth and economic sustainability of the commercial space sector. NASA, since 1962, has provided launching services for privately-owned communications satellites.[47] The offering of technical means to facilitate the launch of a space vehicle implies that NASA's initial objective was to eliminate such technical barriers which might have had denied private actors entry to space. The example of *Telstar* being launched by the Agency supports this view. It is suggested, moreover, that by offering technology to access space, NASA was inviting new commercial undertakings to enter the space industry in an attempt to promote competition and persuade investors to become involved in commercial endeavours.

Legislative amendments to the Space Act granting powers to NASA have been crucial to the development of the nascent commercial space sector. The Agency has the authority to enter into Space Act Agreements with the United States or foreign person or entity; an educational institution, a federal, state or local government body; a foreign government; or an international organisation.[48] Section 203(b)(5) of the Space Act says that NASA is able:

> to enter into and perform such contracts, leases, cooperative agreements, or other transactions as may be necessary in the conduct of its work and on such terms as it may deem appropriate, with any agency or instrumentality of the United States, or with any State, Territory, or possession, or with any

---

[46] 42 U.S.C.A. § 2451(c).

[47] JOHN M. LOGSDON, ET AL., 111 EXPLORING THE UNKNOWN SELECTED DOCUMENTS IN THE HISTORY OF THE US CIVIL SPACE PROGRAM 574 (NASA SP-4407, 2001), *available at* http://history.nasa.gov/SP-4407/vol2/v2chapter3-3.pdf.

[48] *See* NASA Policy Directive, *Authority to Enter into Space Act Agreements*. NPD 1050.1I (Dec. 23, 2008), http://nodis3.gsfc.nasa.gov/displayDir.cfm?t=NPD&c=1050&s=1H.

> political subdivision thereof, or with any person, firm, association, corporation, or educational institution.[49]

That subsection further imposes a mandatory obligation on NASA when acting under this power, "such contracts, leases, agreements, and other transactions shall be allocated by the Administrator in a manner which will enable small-business concerns to participate equitably and proportionately in the conduct of the work of the Administration."[50]

Competent smaller businesses within the space sector have, therefore, an equitable and proportionate opportunity as larger organisations to contract work with NASA. According to Logsdon *et al*., from the beginning of 1972, a number of partnerships have been entered into with private firms.[51] Under the Commercial Orbital Transportation Services (COTS) project, the Agency, also used its section 203(5)(b) power to make an unprecedented investment in the commercial transportation market. This program consists of two phases. Phase 1 involves the development and flight demonstration of a cargo delivery and disposal system. Assuming that the system possesses one or more capabilities sought in order to satisfy the first milestone, under phase 2 NASA plans to competitively tender with successful commercial actors to transport crew, fuel and other supplies to the ISS in place of the retiring US Space Shuttle at the end of the fiscal year 2010.[52] The COTS program is another statutorily-sponsored initiative.[53] Three Space Act Agreements were created under this project. On August 18, 2006, a combined total of US$3.5 billion was granted to SpaceX and Rocketplane-Kistler to assist in the building and demonstration of their respective

---

[49] 42 U.S.C.A. § 2473(c)(5).

[50] *Id.*

[51] 42 U.S.C.A. § 2451(c).

[52] NASA, *NASA commercial orbital transportation services*, (Aug. 4, 2009), *available at*: http://www.nasa.gov/offices/c3po/about/c3po.html.

[53] *See*: section 502(a)(3) of the *National Aeronautics and Space Administration Authorization Act of 2008*. Public Law 109-155, 119 Stat 2895. December 30, 2005. This Act is codified in 42 U.S.C.A. §16601 *et seq*. (Thomson/West, 2010). The relevant codified provision is 42 U.S.C.A. §16762(b)(3). The 2005 Act is affirmed by section 902(a)(1) of the National Aeronautics and Space Administration Authorization Act of 2008. Public Law 110-422, 122 Stat 4779. October 15, 2008. H.R.606, which is codified in 42 U.S.C.A. §17701 *et seq*. (Thomson/West, 2010). Section 902(a)(1) is codified in 42 U.S.C.A. §17801.

space vehicles.[54] On October 18, 2007, Rocketplane-Kistler's agreement was terminated for failing to meet certain milestones.[55] Orbital Science Corporation was awarded the third Agreement on February 19, 2008.[56] Implied from Phase 2 of the program, it is claimed that NASA injected substantial financial incentives in order to create favourable market conditions, enabling it to competitively tender such orbital transportation services contracts to private companies on an equal playing-field, and negotiate acceptable terms for both parties.

Section 203(b)(5), therefore, has the potential to stimulate a competitive commercial industry between differently sized businesses, and is consistent with the Agency's extended statutory role to seek and exploit the full commercial use of space.

NASA's participation in the Small Business Innovation Research Program (SBIR) and the Commercial Crew and Cargo Program (C3PO) shows its recent efforts to support and seize the entrepreneurial activity within the competitive private space sector. The SBIR was established by the Small Business Innovation Development Act of 1982 as amended.[57] It is a program consisting of a three phase financial incentive scheme, awarded to qualifying United States established small businesses, in recognition of unique ideas which meet the research and development needs of a federal agency.[58] NASA has announced recently that 332 submissions have been made by participants for Phase two of the SBIR. From these submissions,

---

[54] NASA, *NASA Invests in Private Sector Space Flight with SpaceX, Rocketplane-Kistler* (Aug. 18, 2006), *available at* http://www.nasa.gov/exploration/news/COTS_selection.html. *See also*, Popular Mechanics, *Commercial space shuttle industry gets a boost* (Aug. 22, 2006), *available at* http://www.popularmechanics.co.za/content/news/singlepage.asp?key=100.

[55] NASA, *Rocketplane Kistler's (RpK) Space Act Agreement Terminated* (Oct. 18, 2007), *available at* http://www.nasa.gov/offices/c3po/home/rpk_terminated.html.

[56] Press Release, NASA, NASA partners with Orbital Science for space transportation services, Release: 08-058 (Feb. 19, 2008), *available at* http://www.nasa.gov/home/hqnews/2008/feb/HQ_08058_COTS_Selection.html; and Orbital Science Corporation, *NASA selects Orbital to demonstrate new commercial cargo delivery system for the International Space Station*, (Feb. 19, 2008), *available at* http://www.orbital.com/NewsInfo/release.asp?prid=644.

[57] Small Business Innovation Development Act of 1982, 15 U.S.C. § 638 (2006).

[58] *Id.* § 638(e)(4). For detailed information relating to the SBIR, *see* Small Business Innovation Research, Small Business Technology Transfer, *Participation Guide*, *available at* http://sbir.nasa.gov/SBIR/partintro.htm (last visited Jan. 14, 2010).

NASA will award the contracts to 126 small businesses in twenty-seven states.[59] The determination of the Agency to reduce the obstacle in financial resources available for smaller businesses against developed industrial leaders is demonstrated by the SBIR. Small businesses are given the opportunity to present their unique ideas which address specific technological gaps in NASA's space missions, develop those technologies and make those products commercially available to the Agency and private space users.[60] NASA applies the funds from the American Recovery and Reinvestment Act of 2009 to award the financial incentives.[61] Under this Act, the Agency has been allocated a total of U.S. $500 million to invest in the development and demonstrations of commercial space transportation vehicles; U.S. $50 million of which, was planned for competitively awarding multiple Space Act Agreements on November 2009.[62] Moreover, the maturity and economic viability of the crew and cargo transportation services market, within the commercial space industry, should be accelerated, as NASA intends to competitively purchase these services once they are available.[63]

The creation of a space agency vested with statutory powers, therefore, has stimulated growth and encouraged free enterprise and investment. NASA's financial award incentives are designed to open the United States' space industry for new actors, both small and large, to enter by removing technical and financial barriers. These awards are also intended to promote the development of safe, reliable and cost effective space technology, establish new markets, and create a highly competitive environment. Such vigorous competition would create a self-sustaining private industry as well as benefit the country by

---

[59] NASA, *NASA Selects Small Business Research and Technology Projects* (Oct. 6, 2009), http://www.nasa.gov/centers/ames/news/releases/2009/09-128AR.html.

[60] *Id*.

[61] American Recovery and Reinvestment Act of 2009, Pub. L. 111-5 at 131, 123 Stat. 115 (Feb. 17, 2009).

[62] NASA, *NASA Begins Commercial Initiative*, *available at* http://www.nasa.gov/offices/c3po/home/Commercial_Crew_Init.html (last visited Jan. 14, 2010).

[63] NASA, *NASA Commercial Orbital Transportation Services, available at* http://www.nasa.gov/offices/c3po/about/c3po.html (last visited Jan. 14, 2010).

supporting the United States' economy and creating job opportunities.

IV. PRESIDENTIAL LEADERSHIP

The United States' post-*Sputnik* programmes have shown remarkable leadership in modifying the country's national space policy and attaching importance to commercialisation of space by private actors. Such leadership has facilitated the maturity of commercial space sector and its continuing success.

The passage of the Communications Satellite Act of 1962, in response to the successful launch of the privately funded and owned communications satellite, *Telstar*, acted as a catalyst for the growth of the nascent private space industry.[64] This Act was passed under the presidency of John F. Kennedy. It is suggested that President Kennedy seized on the emerging space telecommunications market and realised the potential benefits such market could have on the nation and its economy when he statutorily vested the responsibility to provide an international communications network, in commercial space operators rather than federal agencies.

The Administration of Ronald Reagan instituted material legal reform and extended the legislative role of NASA to accommodate new markets being created, particularly the nascent commercial space transportation market, and, like Kennedy, drew the potential benefits of that industry for the country's interests. On July 14, 1982, the first presidential space policy was issued which clearly stated the United States Government's role in encouraging free enterprise in space and private sector investments. It stated that, "[t]he United States Government will provide a climate conducive to expanded private sector investment and involvement in civil space activities. . . ."[65]

The expensive and considerable delay caused in obtaining multiple licences from several different federal agencies to authorise the launch of *Conestoga I* resulted in the amendment

---

[64] Communications Satellites Act of 1962, *supra* note 31.

[65] LOGSDON, ET AL., *supra* note 47, at 572 (*citing* U.S. Executive Office of the President. July 4, 1982).

of the regulatory regime of licensing private launch vehicles. Codifying Executive Order 12465,[66] issued on February 24, 1984, the Commercial Space Launch Act of 1984[67] established the Department of Transportation (DOT) as the single federal body with the legislative responsibility to issue such licences. The Office of Commercial Space Transportation (OCST) was created by the DOT to carry out that function.[68] The purpose of delegating that statutory function to a sole government authority was to "'expedite the processing of private sector requests to obtain licences' to operate launch vehicles."[69]

The precedent set by President Reagan of promoting the maturity of the commercial space industry, was continued by his successors.[70] President George W.H. Bush, for example, issued the *United States Commercial Space Guidelines* in 1991.[71] The guidelines were based in part on the theory that market costs would be driven down if the United States government invested in space technology.[72] In doing so, it was assumed that the United States would maintain its international leadership in the exploration and exploitation of outer space, and such investments would benefit the nation. This view was stated in the Policy Guidelines whereby, "[a] robust commercial space sector has the potential to generate new technologies, products, markets, jobs, and other economic benefits for the nation, as well as indirect benefits for national security."[73]

---

[66] Exec. Order No. 12,465, 49 Fed. Reg. 7099 (Feb. 24, 1984).

[67] Commercial Space Launch Act of 1984, Pub. L. 98-575, 99 Stat. 3055 (1984).

[68] *Commercialisation of Space Commercial Space Launch Amendments Act of 2004*, *supra* note 42, at 625 – 626.

[69] *See* W. D. Kay, *Space Policy Defined: The Reagan Administration and the Commercialization*, 27(1) BUS. & ECON. HIST. 237, 241 (1998) (*citing* the Executive Order No. 12456).

[70] Kay, however, is of the opinion that Clinton's national space policy was unclear and that his Administration did not place as high as priority on the growth of the private sector as his predecessors. *Id.* at 243 – 244.

[71] LOGSDON, ET AL., *supra* note 47, at 583-586 (*citing* Executive Office of the President, *U.S. Commercial Space Policy Guidelines*, NSPD-3 (Feb. 11, 1991)).

[72] *Id.* at 583.

[73] *Id.* at 584.

Under the Clinton Administration, amendments were made to the Commercial Space Act of 1998.[74] The restriction prohibiting NASA from purchasing hardware instead of services from private actors was eliminated, including the ban restricting such actors from returning government payloads, humans, and reusable launch vehicles to Earth.[75]

It is suggested that the Obama Administration is able to grow the United States private space sector to its fullest potential by implementing the recommendation of the Augustine Committee. That is to say, to invest in and purchase space products and services provided by the commercial sector. As well as realising the benefits expressed by the 1991 Policy Guidelines, it could provoke a vigorous, competitive commercial space industry and create new markets therein.

V. THE NEW SPACE AGE

A. Private Competitions and Bold Space Pioneers

The New Space Age is the second stage of development. Prior to commercial undertakings being the primary actor in the exploration of space, a number of wealthy individuals have boldly ventured into space. There currently have been eight "space tourists."[76] The first private space passenger, who paid an estimated U.S. $20,000,000, was Dennis Tito, an American. In April 2001, he enjoyed a short stay in the Russian section of the *International Space Station* (*ISS*).[77] South African, Mark Shuttleworth was the second space adventurer. In order to conduct his own scientific research and experiments, as well as bring attention to the HIV/AIDs epidemic in Africa, Shuttleworth paid up to twenty million U.S. dollars for a eight day visit in the *ISS*.[78] American Gregory Olsen and the American-Iranian Anou-

---

[74] Commercial Space Act of 1998, Pub. L. 105-303, 112 Stat. 2843, H.R. 1702 (Oct. 28, 1998). This Act is codified and amended in 49 U.S.C.A. § 70101.

[75] Bromberg, *supra* note 1, at 650 – 651.

[76] Clara Moskowitz, *Acrobat to be Next Space Tourist*, SPACE.COM, June 4, 2009, http://www.space.com/news/090604-cirquedusoleil-space-tourist.html.

[77] von der Dunk, *supra* note 1, at 404 – 405.

[78] Steven Freeland, *Up, Up and … Back: The Emergence of Space Tourism and Impact on the International Law of Outer Space*, 6 CHI. J. INT'L L. 1, 3 (2005).

sheh Ansari, also the first female participant, were the third and fourth space pioneers, respectively.[79] On August 10, 2003, a wedding was even held on the *ISS* via a video-link between two Russians: cosmonaut Yuri Malenchenko and Ekaterina Dmitriev.[80] In 2008, Richard Garriott bought a ticket at U.S. $30 million, under an agreement with the Russian Federal Space Agency and the United States Space Adventurers to travel to the *ISS* and became the sixth space tourist.[81] The first private space passenger to travel twice into outer space, becoming the fifth and seventh space tourist to the *ISS*, was the Hungarian-American Charles Simonyi.[82] On September 30, 2009, the eighth space tourist was Guy Laliberté, a Canadian acrobat. The cost for his twelve-day stay on the *ISS* was around U.S. $30 million.[83]

Malik takes the view that there were five significant announcements which confirmed the arrival of the New Space Age and indicated the intention of the private space providers to enter into the newly emerging market of "space tourism," or commercial space transportation services, nurture it, and offer affordable space travel to civilians.[84] The Ansari X Prize competition was the first announcement in 1996. Under this prize, the winning competitor would receive U.S. $10 million by flying a privately funded, reusable craft, which carried a pilot and two human-sized figures twice around Earth within three weeks, at an altitude of over 100 kilometres. For the purposes of the competition, this altitude was claimed to constitute the edge of outer space.[85] The winning competitor was a small company,

---

[79] FRANCIS DREER, SPACE CONQUEST: THE COMPLETE HISTORY OF MANNED SPACEFLIGHT 202 (Haynes Publishing, Somerset, 2009).

[80] *Id. See also*, Juan A. Lozano, *Man on International Space Station Weds Bride on Earth*, SPACE.COM, Aug. 10, 2003, http://www.space.com/missionlaunches/malenchenko_wedding_030810.html.

[81] Tariq Malik, *Former Astronaut's Son Set for Space Tourist Trek*, SPACE.COM, Oct. 10, 2008, http://www.space.com/missionlaunches/081010-spacetourist-garriott.html.

[82] *Charles Simonyi Returns to Space*, http://www.charlesinspace.com (last visited Jan. 15, 2010).

[83] Moskowitz, *supra* note 76.

[84] Tariq Malik, *Going Private: The Promise and Danger of Space Travel*, SPACE.COM, Sept. 30, 2004, http://www.space.com/missionlaunches/spacetourism_future_040930.html.

[85] von der Dunk, *supra* note 1, at 405.

Scaled Composites, owned by Burt Rutan and financier Paul Allen.[86] The spacecraft, *SpaceShipOne*, flew to an altitude of 112 kilometres and was piloted by Mevill, the first civilian astronaut.[87] The additional four announcements have been delivered since 2004. The formation of Virgin Galactic by Sir Richard Branson, who was also a competitor of the X Prize, is one such announcement. This company later became a joint venture with Rutan's company.[88] The company has announced, having developed the spacecraft, which is called *SpaceShipTwo* as it uses and builds on the technology of *SpaceShipOne*, that it would offer passengers the experience of suborbital flights above 100 kilometres.[89] Virgin Galactic predicts that its first commercial launch will take place in 2011 or 2012, and shall board Sir Richard, along with passengers who paid the ticket price of U.S. $200,000, from the newly constructed spaceport in New Mexico.[90] Press release of microgravity flights provided by Zero Gravity Corporation and Amerijet International under a joint venture is another. At a cost of around U.S. $3,000, paying passengers would experience weightlessness for a period of 25 seconds in a modified Boeing 727-200 jet. Such parabolic flights were previously used for training NASA astronauts and Novespace, a subsidiary company of the French National Space Centre.[91] Professor Stephen Hawking, renowned British physicist, experienced weightless parabolic flights.[92] His experience lasted around four minutes and the cost of his flight was waived.[93] On June 20, 2009, the first wedding ceremony was conducted in microgravity. The married couple, Americans Noah Fulmor and

---

[86] Bromberg, *supra* note 1, at 639.

[87] von der Dunk, *supra* note 1, at 405 – 406.

[88] *Virgin boss unveils space trips,* BBC NEWS, http://news.bbc.co.uk/2/hi/uk_news/4178747.stm (last visited Jan. 15, 2010).

[89] *Id*.

[90] Alan Boyle, *The 5- Year Old Space Age*, COSMIC LOG, June 19, 2009, http://cosmiclog.msnbc.msn.com/archive/2009/06/19/1971623.aspx. The author reports, furthermore, on five other private enterprises being active during the new space age in offering suborbital spaceflights to private individuals.

[91] Alan Boyle, *Zero-gravity flights go mainstream*, MSNBC, Sept. 16, 2004, http://www.msnbc.msn.com/id/5992077.

[92] *Hawking takes zero gravity flights*, BBC NEWS, Apr. 27, 2007, http://news.bbc.co.uk/1/hi/6594821.stm.

[93] *Id*.

Erin Finnegan, spent U.S. $60,000 to charter the modified Boeing 727-200 aircraft.[94] The third announcement is the America's Space Prize, which was made by Robert Bigelow, founder of Bigelow Aerospace. A privately funded enterprise could receive a competition award of U.S. $50 million by launching a reusable, human spacecraft capable of carrying a total of up to seven passengers, and completing two orbits at a specified altitude by the end of the decade.[95] The fourth announcement was made by SpaceDev, a United States aerospace company. Collaborating with NASA, SpaceDev proposed to design and launch a spacecraft called *Dream Chaser* to offer suborbital flights to paying passengers with the hope of a new hybrid propulsion-based rocket being used.[96] The recent media attention of the Google Lunar X Prize can be added to this list of announcements. Unlike the majority of the private competitions prohibiting government-funded enterprises from entering, the Google Lunar Prize requires competitors to be at least ninety percent privately funded. By December 31, 2010, participants must land an autonomous robot on the Moon's surface, which must travel 500 metres over the lunar surface, and capture and send images back to Earth in order to win the maximum prize of U.S. $30 million.[97]

The recent plethora of private competitions with monetary prizes of great sums displaces a long held view which would have been reasonably entertained during the Space Age. Such opinion was expressed by Jenks in 1956, as aforementioned.[98] He dismissed the possibility of space exploration and exploitation by private entities under the assumptions that, *inter alia*,

---

[94] G. B. Leatherwood, *Weightless Wedding*, SPACE FUTURE, June 20, 2009, http://www.spacefuture.com/journal/journal.cgi?art=2009.06.23.weightless_wedding.

[95] Tariq Malik, *New $50 Million Prize for Private Orbiting Spacecraft,* SPACE.COM, Sept. 27, 2004, http://www.space.com/missionlaunches/bigelow_spaceprize_040927.html.

[96] Tariq Malik, *SpaceDev to Build Piloted Spaceship*, SPACE.COM, Sept. 20, 2004, http://www.space.com/businesstechnology/spacedev_dreamchaser_040920.html.

[97] *See* Google Lunar X Prize, *About the Google Lunar X Prize,* http://www.googlelunarxprize.org/lunar/about-the-prize (last visited Jan. 15, 2010). *See also*, Alan Boyle, *Google Funds $30 Million Moon Prize*. COSMIC LOG, Sept. 13, 2007, http://cosmiclog.msnbc.msn.com/archive/2007/09/13/358739.aspx; and Dave Mosher & Anthony Duigan-Cabrera, *Private race to the moon (and money) takes off*, MSNBC. COM, Feb. 22, 2008, http://www.msnbc.msn.com/id/23278871/.

[98] *See supra* note 27 and accompanying text.

"[the] scale of the capital investment involved, the considerable area necessary for a launching station [and] the degree of preparation required" would be such as to deter those bodies from undertaking private space activities.[99] Eight wealthy individuals becoming space tourists reveals that privately paying civilians are willing to spend their savings to fly to outer space. Poll results show, nineteen percent of affluent Americans, that is to say, those with annual salaries of U.S. $250,000 or greater, would pay four years worth of salary to experience a suborbital flight for 15 minutes.[100] For a two-week stay on the ISS, that same poll claims that seven percent of participants would pay twenty million dollars; that figure would rise to sixteen percent if the total cost was reduced by five million dollars.[101] According to the Futron Corporation's survey in 2002, "sixteen percent of respondents immediately accepted the maximum ticket price of U.S.$250,000 to travel on a suborbital flight."[102] Fifty percent of respondents, however, would be willingly to pay for one ticket for a suborbital flight if the price was in the range of U.S. $25,000 to U.S. $250,000.[103] With regards to a two-week visit to the *ISS*, the study reveals that six percent of respondents expressed a willingness to pay the maximum price of U.S. $25 million for the orbital flight. If that maximum price was reduced by U.S. $5 million, one respondent was prepared to privately pay for the ticket. A more significant number of respondents, 30 per cent in total, were willing to pay for a two-week visit to the orbiting space station if the price was in the range of U.S. $1 to $10 million.[104] Although the study was carried out in the nascent development of commercial space travel, it demonstrates that

---

[99] Jenks, *supra* note 26, at 104. Owing to the successful launch of a privately owned communications satellite by Telstar and the enactment of the US Communications Satellites Act of 1962, Jenks later acknowledged the movement of private enterprises entering the space frontier for commercial purposes. *See* WILFRED JENKS, SPACE LAW 87-92 (Stevens and Sons Ltd, London, 1965).

[100] Freeland, *supra* note 78, at 2.

[101] *Id*.

[102] FUTRON CORPORATION, SPACE TOURISM MARKET STUDY: SUBORBITAL SPACE TRAVEL, at 13 (Futron Corporation, Bethesda MD, 2002), *available at* http://www.futron.com/pdf/resource_center/white_papers/STMS_Suborbital.pdf.

[103] *Id.* at 14.

[104] *Id*. at 20.

there is an existing consumer demand. It is commercial space travel providers like Virgin Galactic that support the view that the "private industry has demonstrated the ability to meet consumer demand to travel into space."[105] Recognition that space services must be affordable in order to satisfy the demand from the public is implied from the number of recent private competitions made. The novel term in the Google Lunar Prize, for example, declares that the maximum prize of U.S. $30 million reduces on a declining scale if the mission's objectives are completed after December 30, 2010, spurs competition and technological innovation to provide safer, more reliable and cheaper space technology.[106] The eight space pioneers and private competitions have, therefore, been a catalyst to lay an infrastructure to economically sustain the commercial space sector in the United States.

B. Political and Legislative Support

Following the successful flight of *SpaceShipOne*, inadequacies within international space law to deal with the novel development of outer space being used for commercial purposes became apparent. Both Lee and Freeland in their respective works take this view, also. Lee argues that:

> Even before the end of the Cold War, however, many scholars and commentators began to realise that the legal framework for international space law was incapable of dealing with the commercial development of outer space. The framers of the treaties in the 1960s had not envisaged that artificial satellites would orbit the world before the end of the century and deliver many services that people now take for granted. These activities, such as remote sensing, weather prediction, direct television broadcasting, telecommunications, global positioning systems and human settlement on permanent space stations have

---

[105] Bromberg, *supra* note 1, at 662.

[106] *See About the Google Lunar X Prize, supra* note 107; *see also Google co-founder aims for space*,.MSNBC.COM, June 11, 2008, http://www.msnbc.msn.com/id/25097156/ns/technology_and_science-space/.

> torn apart the thin fabric of the existing space law framework in several ways.[107]

Freeland provides that, "[i]t is clear from the terms of these treaties that, at the time they were finalised, it had not been anticipated that humankind would engage in commercial space tourism activities and, as a result, they do not deal in any specific manner with such activities."[108] The existing international law on outer space does not have the agility to adapt to modern commercial requirements in the private space sector.

There have been calls for a review on the law to promote the development of the private space industry. Lee provides that, "[d]eveloping a new international framework of space law that provides legal clarity, commercial stability and technological adaptability is a vital and necessary step before our next giant leap in space."[109]

Such calls for legal reform to accommodate the commercialised space travel market have been actively responded to by the United States politicians. The commercialisation of space has been advanced by a number of bills laid before Congress. The Invest in Space Now Act of 2003 is one such example, which was introduced by Congressmen Ken Calvert (R-CA) and Solomon Ortiz (D-TX).[110] This bill proposes to grant tax credits to qualifying commercial space transportation companies to invest in de-

---

[107] Ricky Lee, *Reconciling International Space Law with the Commercial Realities of the Twenty-First Century*, 4 SINGAPORE J. INT'L & COMP. L. 194, 195 (2000). Lee then explores the ways in which the existing regime is inflexible. The international framework for space law consists of five multilateral treaties as developed by the United Nations. These are: (1) the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, *opened for signature* Jan. 27, 1967, 18 U.S.T. 2410, 610 U.N.T.S. 205; (2) the Convention on International Liability for Damage Caused by Space Objects, *opened for signature* Mar. 29 1972, 24 U.S.T. 2389, 961 U.N.T.S. 187; (3) the Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space, *opened for signature* Apr. 22, 1968, 19 U.S.T. 7570, 672 U.N.T.S. 119; (4) the Convention on Registration of Objects Launched into Outer Space, *opened for signature* Jan. 14, 1975, 28 U.S.T. 695, 1023 U.N.T.S. 15; and (5) the Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, *opened for signature* Dec. 18, 1979, 1363 U.N.T.S. 21. Lee, *supra* note 107, at 196-99.

[108] Freeland, *supra* note 78, at 4 – 5.

[109] Lee, *supra* note 107, at 196.

[110] Invest in Space Now Act of 2003, H.R. 2358, 108th Cong. (2003).

signing cost effective commercial space launch vehicles and reusable launch vehicles (RLV). Congressman Calvert takes the view that "[l]etting tax credits go through a company to their investors gives investors additional incentives to invest in broadening the commercial space industry."[111] Congressman Dana Rohrabacher (R-California) introduced it the Zero-Gravity, Zero-Tax Act in 2000,[112] and reintroduced in 2001,[113] 2003,[114] 2005,[115] and 2008.[116] This bill purports that the gross income from qualifying space-related activities be exempted from taxation. Congressman Rohrabacher claims that this bill would promote the commercialisation of space. He argues that "[b]y having no tax associated with revenues generated from a space industry over a 25-year period, that would certainly help increase market activity in low Earth orbit."[117] Rohrabacher, in addition, introduced the Aeronautics and Space Prize Act before the House of Representatives.[118] This bill creates "a National Endowment to advance private sector development of aeronautics and space technologies by way of the National Advanced Space and Aeronautical Technologies Prize Award Program."[119] The purpose of the bill, *inter alia*, is:

> to execute a program awarding cash prizes in recognition of outstanding private sector achievements in basic, advanced, and applied research, technology development, and prototype demonstration that have the potential for application to the Nation's aeronautics and space endeavors within . . . [NASA]

---

[111] Representative Calvert, *Calvert and Ortiz Introduce "Invest in Space Now" Act*, SPACEREF.COM, June 5, 2003, http://www.spaceref.com/news/viewpr.html?pid=5189. *See also* Catherine E. Parsons, *Space Tourism: Regulating Passage to the Happiest Place off Earth*, 9 CHAP. L. REV. 493-526 (2006).

[112] Zero-Gravity, Zero-Tax Act of 2000, H.R. 3898, 106th Cong. (2nd Sess. 2000).

[113] Zero-Gravity, Zero-Tax Act of 2001, H.R. 2504, 107th Cong. (1st Sess. 2001).

[114] Zero-Gravity, Zero-Tax Act of 2003, H.R. 914, 108th Cong. (1st Sess. 2003).

[115] Zero-Gravity, Zero-Tax Act of 2005, H.R. 1024, 109th Cong. (1st Sess.2005).

[116] Zero-Gravity, Zero-Tax Act of 2008, H.R. 5310, 110th Cong. (2nd Sess. 2008).

[117] Leonard David, *Space: No Air. No Gravity. No Taxes?*, SPACE.COM, Mar. 11, 2000, http://www.space.com/businesstechnology/business/tax_free_space_000310.html.

[118] Aeronautics and Space Prize Act, H.R. 4916, 110th Cong. (1st Sess. 2007).

[119] *Id.* at preamble.

> and other governmental agencies as well as private entities in the United States.[120]

A total sum of U.S. $150 million in cash prizes may be granted in a single fiscal year, from the endowment, to qualifying commercial space operators.[121] Unless approval has been granted, no competition prize can be more than U.S. $50,000.[122] Although they have not been enacted by Congress, these bills are welcome signs demonstrating policy makers' efforts to make the United States the international leader in commercial related space services.[123] By providing financial incentives from the outset of the New Space Age, the United States has removed an obstacle for private enterprises which are developing cost effective space vehicles but lack the financial resources. Such space actors are encouraged to make prudent investment choices and become innovative to develop more reliable and cheaper space technology so that access to space for civilians is affordable, and so ensure the economic viability of the commercialised space frontier.

Deregulating the plethora of legislation governing commercial human space flights into a single, codified act has contributed to the movement and growth of the private space sector. Prior to 2004, the legal regime on such space flights was regulated on a piecemeal and *ad hoc* basis.[124] It has been argued that the regulatory framework, where space related activities were carried out by private actors and without the assistance of NASA, proved incapable of stimulating the development of the commercial space industry.[125] The Federal Aviation Act of 1958[126] was enacted to address the concern of the risk of collisions caused by jet technology.[127] In addition to creating the Federal Aviation Administration (FAA), the act was "to provide for the

---

[120] *Id.* § 2(b)(1).
[121] *Id.* § 3(d)(1).
[122] *Id.* § 3(d)(2).
[123] *Per* Representative Dona Rohrabacher (R-California), *cited by* David, *supra* note 117.
[124] *Commercialisation of Space Commercial Space Launch Amendments Act of 2004, supra* note 42, at 625 – 628.
[125] *Id*. at 635.
[126] Federal Aviation Act of 1958, Pub. L. 85-726, 72 Stat. 731 (1958).
[127] Bromberg, *supra* note 1, at 648.

regulation and promotion of civil aviation in such manner as to best foster its development and safety, and to provide for the safe and efficient use of the airspace by both civil and military aircraft, and for other purposes."[128] This act stifled the growth of the space frontier for commercial operators. It was designed to nurture the civil aviation industry by granting broad legislative powers to the FAA to implement safety regulations in a manner so as to not impede technological innovation. Further, the 1958 act refused to recognise that space endeavours like commercial space flights would be performed by private enterprises.[129]

Over-regulation resulted in a range of difficulties for private undertakings to carry out their space endeavours. The requirement for multiple licences from a number of federal agencies in order to be granted approval to launch a space vehicle, proved costly and time consuming. For example, in 1982, Space Services Inc. experienced confusion in obtaining a licence permitting the launch of *Conestoga I*, the first privately funded rocket booster for a suborbital flight test. Licensing approval had to be granted from five different federal agencies and took six months and cost U.S. $250,000 in legal fees.[130] After this incident, leadership from President Reagan led to substantial regulatory changes to help foster the emerging private space transportation market.[131] In 1984, the Office of Commercial Space Transportation (OCST) was created within the Department of Transportation (DOT) which was provided with some regulatory control over space activities.[132] This body regulated the launch of private rockets. In 1995, the OCST merged with the FAA under the new name of the Office of the Association Administrators for Commercial Space Transportation (FAA-AST). Following the passage of the Commercial Space Act of 1998, the FAA was granted definitive authority to oversee space

---

[128] Federal Aviation Act of 1958, *supra* note 126, at preamble.

[129] *Commercialisation of Space Commercial Space Launch Amendments Act of 2004, supra* note 42, at 625 and footnote 44.

[130] *Id*. at 625 and *supra* note 44.

[131] Bromberg, *supra* note 2, at 650.

[132] Commercial Space Launch Act of 1984, *supra* note 67. *See also*, *Commercialisation of Space Commercial Space Launch Amendments Act of 2004, supra* note 42, at 625 and *supra* note 44; *see supra* note 61, at p. 625 and *supra* note 44.

launches and landings. This act further lifted regulatory barriers on commercial entities. This included the ban prohibiting private operators from returning humans, payloads, and reentry vehicles to Earth and government pay loads on private rockets.[133]

The old legal framework was outdated by innovative space technology and so proved to be an obstacle to its development.[134] The impediment to technological development was aggravated by the requirement of the commercial operator to seek multiple licences and permits from different government bodies to authorise the launch of space vehicles, as the *Conestoga I* incident demonstrates.[135] Although the Commercial Space Act (CSA) vested legislative authority with the FAA to grant licences and permits to authorise the launch, it was the space vehicle's design that determined whether the FAA or FAA-AST had regulatory authority and to whom the private undertaking should apply.[136] The progress and use of RLVs by commercial space transportation providers of human space flights caused legal uncertainty. This is explained by Hughes and Rosenberg:

> Until very recently, only expendable launch vehicles (ELVs) and certain types of ballistic missiles were available for private sector use. As such, the principal law governing the licensing and regulation of commercial transportation vehicles, [the CSLA], originally focused on ELVs. As [RLV] development progressed, Congress amended the law to address liability and government indemnification concerns and to address licensing authority for RLVs. How RLVs designed for human carriage were a statutory aforethought, and there was no express statutory declaration of regulatory jurisdiction, nor any instruction from the Congress regarding the licensing and safety regulation of human flight.[137]

---

[133] Bromberg, *supra* note 1, at 650.

[134] Timothy Robert Hughes & Esta Rosenberg, *Space Travel Law (and Politics): The Evolution of the Commercial Space Launch Amendment of Act of 2004*, 31 J. SPACE L. 1, 6-11 (2005).

[135] Bromberg, *supra* note 1, at 651.

[136] *Id*.

[137] Hughes & Rosenberg, *supra* note 134, at 3 – 4.

An RLV can be said to have two characteristics. It takes off and lands as an aircraft using hypersonic technology, and it is attached to a rocket booster to attain orbit.[138] The initial lift off and return of the RLV would fall under the authority of the FAA to regulate; the use of the rocket booster to achieve orbit would lie with the FAA-AST.[139] Bromberg takes the view that, "[t]he multiple licenses required by this regulatory structure restricted entry into the market by private RLV manufacturers. While an improvement over existing legislation, the CSA failed to lower entry barriers and to engage private enterprise to the level necessary for the creation of a sustainable space market."[140]

Congress enacted the Commercial Space Launch Amendments Act of 2004 (CSLAA) to accommodate the commercial space travel market and nurture its growth.[141] Bromberg claims that, "[t]he CSLAA is the most significant piece of domestic space law, and its passage shows, for the first time, assertive steps by the government to promote public space travel."[142] This act has several purposes in order "to encourage the development of the emerging commercial space flight industry."[143] These purposes are codified under sections 70101(10) – (15), Title 49 of the United States Code. That is to say, to define human spaceflight as a commercial activity;[144] to streamline the regulatory procedure on commercial operations; to amend the legal rules to balance the safety of passengers and technological development as the private industry grows; and to reduce liability requirements on commercial providers.[145]

---

[138] Associate Administrator for Commercial Space Transportation, *Reusable Launch Vehicle Programs and Concepts* (Jan. 1998), http://www.faa.gov/library/reports/commercial_space/dev_concepts/media/98rlv.pdf.

[139] Bromberg, *supra* note 1, at 651.

[140] *Id.*

[141] Commercial Space Launch of Amendments Act of 2004, Pub. L. 108-492, 118 Stat. 3974 (2004). This Act is codified in 49 U.S.C.A. § 70101.

[142] Bromberg, *supra* note 1, at 659.

[143] Commercial Space Launch of Amendments Act of 2004, *supra* note 141, at preamble.

[144] Bromberg, *supra* note 1, at 659.

[145] *Id.*

The CSLAA provides a definition of human space flight.[146] Legislative recognition of commercial space flight at its infancy is necessary for its development. It reveals that human space flights are a unique market in the space sector requiring a clear and balanced regulatory regime to monitor its activities and facilitate its growth. Such legislative recognition, in addition, places private human space flight on an equal footing with established commercial space services like telecommunications satellites, and indicates that these flights contribute to the growth of the United States' economy.[147] This act also defines key terms to remedy ambiguities created under the then regulatory structure. Types of launch vehicles are defined therein. Section 70102(19), Title 49 of the United States Code, defines "suborbital rocket," for example, as "a vehicle, rocket-propelled in whole or in part, intended for flight on a suborbital trajectory, and the thrust of which is greater than its lift for the majority of the rocket-powered portion of its ascent."[148] Clarity as to the meanings of these terms indicates that the FAA has legislative authority to regulate all commercial space flights which would minimise cost and time delays for private actors seeking licences and permits granting the launch of its space vehicles.

Bromberg claims that "the most significant change from the enactment of the CSLAA is the "single license or permit" provision."[149] As illustrated from the incident of the *Conestoga I*, the requirement of multiple licences and permits could be a costly and time consuming process. This could have limited the development of the private sector, discouraged investments and hindered competition in the industry. Section 70104(d), Title 49 of the United States Code, says that only one licence or permit is required "to conduct activities involving crew or space flight participants, including launch and reentry, for which a license or permit …."[150] In addition to a single permit requirement to launch a space vehicle or for its reentry, there is a new type of

---

[146] *Id.*
[147] *Id*. at 627.
[148] 49 U.S.C. § 70102(19).
[149] Bromberg, *supra* note 1, at 660.
[150] 49 U.S.C. § 70104(d).

permit called the "experimental permit." This type of permit may only be granted for reusable suborbital rockets for specified purposes. That is to say, for the "research and development to test new design concepts, new equipment, or new operating techniques";[151] or for "crew training prior obtaining a licence for a launch or reentry using the design of the rocket."[152] Bromberg concludes that, "[t]hese provisions allow new low-cost suborbital providers to spend their money and time on building spacecraft and not on the regulation and licensing processes."[153]

The act has another objective: to improve safety regulations to minimise inherent risks associated with human space flight while promoting technological innovation for safer and reliable space vehicles. The relevant provision states, "the regulatory standards governing human space flight must evolve as the industry matures so that regulations neither stifle technology development nor expose crew or space flight participants to avoidable risks as the public comes to expect greater safety for crew and space flight participants from the industry."[154] It is suggested that there are two methods that achieve this objective. The first method is that the Secretary of Transportation has legislative authority to issue regulations "governing the design or operation of a launch vehicle to protect the health and safety of crew and space flight participants."[155] The regulations issued, however, are "limited to restrict . . . or prohibit . . . design features or operating practices that have resulted in a serious or fatal injury to crew or space participants during a licensed or permitted commercial human space flight;"[156] or "contributed to an unplanned event or series of events during a licensed or permitted commercial human space flight that posed a high risk of causing a serious or fatal injury as to crew or space flight participants."[157] This implies that the Secretary has the continuous duty to issue appropriate safety measures as he or she sees fit

---

[151] *Id.* § 70105a(d)(1).
[152] *Id.* § 70105a(d)(3).
[153] Bromberg, *supra* note 1, at 660.
[154] 49 U.S.C.A. § 70101(a)(15).
[155] *Id.* § 70105(c)(1).
[156] *Id.* § 70105(2)(C)(i).
[157] *Id.* § 70105(c)(2)(C)(ii).

in order to accommodate quick developments of space transportation technology without inhibiting the design features or operating practices of the spacecraft. The requirement for the licensed private human space flight provider to obtain liability insurance is the second method,[158] which also includes the reciprocal waiver of claims.[159] In other words, the crew and space flight participants and commercial provider agree to waive liability claims and be responsible for the damage, losses, and injuries suffered to persons or property which arise from the licensed or permitted activity. A commentator argues that the liability insurance scheme "represent[s] an economic benefit, helping to protect the commercial human space flight industry from high insurance costs due to the risk of even a single catastrophic incident."[160]

That writer concludes that:

> The CSLAA may very well represent the first significant step in a shift of American space policy toward nurturing and supporting commercial efforts beyond Earth's atmosphere. This shift will herald the beginning of a new era in which mankind finally may realize the enormous potential for value creation in space.[161]

C. The Creation of a Single Regulatory Authority – the FAA

A single regulatory body over the private industry has materially assisted the growth of that sector and spurred technological development. As aforementioned, the FAA has legislative powers to grant a single licence to allow private undertakings to offer flights to space tourists.[162] Under its licensing powers, the FAA has granted 196 launch licences over the last 20 years.[163]

---

[158] *Id.* § 70112(a)(1).
[159] *Id.* § 70112(b)(1).
[160] *Commercialisation of Space Commercial Space Launch amendments Act of 2004*, *supra* note 42, at 629.
[161] *Id*. at 631.
[162] 49 U.S.C.A. § 70104(d).
[163] N. Spall, *Space Tourism Goes Global*, 51(9) SPACEFLIGHT 328 (2009).

Regulatory powers, moreover, are vested with the FAA to grant a licence for the creation of federal and non-federal "spaceports."[164] In other words, sites enabling the launch and/or reentry of space vehicles providing private human space flights. The FAA holding this power, it is suggested, has facilitated the growth of the commercial space flights and enabled markets by laying down a space transportation network to private actors to offer such services at safe and approved sites. Presently, there are eleven spaceports in different States: five of which are federal launch and reentry sites; the remainder are non-federal.[165] Since 1996, this body has licensed seven non-federal launch sites.[166] These are: Blue Origin Launch site, California Spaceport, Kodiak Launch Complex, Mid-Atlantic Regional Spaceport, Mojave Air and Spaceport, Oklahoma Spaceport, and Spaceport America.[167] The California Spaceport was the first commercial spaceport to be licensed on September 19, 1996.[168] According to the FAA, there are several states aspiring to develop spaceports offering a variety of launch and landing sites.[169] Spaceport America, located in New Mexico, is a recent example of a launch and reentry site being specifically built for the use of human space flights by private undertakings. The New Mexico Spaceport was built to facilitate the operation of Virgin Galactic to offer the first suborbital space flight to paying passengers in 2011 or 2012.[170] This regulatory authority claims that "[t]he U.S. now has a string of approved space-launch sites across the country and seems well-placed to harness the space tourism market."[171]

---

[164] 49 U.S.C.A. § 70105(a).

[165] Federal Aviation Administration, *2009 U.S. Commercial Space Transportation Developments and Concepts; Vehicles, Technologies, and Spaceports*, 59 – 72 (Jan. 2009), http://www.faa.gov/about/office_org/headquarters_offices/ast/media/Developments%20and%20Concepts%20January%202009.pdf.

[166] *Id*. at 60.

[167] *Id*. at 60 – 65.

[168] *Id.*

[169] *Id*. at 72 – 78.

[170] *Virgin boss unveils Space trips, supra* note 88.

[171] Spall, *supra,* note 174.

D. The Augustine Committee

The Augustine Committee unequivocally held that future United States human space flights and the intended vision of space exploration to expand human presence into the solar system can be sustained by engaging the services of commercial enterprises. This Committee was launched by the Obama Administration to independently review the United States human space flight plans and recommend safe, innovative, and affordable alternatives to sustain the country's national space policy.[172] It found that once the United States space shuttle has retired at the end of the fiscal year 2010, "there will be a gap in America's capability to launch humans into space."[173] That gap could extend until safe and reliable human launching space vehicles have been developed. Owing to the delayed and underfunded *Constellation* programme, which was created by the then President George W. Bush with the aim of expanding human presence into the solar system and returning astronauts to the Moon by 2020, the Committee claims that the gap would be at least seven years.[174] If current plans are unchanged, the United States will be dependent on the Russian *Soyuz* and be required to purchase seats at a cost of at least U.S.$51 million per person in order to transport American astronauts to and from the *ISS*.[175] The Commercial Spaceflight Federation argues that reliance on the Russian's human launch space vehicles to transport Americans to space would displace the country's international lead in human space flights and explorations, including the United States' ability to carry out effective scientific research because of limited crew members onboard the *ISS*.[176] It takes the view that:

---

[172] Augustine Committee, *supra* note 11, at 2 and note 44.

[173] Augustine Committee, *supra* note 11, at 3.

[174] *Id*. at 3 – 5.

[175] Press Release, Commercial Spaceflight Federation. Commercial Spaceflight Federation, Next Step in Space Coalition Welcomes White House Committee's Support for Commercial Human Spaceflight (Sept. 9, 2009). SPACEREF.COM, http://www.spaceref.com/news/viewpr.html?pid=29136.

[176] Commercial Spaceflight Federation, *Commercial spaceflight in Low Earth Orbit is the Key to Affordable and Sustainable Exploration Beyond: Input to the Review of U.S. Human Space Flights Plans Committee* (June 29, 2009), at 2, http://www.

> In addition, Russian per-seat costs have continued to increase in recent years, increasing the amount of U.S. government funds spent overseas instead of here at home. Without domestic competitive pressure, the United States is vulnerable not only to further increases in Russian prices, but deterioration in the U.S.-Russia bilateral relationship. Finally, relying on a single-string capability exposes the $100 billion investment in the Station to the risk of a single Russian technical failure.[177]

The Augustine Committee suggested that the launch of astronauts to gain access to low Earth orbit should be carried out by private actors as opposed to government entities. It claimed that this "creates the possibility of lower operating costs for the system and potentially accelerates the availability of the U.S. access to low-Earth orbit about a year to 2016."[178] It is suggested that this recommendation, if implemented, could open a new market with the commercial space sector to transport astronauts, supplies, fuel and other cargo to the *ISS*. The offering of guaranteed contracts to outsource the work from NASA to operators in the commercial space transportation market, as recommended further by the Committee, has "the potential to stimulate a vigorous competitive commercial space industry."[179] NASA, too, would benefit from outsourcing work to the private sector. It would reduce costs and so enable NASA to use its allocated, limited budget economically by designing reliable and safer space technology and concentrating its efforts on missions beyond low Earth orbit.[180] As aforementioned, NASA has demonstrated its willingness to invest in the competitive commercial space industry in order to save resources and create a new market to transport supplies to the *ISS*. On August 18, 2006, NASA used its legislative powers under the Space Act to form Space Act Agreements worth U.S. $3.5 billion with two private enterprises to provide commercial transportation services to the *ISS* in place of the retiring *Space Shuttle*. Under these unprece-

---

commercialspaceflight.org/pressreleases/Commercial%20Spaceflight%20Augustine%20White%20Paper%20-%206-29-09.pdf.

[177] *Id.*

[178] Augustine Committee, *supra* note 11, at 7.

[179] *Id.*

[180] *Id.*

dented Space Act Agreements, SpaceX and Rocketplane-Kistler are to use the contractual sums to facilitate the design and demonstration of reliable and cost effective space vehicles to transport crew to the *ISS*.[181]

The Augustine Committee's recommendations could open competition between new and existing undertakings to offer commercial space services to the United States government and other space users, and accelerate the growth of that new market. Therefore, this would boost the United States economy, create additional, as well as support existing, job opportunities, and prevent taxpayers' money from being spent overseas.[182]

VI. CONCLUSION

The United States commercial space sector is developed, successful, and economically sustainable. The country continues to reap the benefits brought by that highly competitive industry. This includes safe, reliable, and cheaper space technology; new markets within the sector being created; and enhanced the United States' international leadership in space activities and its capabilities in human space flights. The United States economy has experienced upward growth and the private sector has created new, as well as supported existing, job opportunities. The accelerated development of the United States' space commerce from its inception in 1962 to the present day, can be attributed to six galvanising factors. The International Geophysical Year was a landmark victory for scientists within the international community during which the possibility of entering outer space was realised. During the Space Age, the exploration and exploitation of space was limited to the State owing to, *inter alia*, the scale of financial resources and the technical as well as technological means involved. Such factors did not prevent private enterprises from using space for commercial endeavours, however. NASA opened the space sector to new commercial actors by facilitating the launch of space vehicles, and so eliminating technical barriers which might have otherwise denied access

---

[181] *NASA commercial orbital transportation services*, *supra* note 52.
[182] David, *supra* note 117.

to space. Participation in financial incentive programmes and the statutory power vested in NASA to enter into Space Act Agreements reduced the financial disparity between smaller businesses and industrial leaders. Smaller businesses now have an equitable and proportionate opportunity to be granted the financial incentives from the programmes and the Space Act Agreements. This has stimulated a vigorous, competitive commercial space sector and spurred technological innovation. Private competitions and wealthy space tourists set the era of the New Space Age and marked the transition of the primary actors of space from the State to commercial entities. Such competitions recognised the demand to provide the public with space services at affordable costs. They acted as platforms for new actors to enter the space industry, encouraged competition and technological development, and so contributed to the maturity of the infant United States private space sector. Like presidential leadership, political and legislative support have nurtured established markets - for instance, space telecommunications - and acted as a catalyst to create new ones, such as commercial space transportation. The creation of the FAA with definitive authority to regulate all commercial human space flights has facilitated the recent emergence of that market and its subsequent growth. Legislative support, particularly the enactment of the CSLAA, and statutory powers vested in the FAA have generated legal and regulatory certainty for the commercial transportation market, which has encouraged investments made by the United States government and other space users.

HIGH HOPES AND LOW ESTIMATES: NEW SPACE'S ROCKY CONTRACTUAL ROAD

Marielle Elisabet Dirkx[*]

INTRODUCTION

In the 1960s, at the height of the space race, Pan Am created a waiting list for people wishing to travel to the moon.[1] There was so much public interest that 80,000 people joined the list.[2] However, because a successful space program costs billions of dollars to develop and operate, space transportation activities remained within the government sector.[3] Then, in February 2010, President Obama announced a new space policy, taking an unprecedented shift away from using National Aeronautics and Space Administration (NASA) vehicles for spaceflight and towards relying primarily on commercial low-Earth orbit (LEO) space transportation systems.[4] Half a century after Pan Am's waiting list, there is a groundswell in the American private sector expecting to deliver space tourism activities, crew transpor-

---

[*] J.D. Candidate, May 2011, University of Mississippi School of Law; B.A., 2008, Union University; B.S., 2008, Union University.

[1] *Commercial Space Flight: A Real Starship Called Enterprise*, THE ECONOMIST, Dec. 12, 2009, at 67. Pan Am was an American airline. *Id*.

[2] *Id*.

[3] W.J. Hennigan, *Space Vacation Anyone? As NASA's Shuttle Program Winds Down, Private Companies Race to Fill the Void*, LA TIMES, Jan. 31, 2010, at 1.

[4] *See generally* Joint Statement, Launching a New Era in Space Exploration, Feb. 1, 2010, *available at* http://www.nasa.gov/pdf/421063main_Joint_Statement-2-1.pdf [hereinafter Joint Statement]. The retirement of the space shuttle program is very likely to provide a similar push toward the privatization of the space industry that the U.S. Postal service did for the aerospace industry. Mike Schneider, *High Finance: Space Luring Private Sector NASA Plans to Outsource Next Shuttles*, FT. WAYNE JOURNAL GAZETTE, June 26, 2006, at 8D. The Postal Service started flying mail in 1918. *Id*. In 1927, the Postal Service turned over its routes to private companies. *Id*. Walter Folger Brown, President Hoover's Postmaster General, started a policy of providing bonuses to companies that would offer seats to passengers in addition to transporting the mail. *Id*. Consequently, the amount of commercial air traffic increased from 6,000 passengers in the late 1920's to 450,000 passengers in 1934. *Id*.

tation, and cargo transit at a fraction of the price of NASA: the new space industry.[5]

One of the most visible and thus far successful ventures in the new space industry is space tourism.[6] In the past, Russia monopolized the business of transporting private citizens into outer space, charging a hefty $35 million for a seat aboard its Soyuz spacecraft.[7] However, entrepreneurs believe that recent technological advances will make rocketry and space tourism more affordable.[8] Beginning in 1996, the X-Prize Foundation announced that the first team to build and launch a spacecraft capable of carrying three passengers 100 kilometers above the earth's surface, twice in the period of two weeks, would win the $10 million Ansari X Prize.[9] On October 4, 2004 Scaled Composites' *SpaceShipOne*, designed by Burt Rutan and financed by Paul Allen, claimed the Ansari X-Prize after the ship's second voyage.[10] *SpaceShipOne*'s successful flight proved that commercial spaceflight did not have to rely solely on the Russian government and subsequently initiated $1.5 billion of public and private financial support for this new space industry.[11]

On the heels of his success of the Ansari X Prize, Scaled Composites' founder Burt Rutan, partnered with Virgin Galactic's owner, Sir Richard Branson, to form the Spaceship Com-

---

[5] John Swartz, *With U.S. Help, Private Companies Press Their Case: Why Not Us?* N.Y. TIMES, Dec. 30, 2008, at D4.

[6] Sam Howe Verhovek, *In 2010, The Civilian Space Industry Finally Takes Off*, POPULAR SCIENCE, Dec. 6, 2009, *available at* http://www.popsci.com/technology/article/2009-12/space-inc.

[7] *Id*.

[8] Hennigan, *supra* note 3.

[9] X-Prize Foundation, *Ansari X Prize*, http://space.xprize.org/ansari-x-prize (last visited Mar. 15, 2010). The Ansari family and the X-Prize Foundation modeled the Ansari X Prize on the Orteig Prize, won by Charles Lindberg in 1927 for flying non-stop from New York to Paris. *Id*.

[10] *Id*.; Press Release, Scaled Composites, SpaceShipOne Flies Again Within 14 Days – Wins $10 Million X-Prize (Oct. 4, 2004), http://www.scaled.com/news/spaceshipone_flies_again_within_14_days_-_wins_10m_x_prize. Twenty-six teams from seven different countries entered into the competition for the X Prize. X-Prize Foundation, *supra* note 9. The twenty-six teams combined spent more than $100 million to win the prize. *Id*.

[11] *Id*.

pany.[12] The jointly owned company, whose purpose is to manufacture spaceships and launch equipment, created the Virgin Space Ship (VSS) Enterprise, the first commercial manned spaceship.[13] Virgin Galactic expects the VSS Enterprise to send up to six commercial passengers at a time into space as early as 2011.[14] Virgin Galactic, which has become the preeminent suborbital space tourism company, is charging $200,000 per voyage into space.[15] While a spacecraft that can carry commercial passengers is an enormous innovation in the new space industry, the VSS Enterprise is only capable of suborbital not orbital flight.[16]

With the retirement of the *Space Shuttle* program, the tasks of ferrying cargo and scientific experiments to and from the international space station, hoisting and repairing satellites, and cleaning up the increasing amount of orbiting "space junk," are going to shift to the private sector.[17] Because these tasks are so important to United States space program goals, NASA has rewarded contracts, potentially worth billions of dollars, to private companies to deliver cargo to the *International*

---

[12] Press Release, Virgin Galactic, The Spaceship Company (Jul. 7, 2007), http://www.virgingalactic.com/news/item/the-spaceship-company/.

[13] *Id.*; Press Release, Scaled Composites, Virgin Galactic Unveils SpaceShipTwo, the World's First Commercial Manned Spaceship (Dec. 7, 2009), http://www.scaled.com/images/uploads/news/VGPressRelease12-07-09.pdf [hereinafter Virgin Galactic Unveils SpaceShipTwo]. The VSS Enterprise had the working title of *SpaceShipTwo*. *Id.* The VSS Enterprise's mothership is named *EVE*, after Richard Branson's mother. *Id.* The Company plans for *EVE* to carry the VSS Enterprise to above 50,000 feet before the spaceship is dropped and fires its rockets to launch into space. *Id.*

[14] Virgin Galactic Unveils SpaceShipTwo, *supra* note 13; John Swartz, *supra* note 5.

[15] Dan Barry, *A New Exit to Space Readies for Business*, N.Y. TIMES, Feb. 22, 2010, at A10.

[16] Swartz, *supra* note 5. There are also plans for orbital space tourism. Stuart McDill, Space Hotel Says It's on Schedule to Open in 2012, REUTERS, Nov. 2, 2009, at http://www.reuters.com/article/idUSTRE5A151N20091102. The Galactic Suite Space Resort is a Spain-based company planning to launch a pod-style space hotel in 2012. *Id.*; Pascale Harter, Fly *Me to the Moon: Space Hotel Sees 2012 Open*, REUTERS, Aug. 10, 2007, http://www.reuters.com/article/idUSL1089156420070810?loomia_ow=t0:s0:a49:g43:r1:c1.000000:b30317152:z0. Galactic Suite Ltd. wants to start with a single pod capable of holding four guests. McDill, *supra* note 16. The company plans to use Russian rockets launched from a spaceport in the Caribbean to reach the boutique hotel. *Id.* It will cost guests approximately $4.4 million for a three night stay. *Id.* Critics of the project proclaim that the time frame is unreasonable and question its financing. *Id.*

[17] Verhovek, *supra* note 6.

Space Station (*ISS*).[18] Meanwhile, without the shuttle, the U.S. is going to have to rely upon Russia for crew transportation to the *ISS*, until the American commercial space industry is capable of taking Russia's place.[19] For this reason, NASA intends to invest $6 billion over the next five years to help jumpstart the capability of private companies to supply crew transportation services to the *ISS*.[20] Although, the technology to fly to low-Earth orbit has existed for fifty years, not a single commercial firm has independently launched a manned spacecraft into orbit.[21]

The Obama Administration's shift in space policy and front page headlines garnered by space tourism have brought the new space industry to the public's attention. However, very little is known about the fledgling industry. This case study follows some of the legal problems of Rocketplane Kistler (RpK) in an attempt to draw attention to some of the potential pitfalls awaiting companies in the new space industry. In addition, this paper will highlight problems specific to the company and discuss the validity of privatizing LEO space transportation services.

Note that the cases examined in this paper are primarily related to legal claims under classical contract law.[22] While it is an interesting academic endeavor in its own right, a thorough discussion on the jurisprudence of American contract law would not reveal any novel issues to the new space industry. Moreover, the facts and allegations contained in the filings of the *Abercrombie & Kent Space v. Rocketplane Kistler, Inc.* case have yet, as of this writing, to be established in a court of law.

RpK is the quintessential example of a new space industry entity because it decided to pursue both suborbital space tour-

---

[18] *Id.*; Swartz, *supra* note 5.

[19] Verhovek, *supra* note 6; *see generally* Joint Statement, *supra* note 4, at 2.

[20] Clara Moscowitz, *No Moon Trips, Obama's Space Vision a 'Paradigm Shift'*, SPACE.COM, Jan. 28, 2010, *available at* http://www.space.com/news/obama-nasa-space-plan-reactions-100128.html.

[21] *Id.*

[22] *See generally*, Complaint, Abercrombie & Kent Space v. Rocketplane Kistler, Inc., (Aug. 27, 2007) (on file with author) [hereinafter Complaint]; Answer, Abercrombie & Kent Space v. Rocketplane Kistler, Inc., (Nov. 7, 2007) (on file with author) [hereinafter Answer].

ism and LEO cargo transport services simultaneously.[23] Therefore, this study begins with an examination of the historical development of the company in order to provide a context for the subsequent discussions of the legal issues.

This paper continues with an examination of the NASA Commercial Orbital Transportation Services (COTS) program pursued under the Bush Administration's space policy.[24] The objective of COTS was to form agreements with the private sector for LEO transport services, an early precursor to the Obama Administration's space policy.[25] Rocketplane Kistler was awarded one of the original two COTS Space Act Agreements (SAA) for their work on the *K-1*.[26] The terms of the Space Act Agreement formed between RpK and NASA are also discussed, as well as an analysis of Rocketplane Kistler's failure to meet milestones outlined in the agreement and the holdings of the subsequent GAO decision.

Next, the paper examines the filings of the current lawsuit against RpK for breach of contract concerning marketing and advertising services with Abercrombie & Kent Space. Finally, this paper provides an analysis of lessons to be learned from RpK and a discussion of the increased role of the private sector in the United States space program.

---

[23] *See generally* Press Release, Rocketplane Global Inc., Two Commercial Space Companies Join Forces (Mar. 7, 2006), *available at* http://www.rocketplane.com/press/20060307a.html. [hereinafter Companies Join Forces].

[24] Press Release, White House, President Bush Announces New Vision for Space Exploration Program (Jan. 14, 2004), *available at* http://history.nasa.gov/SEP%20Press%20Release.htm [hereinafter President Bush Announces New Vision for Space Exploration Program]; *see also* Tiphany Baker Dickerson, *Patent Rights Under Space Act Agreements and Procurement Contracts: A Comparison by the Examination of NASA's Commercial Orbital Transportation Services (COTS)*, 33 J. SPACE L. 341, 342 (2007).

[25] Press Release, NASA, NASA Invests in Private Sector Space Flight with Space-X, Rocketplane-Kistler (Aug. 19, 2006), *available at* http://www.nasa.gov/exploration/news/COTS_selection.html [hereinafter NASA Invests in Private Sector Space Flight].

[26] *Id*.

I. THE DEVELOPMENT OF ROCKETPLANE KISTLER

A. Rocketplane Ltd., Inc.

Rocketplane Ltd. Inc was a small company focused on the space tourism niche of the new space industry. Formed in 2001, this Oklahoma City based company was the successor company to Pioneer Rocketplane, Inc.[27] It opened its first office in 2004 with just three employees.[28] Rocketplane's business model focused on developing a suborbital spaceplane for commercial space tourism.[29] In return for bringing jobs and space tourism to Oklahoma, the State granted the company an $18 million tax credit and gave the company exclusive tenancy rights in the Oklahoma Spaceport in Burns Flat.[30]

The *Rocketplane XP*, Rocketplane's suborbital spaceplane that was in development, was being built from the fuselage of a Learjet 25 series.[31] Rocketplane expected the project to cost $30 million, in total.[32] The company projected that flights on the *XP* would last less than an hour from take-off, with three to four minutes of weightlessness.[33] Rocketplane anticipated its first commercial flight would commence in 2006, but it had to be pushed back to 2007, and then again to 2010.[34]

B. Kistler Aerospace

Whereas Rocketplane was focused on commercial space tourism, Kistler Aerospace was focused on orbital cargo trans-

---

[27] Companies Join Forces, *supra* note 23. As Pioneer Rocketplane, the company had been involved in an unsuccessful attempt to win the Ansari X Prize. Prize Foundation, *Pioneer Rocketplane*, *available at* http://space.xprize.org/ansari-x-prize/pioneer-rocket plane (last visited Mar. 10, 2010).

[28] Rocketplane Global, Inc., *About Rockeplane*, http://www.rocketplaneglobal.com/our_company.html (last visited Apr. 2, 2010).

[29] Companies Join Forces, *supra* note 23.

[30] Rusty Surette, *Aerospace Company Deserts Oklahoma Leaving Questions*, NEWS 9 *available at* http://www.news9.com/global/story.asp?s=10806368 (last visited Apr. 4, 2010).

[31] Leonard David, *Have Spaceplane Will Travel*, USA TODAY, Feb. 24, 2005.

[32] *Id*.

[33] Rocketplane Global, *Model XP Mission Profile*, http://www.rocketplaneglobal.com/mission_profile.html (last visited Apr. 21, 2010).

[34] David, *supra* note 31.

port. The Kirkland, Washington based company was developing the *K-1*,[35] a two-stage, reusable liquid fueled rocket.[36] Kistler expected the *K-1* to be capable of transporting payloads into orbit and carrying cargo to and from the *ISS*.[37] In fact, the C.E.O. of Kistler Aerospace, Dr. George Mueller, stated that Kistler's goal was to become the "UPS of space transportation."[38] Under Dr. Mueller's leadership, Kistler calculated that the *K-1* would cut LEO launch prices for consumers in half and would cost the company approximately $500 million to develop.[39]

Kistler's aspiration to develop a more affordable reusable launch vehicle did not go unnoticed by the business community. Kistler received backing from many major aerospace companies in the development of the *K-1*, including: Northrop Grumman, Lockheed Martin, GenCorp Aerojet, Honeywell, Draper Laboratory, Oceaneering, Irvin Aerospace, ATA Engineering, and RS&H.[40] Thus, the company was able to raise solid financing for its endeavors in excess of $600 million.[41]

However, while Kistler Aerospace was able to complete almost seventy-five percent of the *K-1*,[42] it was plagued with financial problems.[43] In 2003, Kistler Aerospace filed for Chapter

---

[35] Brandice L. Armstrong, *Rocketplane & Kistler Aerospace to Merge, Move Out of Oklahoma*, JOURNAL RECORD, Mar. 10, 2006.

[36] *Id*.

[37] Jim Banke, *Kistler Aerospace Files for Chapter 11 Bankruptcy Protection*, SPACE.COM, Jul. 23, 2003, http://www.space.com/news/kistler_bankurptcy_030723.html; Armstrong, *supra* note 35.

[38] James Wallace, *Kistler's Rocket Dreams Fade*, SEATTLE PI BLOGS, Oct. 3, 2007, http://blog.seattlepi.com/aerospace/archives/122981.asp (quoting Dr. George Mueller, the C.E.O. of Kistler Aerospace and former head of NASA's Apollo manned space program).

[39] *Id*. However, when the *K-1* project was under development at Kistler Aerospace in the late 1990's, many experts were skeptical of the company's budget projections. *Id*. John Pike, director of space policy for the Federation of American Scientists, addressed Kistler's attempt to develop a reusable rocket on such a paltry budget, "[w]hen you are talking spaceships, that's just rounding-off money. It's money lost in seat cushions. There are not enough zeros in their budget." *Id*. Critics pointed to a recent near-billion dollar contract received by Lockheed Martin to develop a reusable rocket prototype, which was not intended to reach orbit. *Id*

[40] *Kistler Aerospace Corp. K-1*, GLOBALSECURITY.ORG, http://www.globalsecurity.org/space/systems/kistler.htm [hereinafter *Kistler, K-1*].

[41] Ron L. Rains, *Rocketplane's Majority Owner Buys Kistler*, SPACE.COM, http://www.space.com/news/rocketplane_022606.html.

[42] *Kistler, K-1, supra* note 40.

[43] *Business Briefs*, SEATTLE TIMES, July, 31, 2003, at E1.

11 bankruptcy.[44] In the original court filing, the company asserted it had $6.3 million in assets and $603.9 million in secured and unsecured liabilities.[45] Kistler Aerospace also claimed it would need an additional $650 million in financing to complete the original *K-1*.[46] During Kistler's restructuring, NASA announced that it was interested in buying pre-/post-flight data from a series of *K-1* demonstrations.[47] On March 29, 2005, the Bankruptcy Court in Seattle, Washington entered an order confirming Kistler's Plan of Reorganization, indicating Kistler could start moving out of Chapter 11.[48]

C. Rocketplane Kistler

In February 2006, George French, the majority owner, President, and CEO of Rocketplane, purchased Kistler Aerospace for an undisclosed amount of money.[49] The two companies merged to form a single company, Rocketplane Kistler (RpK).[50] RpK continued to pursue development of the *Rocketplane XP* for space tourism, as well as the *K-1* for commercial transportation services of space cargo.[51] Accordingly, the company attempted to achieve financial success by combining both major activities in the new space industry, space tourism, and LEO cargo transportation.[52] In fact, RpK viewed its project diversity to be so unique that it did not consider itself to have any comparable competitors.[53]

---

[44] *Id*.

[45] *Id*. Some of the company's creditors included Saudi Arabian investors and various aerospace firms Kistler had collaborated with while building the K-1. Banke, *supra* note 37. Kistler owed Aerojet, a company that Kistler contracted with for Russian designed engines, $99 million. *Id*.

[46] *Business Briefs*, *supra* note 43.

[47] Brian Berger, *NASA Contract Could Jumpstart Rocket Start Up*, SPACE.COM, Feb. 3, 2004, http://www.space.com/news/kistler_nasa_040203.html.

[48] *Kistler, K-1, supra* note 40.

[49] Rains, *supra* note 41.

[50] Companies Join Forces, *supra* note 23.

[51] *Id*.

[52] *Id*.

[53] Rocketplane Kistler, RpK Business Plan – Executive Summary, 35 (2006), *available at* http://www.nasa.gov/centers/johnson/pdf/162330main_SPACE_ACT_AGREEMENT_FOR_COTS.pdf [hereinafter RpK Business Plan].

RpK did not consider itself a company that built launch systems.[54] Instead it distinguished itself as a "provider of space transportation services."[55] RpK viewed this as an important distinction because the purpose of its company was to build reusable space vehicles.[56] The reusability of its hardware and the associated low cost were the key to RpK's business plan.[57]

Shortly after the acquisition of Kistler Aerospace, RpK projected that the *K-1*'s design was 94% complete.[58] The company also estimated that work on the vehicle was 75% complete, approximately the same as when Kistler Aerospace entered bankruptcy.[59]

French did not say how much he paid to acquire Kistler.[60] However, the reason French purchased Kistler is quite clear; he intended to submit a proposal for NASA's Commercial Orbital Transportation Services program.[61]

II. ROCKETPLANE KISTLER, NASA, AND THE COMMERCIAL ORBITAL TRANSPORTATION SERVICES (COTS) PROGRAM

A. Background of COTS Program

In 2004, President Bush announced a new policy promoting commercial participation in the United States' space program.[62] In the Vision of Space Exploration, a compendium of recommendations to implement President Bush's space policies, the President's Commission declared that outdated business standards established during the *Apollo* era governed the majority of NASA's interactions with the private sector needed to be

---

[54] *Id*. at 31.
[55] *Id*.
[56] *Id*.
[57] *Id*.
[58] RpK Business Plan, *supra* note 53, at 30.
[59] *Id*.
[60] Rains, *supra* note 41.
[61] *Id*.
[62] President Bush Announces New Vision for Space Exploration Program, *supra* note 24; *see also* Dickerson, *supra* note 24, at 342.

changed.[63] In response to this finding, the Commission recommended that "NASA recognize and implement a far larger presence of private industry in space operations with the specific goal of allowing private industry to assume the primary role of providing services to NASA."[64] Furthermore, the Commission concluded that the preferred method for NASA's future operational activities would be through competitively awarded contracts to the private sector; and NASA's role should be limited to areas where it is proven that only the government can perform that activity.[65] Specifically, the best way to achieve this policy would be to establish competitive performance-oriented goals and allow the private sector to compete with each other to achieve NASA's objectives.[66] The Commission believed that if the private sector played a greater role in NASA's operations it would, "allow us to do more scientific work in space sooner, reduce government investment, and make long-term goals more affordable."[67]

In response to the President's new space policy and the Commission's findings, NASA implemented the Commercial Orbital Transportation Services Program.[68] The program challenged the private sector to develop space transportation capabilities for both cargo and crew to the *ISS*.[69] First, COTS invited proposals from companies who believed that they could successfully complete a commercial orbital transportation services demonstration.[70] NASA would then award a contract to the company, or companies, with the best proposal and would subsequently require the company to successfully complete an Earth-to-orbit space flight demonstration.[71] Furthermore, NASA

---

[63] PRESIDENT'S COMMISSION ON IMPLEMENTATION OF UNITED STATES SPACE EXPLORATION POLICY, REPORT: A JOURNEY TO INSPIRE, INNOVATE AND DISCOVER (June 2004), 19, *available at* http://www.nasa.gov/pdf/60736main_M2M_report_small.pdf.

[64] *Id*.

[65] *Id*.

[66] *Id*. at 20.

[67] *Id*.

[68] Dickerson, *supra* note 24, at 342.

[69] Press Release, NASA, NASA Seeks Proposals for Crew and Cargo Transportation to Orbit (Jan. 19, 2006), *available at* http:www.nasa.gov/home/hqnews/2006/jan/HQ_06029_Crew_Cargo_RFP.html [hereinafter NASA Seeks Proposals].

[70] *Id*.

[71] *Id*.

awarded $500 million in financing to two companies to fund the development of reliable, cost effective access to low-earth orbit.[72]

While the first phase of COTS was merely a demonstration phase, NASA expected to competitively purchase the services of the companies after a successful demonstration.[73] COTS was a major step to significantly increasing the private sector's role in NASA.[74] Scott Horowitz, NASA's associate administrator for Exploration services announced, "[w]e look forward to being able to purchase services for routine access to space, as NASA explores the Moon, Mars, and beyond."[75]

Historically, NASA issued detailed requirements and specifications of its flight hardware and took ownership rights of any vehicles or hardware produced.[76] COTS, on the other hand, was a significant departure from NASA's traditional way of doing business.[77] Instead of detailed specifications, the agency provided the companies with high level goals and objectives, and gave them decision-making authority concerning the design, development, and operation of the vehicles.[78] Additionally, the companies would retain ownership of their transportation systems.[79] Therefore, NASA did not fully finance the project; but instead, encouraged the participants to seek private financing for the space vehicles.[80]

An enormous response from the private sector ensued.[81] More than a hundred companies expressed interest, and twenty companies submitted full proposals.[82] NASA then narrowed the applicants down to six: Andrews Space, SpaceDev, SpaceHab, Transformational Space Corporation, Space Exploration Tech-

---

[72] NASA Invests in Private Sector Space Flight, *supra* note 25.
[73] NASA Seeks Proposals, *supra* note 69.
[74] *Id.*
[75] *Id.*
[76] NASA Invests in Private Sector Space Flight, *supra* note 25.
[77] *Id.*
[78] *Id.*
[79] *Id.*
[80] *Id.*
[81] NASA Invests in Private Sector Space Flight, *supra* note 25.
[82] *Id.*

nologies (SpaceX), and Rocketplane Kistler.[83] Eventually, NASA selected SpaceX and Rocketplane Kistler to be the first participants in the COTS demonstration program.[84] SpaceX received $278 million, the larger of the two COTS awards;[85] and Rocketplane Kistler secured $207 million to complete the *K-1*.[86]

B. Antitrust Law and the Increased Privatization of Space

According to classical economic theory, both economic regulation and antitrust principles aim to accomplish the same set of economic objectives: keep prices roughly equivalent to incremental costs, maintain efficient production processes, and foster innovation.[87] Economic regulation seeks to achieve these objectives *directly*.[88] The typical pattern for regulation involves agencies, like NASA, using a formulaic pattern of rules and orders to make offers to private firms, which ideally increases efficiency and innovation.[89] The writings of John Maynard Keynes, in particular, had a major influence on regulation theory.[90] From the early 1950's to the 1980's, including the *Apollo* era, the dominant macro-economic model utilized in the United States stipulated that some form of government control was required to

---

[83] Brian Berger, *SpaceX, Rocketplane Kistler Win NASA COTS Competition*, SPACE.COM, Aug. 18, 2006 *available at* http://www.space.com/news/060818_nasa_cots_wrap.html.

[84] NASA Invests in Private Sector Space Flight, *supra* note 25.

[85] *SpaceX, Rocketplane Kistler Win NASA COTS Competition, supra* note 83.

[86] *Id*.

[87] Stephen G. Breyer, *Antitrust, Deregulation, and the Newly Liberated Marketplace*, 75 CAL. L. REV. 1005, 1006 (1987). As prices get closer to incremental costs, theoretically, there are buying and production decisions that lead to less economic waste. *Id*. Generally speaking, efficiency is the maximization of output. Kenneth G. Elzinga, *The Goals of Antitrust: Other Than Competition and Efficiency, What Else Counts?*, 125 U. PA. L. REV. 1191, 1192 (1977). Efficiency occurs when output of goods is equal to consumer demand and minimizing production costs at the same time. *Id*.

[88] Breyer, *supra* note 87, at 1006. When using the term regulation or deregulation, it is used synonymously with economic regulation, which concerns issues of prices and profits and entry. *See* Panel Discussion, *The Cutting Edge of Anti-trust: Lessons from Deregulation*, 57 ANTITRUST L. J. 723, 724 (1988). The term is also used reference to health-safety-environment regulation. *Id*.

[89] Breyer, *supra* note 87, at 1006.

[90] *See generally* DANIEL A. YERGIN & JOSEPH STANISLAW, THE COMMANDING HEIGHTS: THE BATTLE BETWEEN GOVERNMENT AND THE MARKETPLACE THAT IS REMAKING THE MODERN WORLD 127 (1998).

achieve economic well-being and improve the standard of living.[91] The overwhelming rationale justifying government control is potential "market failure."[92] In other words, some desired outcomes, such as landing a man on the Moon, required degrees of coordination that competition and the private sector could not muster on their own.[93]

The academic antithesis to Keynes and his heavy-handed government control is Friedrich von Hayek.[94] Hayek was a strict classical economist who believed that the free market and competition were the keys to achieving lower prices, greater efficiency, and innovation.[95] Antitrust principles, in support of a strong market theory, as advocated by Hayek, seek to achieve economic objectives *indirectly* through prohibiting anti-competitive market behavior.[96] Antitrust law has been summarized as promoting "competition so that competition itself can bring us economic benefits."[97] Therefore, trends in antitrust policy veer toward decentralized private decision-making and individual freedom from excessive government control.[98]

Classical economists believe that the objectives of lower prices, greater production efficiency, and innovation are best achieved through market competition, thus giving credence to antitrust legislation.[99] Further, classical economists attack entities, such as government sponsored monopolies, for having

---

[91] *Id*. Governments influenced by Keynesianism, or mixed economies, used five tools to achieve market control: regulation, planning, state ownership, industrial policy, and Keynesian fiscal management. *Id*.

[92] *Id*.

[93] *Id*.

[94] *Id*. at 141-45. He described Keynesianism as, "the wildest farrago of nonsense." *Id*.

[95] *Id*. at 141-45. Hayek did the some of his research concerning how free markets influence the price system. *Id*. at 143. He explained the price system, "]t]he miracle is that in a case like that of a scarcity of one raw material, without an order being issued, without more than perhaps a handful of people knowing the cause, tens of thousands of people whose identity could not be ascertained by months of investigation, are made to use the material or its products more sparingly; that is, they move in the right direction." *Id.*

[96] Breyer, *supra* note 87, at 1006.

[97] *Id.* at 1006.

[98] Elzinga, *supra* note 87, at 1200.

[99] Breyer, *supra* note 87, at 1006.

many systemic flaws that patently prevent them from matching the innovation achieved through competition.[100]

In 1890, Congress passed the Sherman Antitrust Act, the first, and perhaps the most significant, American antitrust legislation.[101] Congress passed the act in order to protect the market by fostering competition and barring unreasonable restraint on trade.[102] The purpose of the Antitrust Act is not to protect individual businesses or government from the workings of the market.[103] Rather, the act was designed to protect competition in the market as a whole.[104] The first section of the act prohibits all conduct, conspiracies, and other anti-competitive behavior that act in restraint of trade.[105] The second section of the Antitrust Act forbids monopolistic behavior.[106] Taken as a whole, the act prohibits both the ways (conduct and conspiracies in constraint of trade) and means (monopolies) of anti-competitive behavior.[107]

While the Sherman Antitrust Act targets anti-competitive behaviors, it is not directed at government activities that are acrimonious to free markets.[108] For instance, when a state is acting in its regulatory capacity and not as a market participant, its behavior is not subject to scrutiny under the Sherman Act.[109] Moreover, immunity for state action is limited to state govern-

---

[100] *Id.*

[101] 54 AM. JUR. 2D *Monopolies and Restraints of Trade* § 1 (2010).

[102] *Id.*

[103] *Id.* § 2.

[104] *Id.*

[105] 15 U.S.C. § 1 (2004) ("Every contract, combination in the form of trust or otherwise, or conspiracy, in restraint of trade or commerce among the several States, or with foreign nations, is declared to be illegal").

[106] *Id.* § 2 ("Every person who shall monopolize, or attempt to monopolize, or combine or conspire with any other person or persons, to monopolize any part of the trade or commerce among the several States, or with foreign nations, shall be deemed guilty of a felony, and, on conviction thereof, shall be punished by fine not exceeding $100,000,000 if a corporation, or, if any other person, $1,000,000, or by imprisonment not exceeding 10 years, or by both said punishments, in the discretion of the court").

[107] *Id.* §§ 1-2.

[108] California Retail Dealers Liquor Ass'n v. Midcal Aluminum, Inc., 445 U.S. 97, 103, 105-106 (1980) (holding that a state's involvement in a wine pricing scheme is insufficient to bring it into the realm of "state action" under *Parker v. Brown*).

[109] Parker v. Brown, 317 U.S. 341, 350-51 (1943) (finding "nothing in the language of the Sherman Act or in its history which suggests that its purpose was to restrain a state or its officers or agents from activities directed by its legislature").

ments and does not apply to the federal government.[110] Nonetheless, the federal government and its agencies, also remain outside the scope of the Sherman Act.[111] Essentially, U.S. government agencies are allowed to create government monopolies and engage in anti-competitive behavior that otherwise would be prohibited.[112]

C. The COTS Space Act Agreement

Under the COTS program, NASA entered into a Space Act Agreement (SAA) with Rocketplane Kistler in 2006.[113] NASA's authority to enter into the COTS SAA is granted by section 203(c)(5) of the 2004 Coordination of Aeronautical and Space Activities Act which authorizes NASA "to enter into and perform such contracts, leases, cooperative agreements, or other transactions as may be necessary in the conduct of its work and on such terms as it may deem appropriate."[114] Consequently, SAAs "are legally enforceable promises between NASA" and the signing party.[115] Moreover, SAAs are formulated under NASA's "other transactions," and therefore, are legally distinct from procurement contracts.[116] Space Act Agreements allow NASA to have a broad range of freedom to negotiate and tailor the terms of the agreement to a specific mission or private partner.[117]

---

[110] N.C. *ex rel.* Edmisten v. P.I.A. Asheville, Inc., 740 F.2d. 274, 277 (4th Cir. 1984) (holding "the state action immunity doctrine, by definition, is restricted to conduct undertaken under the aegis of a state rather than the federal government").

[111] Sea-land Service, Inc. v. Alaska R.R., 659 F.2d 243, 246 (D.C. Cir. 1981) (finding "that the United States, its agencies and officials, remain outside the reach of the Sherman Act").

[112] *Id*.

[113] NASA, Space Act Agreement Between National Aeronautics & Space Administration & Kistler Aerospace Corporation & Rocketplane Ltd, Inc. for Commercial Orbital Transportation Services Demonstration, 29, *available at* http://www.nasa.gov/centers/johnson/pdf/162330main_SPACE_ACT_AGREEMENT_FOR_COTS.pdf. [hereinafter Space Act Agreement]

[114] 42 U.S.C. § 2473(c)(5) (2010).

[115] Dickerson, *supra* note 24, at 347.

[116] Rocketplane Kistler, B-310741, 1 (USGAO Jan. 28, 2008) *available at* http://www.gao.gov/decisions/bidpro/310741.pdf [hereinafter GAO Decision].

[117] Dickerson, *supra* note 24, at 348.

The 2006 agreement concerned the Crew/Cargo Project Office at Johnson Space Center.[118] One of the objectives of the Crew/Cargo Project Office is to "implement U.S. Space Exploration Policy with an investment to stimulate commercial enterprises to space."[119] The office is also focused on creating a market where commercial space transportation is available to both government and private sector purchasers.[120]

The purpose of the COTS agreement was to conduct the development and demonstration phases of the *K-1*.[121] During the process, NASA paid Rocketplane Kistler according to RpK's ability to demonstrate NASA designated performance capabilities and fundraising milestones.[122] Rocketplane Kistler was responsible for developing an "end-to end" space transportation system, including ground operations, launch, proximity operations, docking, orbital operations, reentry, and safe disposal or return.[123] According to NASA's objectives, Rocketplane Kistler needed to show that the *K-1* was able to perform external cargo delivery and disposal, internal cargo delivery and disposal, internal cargo delivery and return, and crew transportation.[124] The crew transportation objective was the only major objective where performance was optional.[125]

RpK and NASA's responsibilities were divided into objectives and milestones, making Rocketplane Kistler accountable to complete each element of the project on time.[126] The first three objectives contained fifteen milestones for RpK to complete. The

---

[118] Space Act Agreement, *supra* note 113, at 1.

[119] *Id*.

[120] *Id*.

[121] *Id.* at art. 2 (A), 2.

[122] *Id*.

[123] *Id*. at art. 2 (C), 2.

[124] *Id*. at art. 2 (A), 2. External Cargo delivery and disposal was defined by NASA as: "delivers cargo (payloads) that operate directly in the space environment to a LEO test bed and provided for its safe disposal." *Id.* Internal cargo delivery and disposal required RpK to deliver "cargo (payloads) that [operate] within a volume maintained at normal atmospheric pressure to a LEO test bed and [provide] for its safe disposal." *Id*. The third required capability stipulated RpK, "delivers cargo (payloads) that operated within a volume maintaine at normal atmospheric pressure to a LEO test bed and provides for its safe return to Earth." *Id*. The optional crew transportation capability was defined as, "delivers crew to a LEO test bed and provide for safe return to Earth." *Id*.

[125] *Id.* at art. 2 (A), 2.

[126] *Id*. at art. 3 (A), 2.

objectives were: external cargo delivery and disposal, internal cargo delivery and disposal, and internal cargo delivery and return.[127] Each milestone also contained an objective, target completion date, success criteria, and the stipulated NASA payment.[128] The optional crew flight objective had its own set of milestones, which were included as a price option to the Agreement.[129] NASA, in turn, was obligated to make milestone payments as RpK completed the project.[130] Hence, NASA was only obliged to pay funds according to the agreement, or by amendment to the agreement.[131] NASA also reserved the right to incrementally supplement the funds in the agreement.[132]

Furthermore, NASA emphasized that the agreement was non-exclusive.[133] Meaning, NASA had the right to enter into similar contracts for the same purpose as the COTS SAA with Rocketplane.[134]

Significantly, the SAA could be terminated at anytime based on the parties' written consent.[135] Alternatively, the

---

[127] *Id*. at Appendix 2, 46.

[128] *Id*. at Appendix 2, 46-49. Rocketplane Kistler's milestones were as follows:
Milestone 1: Program Implementation Plan Review
Milestone 2: Financing Round 1
Milestone 3: System Requirements Review
Milestone 4: Financing Round 2
Milestone 5: Pressurized Cargo Module Critical Design Review
Milestone 6: Unpressurized Cargo Module Critical Design Review
Milestone 7: ISS Readiness Review
Milestone 8: Rendezvous Software Test Readiness Review
Milestone 9: Financing Round 3
Milestone 10: PCM Test Readiness Review
Milestone 11: K-1 Complete and Shipped to Woomera
Milestone 12: Certification of Flight Readiness
Milestone 13: Pre-Demo 1 Risk Reduction Flight
Milestone 14: 1st Demo Flight
Milestone 15: 2nd Demo Flight
Id. The amount of financing required in financing rounds one, two, and three have been omitted from public record. *Id*.

[129] *Id.* at art. 14 and at Appendix 2, 50-53. RpK could have netted $200 million in NASA funding by successfully completing the crew objective. *Id*.

[130] *Id*. at art. 3 (B), 3.

[131] *Id*. at art. 5 (A) (1), 3.

[132] *Id*.

[133] *Id.* at arts. 8, 6.

[134] *Id*.

[135] *Id.* at art. 17 (A), 25.

agreement could also be terminated for failure to perform.[136] NASA reserved the ability to terminate the SAA with RpK for failure to perform within 30 days of written notice.[137] Failure to meet a prescribed milestone qualified as a breach of performance,[138] and the company would not be entitled to any additional payments from NASA.[139] NASA also had the right to unilaterally terminate the COTS SAA under certain circumstances, such as: Congress declares war, the President declares a state of national emergency, or where NASA is forced to terminate due to circumstances beyond its control.[140]

Finally, the process for dispute resolution under the SAA required all disputes of law or fact to be referred to the NASA Administrative Contact and RpK Administrative Contact.[141] If the Administrative Contacts were unable to reach an agreement, then the dispute would be addressed by the JSC Commercial Crew Cargo Project Manager and the CEO of RpK.[142] If still unable to reach a resolution, the Associate Administrator for Exploration Systems Mission Directorate would attempt to resolve the dispute and, if necessary, issue a final written decision which would qualify as the official Agency opinion.[143] This opinion would be final for all purposes, including seeking official review of the decision.[144]

---

[136] *Id*. at art. 17 (B), 25.
[137] *Id*. at art. 17 (B) (1), 25.
[138] *Id.* at art. 17 (B) (1), 25.
[139] *Id*. at art. 17 (B) (2), 25.
[140] *Id*. at art. 17 (C) (1), 25. "Reasons beyond NASA's control include but are not limited to, acts of God or of the public enemy, acts of the U.S. Government other than NASA, in either its sovereign or contractual capacity, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes, or unusually severe weather." *Id*.
[141] *Id*. at arts. 19, 26.
[142] *Id*.
[143] *Id.* at arts. 19, 26.
[144] *Id*.

D. Performance of the COTS SAA

Rocketplane Kistler was able to successfully complete its first three milestones.[145] However, in May 2007, RpK missed the fourth milestone, the requirement to conduct a second round of private sector financing.[146] In September 2007, NASA officially notified Rocketplane Kistler of its failure to perform under the Agreement.[147] After notification, NASA decided it was not in the Agency's best interest to pursue the COTS program with RpK, and terminated the SAA.[148]

Less than twenty-four hours after NASA terminated the Agreement, RpK began the appeals process.[149] Ultimately, however, NASA committed to reinvesting the $175 million, not earned by Rocketplane Kistler, into a new COTS competition, where another company would be awarded a similar milestone-oriented SAA.[150]

E. GAO Decision

Still smarting from the loss of the COTS contract, Rocketplane Kistler appealed to the Governmental Accountability Office (GAO).[151] RpK disputed the form of the agreement in order to bring their protests within the jurisdiction of the GAO.[152] In general, the GAO reviews alleged violations or misconduct concerning procurement contracts.[153] However, the GAO determined

---

[145] NASA, Rocketplane-Kistler (RpK), *available at* http://www.nasa.gov/offices/c3po/partners/rpk/index.html. Rocketplane Kistler was over a month late on the second milestone, which was the first round of financing. *Id*.

[146] Press Release, NASA, NASA to Open New Competition for Space Transportation Seed Money (Oct. 18, 2007), *available at* http://www.nasa.gov/home/hqnews/2007/oct/HQ_07228_COTS_competition.html [Hereinafter NASA to Open New Competition].

[147] *Id*.

[148] *Id*.

[149] Brian Berger, *Rocketplane Kistler Appeal NASA Decision to Terminate COTS*, SPACE.COM, Oct. 22, 2007, at http://www.space.com/businesstechnology/071022-sn-cotsappeal.html.

[150] NASA to Open New Competition, *supra* note 146.

[151] GAO Decision, *supra* note 116, at 1.

[152] *Id*. at 1, 3.

[153] *Id*. at 3.

that SAAs are not procurement contracts.[154] Moreover, the GAO established that it does not review award protests that fall outside their bid protest jurisdiction.[155] RpK asserted that NASA was utilizing a non-procurement instrument for procurement purposes in order to circumvent procurement statutes and regulations.[156] The company further argued that the solicited services were for research and development and can only be acquired through a procurement contract not an SAA.[157]

The first phase of COTS, which Rocketplane competed in, was the demonstration phase.[158] It was geared at developing commercial space transportation capabilities that would be desirable to private industry and the government.[159] The second phase, which has yet to be completed by any company, was described by NASA as, "planned competitive procurement of orbital transportation service to resupply the [*International Space Station*] with cargo and crew."[160]

Under Federal law, an agency must use a procurement contract when:

> (1) The principal purpose of the instrument is to acquire (by purchase, lease, or barter) property or services for the direct benefit or use of the United States Government; or
>
> (2) The agency decides in a specific instance that the use of a procurement contract is appropriate.[161]

RpK argued that the direct purpose of the COTS program was to obtain research and development services for the direct benefit of NASA.[162] However, NASA asserted that it received no direct benefit through goods and services from the contract be-

---

[154] *Id*
[155] *Id*.
[156] *Id*.
[157] *Id*. at 1.
[158] *Id*. at 2.
[159] *Id*.
[160] *Id*.
[161] *Id*. at 4 (quoting 31 U.S.C § 6303 (2000)); *see also* FAR § 35.003(a) ("Contracts shall be used only when the principal purpose is the acquisition of supplies and services for the direct benefit of the Federal Government").
[162] GAO Decision, *supra* note 116, at 3.

cause the administration obtained no vehicles, supply service, prototypes, etc. from the program.[163] Instead, NASA said that the purpose of the COTS program is to "encourage the growth of a future U.S. commercial market in which space transportation services will be available for commercial and Government customers."[164]

The GAO found NASA's argument persuasive because the record sufficiently showed that the purpose of the COTS program was to support the development of a market for commercial space transportation services, from which NASA could eventually buy orbital transportation services.[165] While the development of a commercial space transportation industry supports NASA's space exploration policies, supporting the growth of the market as a matter of public policy does not equate the administration's acquiring services and goods for its direct administration benefit, as contemplated by the statute.[166]

III. ABERCROMBIE & KENT SPACE V. ROCKETPLANE INC.

A. The Origins of the Lawsuit

While RpK was pursuing the COTS program with NASA, the company was also attempting to establish itself as a mainstay in suborbital space tourism.[167] On December 22, 2006, Rocketplane Kistler entered into an Exclusive Sales and Marketing Agreement with Abercrombie & Kent Space, an Illinois based company that promoted and advertized space tourism.[168]

1. Terms of the Contract

Per the agreement, *Rocketplane Kistler* was responsible for building the *Rocketplane XP* suborbital flight program.[169] RpK's

---

[163] *Id*. at 4.
[164] *Id*.
[165] *Id.* at 5.
[166] *Id*.
[167] *See generally* Companies Join Forces, *supra* note 23.
[168] Complaint, *supra* note 22, at ¶ 1, 3.
[169] Excusive Sales and Marketing Agreement, Abercrombie & Kent & Rocketplane Kistler, Dec. 22, 2006, at 1 (on file with author) [hereinafter Agreement].

responsibilities included suborbital flights, mission control, flight simulation, facility, specialty meals for passengers, and building viewing rooms for spectators.[170] In other words, Rocketplane Kistler agreed to develop all aspects of the suborbital flight program that was to be marketed and promoted by Abercrombie & Kent.[171] In addition, RpK was responsible for the management, administration, and operation of the commercial flight participant training program.[172]

Rocketplane Kistler appointed Abercrombie & Kent to be the exclusive seller and marketer of all RpK's commericial suborbital space flights worldwide.[173] Abercrombie & Kent was also accountable for planning all pre and post-flight programs in relation to both the training program and the suborbital space tourism.[174]

The contract also discussed RpK's financing of the *Rocketplane XP* stating, "It is understood by both parties that currently R[p]K does not have financing in place to complete the *Rocketplane XP* suborbital space vehicle."[175] Similar to the COTS SAA, RpK committed to meeting specified benchmarks in the development of the *XP*, and raising $520 million in funding. Specifically, the contract provided:

1. The first round of financing is anticipated to raise $40 million in equity and is completed.

2. The second round of financing is anticipated to be a $150 million equity round that will close near the end of February 2007.

---

[170] *Id*.
[171] *Id*.
[172] *Id*.
[173] *Id.* at 2 ("[Abercrombie & Kent] will be responsible for all marketing and promotional activities and associated expenses, including but not limited to micro-website, printing brochures, brochure design, production, distribution, and fulfillment.").
[174] *Id*. at 2. The types of programs Abercrombie and Kent were in charge of were, "airport meet and greet, transfers, hotel accommodations, meals, and celebrations." *Id*.
[175] *Id.* at 9.

3. The third round of financing is anticipated to raise $330 million, in a combination of debt and equity which would occur near the end of 2007.[176]

2. Performance of the Contract

According to the plaintiff's brief, in April 2007, Rocketplane Kistler's Board of Directors (BOD) decided that pursuing space tourism did not offer enough potential profit.[177] Instead of finishing development on the *Rocketplane XP*, the BOD decided to pursue promotion of the *K-1* project. The BOD instructed all RpK's employees to cease work on the *XP* on May 4, 2007.[178] Thereafter, Rocketplane terminated most of its employees working on the *XP*[179] and stopped fundraising efforts for the *XP* project.[180]

B. Abercrombie & Kent's Allegations

Abercrombie & Kent alleged that ceasing work on the *XP* was a termination of the agreement.[181] Abercrombie & Kent further alleged, in addition to failing to complete the *Rocketplane XP* and program, RpK failed to complete the second round of financing in February 2007.[182] In June 2007, Abercrombie &

---

[176] *Id*. The parties also agreed to these additional benchmarks:
4. First Commercial flight in 2009.
5. Thereafter, commercial flights at least once every two weeks (subject to demand).
6. No casualties, serious injuries, or crashes.
7. Pricing competitive with other suborbital products, if any.
Id. (Numbering resumed from benchmarks above, same numbering that exists in the contract.)

[177] Complaint, *supra* note 22, at ¶ 8.

[178] *Id*. at ¶ 9(a).

[179] *Id*. at ¶ 9(b). The employees fired that were working on the *XP* project included employees in charge of inside sales, outside sales, the vice president of operations, the office manager, and an engineer. *Id*.

[180] *Id*. at ¶ 9(c).

[181] *Id*. at ¶ 10.

[182] *Id*. at ¶ 19 (a) – (h). Abercrombie & Kent also claimed the Agreement was breached by:

a. Abandoning or purporting to suspend the XP project, which is the subject of the purpose of the agreement
b. Failing to engage in the development, administration, and operations for Rocketplane XP suborbital flight . . .
c. Failing to create and provide the elements of the suborbital flight product . . .

Kent demanded that Rocketplane Kistler pay $3.4 million in damages under the agreement.[183] In response to Abercrombie & Kent's request for damages under the contract, Rocketplane agreed to attend mediation at the plaintiff's request.[184] Abercrombie & Kent scheduled mediation for August 2007, but Rocketplane Kistler unilaterally canceled the mediation.[185]

C. Subsequent Filings

Although the complaint was filed in August 2007, the case has yet to go to trial.[186] Unfortunately for lawyers following the case, Rocketplane Kistler[187] was successful in keeping the discovery documents confidential.[188] Moreover, the case has had a

---

d. Failing to provide A&K Space with the specific details of an astronaut training program . . .
e. Failing to provide A&K Space with current technical data and support for the development by A&K of a brochure, sales collateral, digests, and a marketing plan . . .
f. Failing to work toward developing an XP product with a first revenue flight expcted by January 1, 2009 . . .
g. Failing to provide A&K Space with selected images of the now-planned Rocketplane XP and related information . . .
h. Filing [sic] to complete a second round of financing by the end of February, 2007 . . .

Id.

[183] *Id*. at ¶ 11.

[184] *Id*. at ¶ 14-15.

[185] *Id*. at ¶ 15. Due to Rocketplane's failure to mediate, Abercrombie & Kent incurred another $3, 025 in damages, bringing the total amount of damages claimed to $3,403,025. *Id*. at ¶ 16 In response to Abercrombie & Kent's complaint, Rocketplane Kistler claims the plaintiff had breached the agreement by failing to work on the civilian astronaut program, plan the pre/post land trips, produce pre-trip materials for the public, perform promotional activities, be responsible for public relations, promote suborbital flights, develop a space travel micro-site, and establish a production schedule for marketing activities. Answer, *supra* note 22, at Affirmative Defenses ¶ 2 (a) –(h). RpK also counterclaimed that the contract had failure of consideration. *Id*. at ¶ 4-6. RpK asserted Abercrombie & Kent had unclean hands, specifically related to the alleged breach and lack of consideration. *Id*. at ¶ 7-8. Furthermore, RpK alleged that the amount of damages claimed by Abercrombie & Kent was an unlawful penalty because it did not correlate with the amount of efforts the advertising firm put into the contract. *Id*. at ¶ 11.

[186] *See* Complaint, *supra* note 22, at 1; Order Granting Mot. for Continued Tr., Dec. 14, 2009 (resetting the trial date to Apr. 26, 2010).

[187] During the course of litigation Rocketplane Kistler changed its name to Rocketplane Global Inc.

[188] *See generally*, Def. Mot. (Consented to) for Entry of Protective Order & To Extend Discovery ¶ 1-7 (Mar. 11, 2008); Stipulated Protective Order, (Mar. 11, 2008)..

long and nasty discovery process.[189] RpK's original legal representation, Burker, Warren, MacKay & Serritella, withdrew from the case citing multiple reasons under Model Rule of Professional Conduct 1.16.[190] The law firm alleged that "Rocketplane and its principals have rendered it unreasonably difficult for the firm to carry out the employment effectively and have acted in a manner that has created irreconcilable difference between Rocketplane, its principals, and the [f]irm."[191] After their designated law firm withdrew from the case, the court entered an order of default judgment against RpK.[192] Subsequently, discovery was extended repeatedly with general allegations that Abercrombie & Kent were "unaggressive in attempting to conduct discovery."[193]

---

[189] *See generally*, Pl.'s Mot. to Compel Production of Documents (Jul. 11, 2008).

[190] Def. Mot. for Leave to Withdraw ¶ 3 (Jul. 15, 2008) (on file with author). The Model Rule of Professional Conduct that RpK's lawyers utilized to withdraw from representation states in pertinent part:

> (a) Except as stated in paragraph (c), a lawyer shall not represent a client or, where representation has commenced, shall withdraw from the representation of a client if:
> (1) the representation will result in violation of the rules of professional conduct or other law;
> (2) the lawyer's physical or mental condition materially impairs the lawyer's ability to represent the client; or
> (3) the lawyer is discharged.
> (b) Except as stated in paragraph (c), a lawyer may withdraw from representing a client if:
> (1) withdrawal can be accomplished without material adverse effect on the interests of the client;
> (2) the client persists in a course of action involving the lawyer's services that the lawyer reasonably believes is criminal or fraudulent;
> (3) the client has used the lawyer's services to perpetrate a crime or fraud;
> (4) the client insists upon taking action that the lawyer considers repugnant or with which the lawyer has a fundamental disagreement;
> (5) the client fails substantially to fulfill an obligation to the lawyer regarding the lawyer's services and has been given reasonable warning that the lawyer will withdraw unless the obligation is fulfilled;
> (6) the representation will result in an unreasonable financial burden on the lawyer or has been rendered unreasonably difficult by the client; or
> (7) other good cause for withdrawal exists.

MODEL RULES OF PROF'L CONDUCT R. 1.16 (a) – (b), *available at* http://www.abanet.org/cpr/mrpc/rule_1_16.html.

[191] Def. Mot. for Leave to Withdraw, *supra* note 190, at ¶ 3.

[192] Order Granting Default Judgment, Aug. 20, 2008 (on file with author).

[193] Def. Response to Pl.'s Mot. to Conduct Additional Discovery ¶ 3 Oct. 19, 2009 (on file with author) ("At plaintiff's request, discovery has repeatedly been continued in this

IV. ANALYSIS

A. Rocketplane Kistler and Individual Firms in the New Space Industry

Rocketplane Kistler entered into the new space industry brimming with confidence.[194] However, less than two years after formation, the venture was trapped in a legal quagmire filled with terminations of contracts and lawsuits.[195] As of yet, the company still has not conducted a successful demonstration of a spaceship in either suborbital or LEO flight.

One of the most obvious similarities between the COTS SAA and the Exclusive Sales and Marketing Agreement with Abercrombie & Kent Space, is the identical use of milestones to gauge RpK's performance.[196] More importantly, RpK was unable to meet the second private financing milestone under both agreements.[197] While the amount of private funding required by the COTS SAA financing milestones is not available to the public, RpK committed to raising $150 million in financing for its suborbital flight program. RpK's inability to meet its financial milestones indicates that the primary hindrance to the completion of its obligations was lack of equity.[198] However, a rather confusing piece of Rocketplane Kistler's financial puzzle is that the company had a single offering of preferred stock in 2006 where it sold over $46 million in stock to five investors.[199] While issuing preferred stock is fairly common in privately held companies, it is odd, to say the least, that the company only had a single offering if it was making good faith efforts to raise financing to adhere to its contracts.[200] RpK was never able to prove the

---

matter. On January 13, 2009, the court entered an order establishing a discovery cut-off on March 13, 2009. On March 4, 2009, the court continued the discovery cut-off to June 15, 2009. On June 25, the court extended the discovery cut-off to September 21, 2009." *Id*. at ¶ 2.).

[194] *See supra* text accompanying notes 49-53.

[195] *See* discussion *supra* pp. 73-79.

[196] *See supra* text accompanying notes 121-125, 176.

[197] *See supra* text accompanying notes 145-148, 182.

[198] *See* discussion *supra* pp. 73, 77.

[199] Rocketplane Kistler Inc., Notice of Sale of Securities (Form D), at 4 (Nov. 16, 2006), *available at* http://www.sec.gov/Archives/edgar/vprr/06/9999999997-06-047742.

[200] *Id*.

technical merits of either its *Rocketplane XP* design or the *K-1*, because it never reached those milestones in their agreements.[201] However, it can be reasonably inferred that if the company believed in the success of its projects, it would have made more public efforts to raise the necessary funding, whether through taking out additional debt or pursuing more equity offerings.

Another possibility for the company's inability to meet financial milestones is its overly ambitious business plan.[202] While the company openly and proudly proclaimed that it had no competition in the market because it was pursuing the dual projects of suborbital and LEO transportation services, perhaps they had no competition from similar companies in the new space industry because it was inefficient, both financially, and as far as achieving labor utility, to pursue both projects at the same time.[203] If the allegations in the Abercrombie & Kent Space complaint are true and RpK abandoned its suborbital space tourism enterprise in April 2007, then it shows the company's acknowledgement of its diverse business strategy. In any case, it indicates a lack of organization on the part of the company to pursue private funding of both projects simultaneously. While Rocketplane Kistler struggled to meet its milestones on both of its projects, SpaceX, the company awarded the other funded COTS SAA, was able to meet all of its financial milestones on time.[204]

Moreover, a paradoxical problem is posed by the structure of the COTS program.[205] NASA designed the COTS program in order to develop a market for commercial space transportation services. As a result, instead of paying for the entirety of the project, as the administration would with a procurement contract, NASA provided partial funding for its COTS partners.[206] The benefit of this arrangement was that, if successful, the partners would remain the owners of their launch systems and

---

[201] *See supra* text accompanying notes 145-193.
[202] *See* discussion *supra* p. 62.
[203] *Id*.
[204] *See* NASA to Open New Competition, *supra* note 146.
[205] *See supra* text accompanying notes 113-140.
[206] *See supra* text accompanying note 80.

could contract with the private sector for LEO transportation services.[207] While NASA publicly stated its intention to enter into Phase II contracts with companies who successfully completed demonstrations, these COTS contracts were not guaranteed.[208] The lack of a guaranteed contract in Phase II would certainly deter private investors whose funding was necessary to meet NASA's milestones.[209] But, if NASA was to eliminate the financial milestone requirements, it would have no means of keeping its partners financially on track. Alternatively, if NASA was to fully fund the research and development of its COTS partners, it would essentially be operating a less efficient shuttle program through procurement contracts. Furthermore, requiring NASA to commit to a Phase II contract with its COTS partners would require the agency to commit to spending millions of dollars of tax payer money on heretofore unproven technology.

Another persistent theme in Rocketplane Kistler's company history is unrealistic timeframes and financial goals. Kistler Aerospace originally expected the *K-1* to cost the company $500 million to develop.[210] After raising $600 million in financing for the project, Kistler Aerospace filed for bankruptcy.[211] When the company emerged from bankruptcy, it forecasted that the project would cost an additional $650 million.[212] Rocketplane Kistler estimated that the design for the *K-1* was 94% complete and the hardware was 75% intact.[213] In other words, completing a quarter of the *K-1* project would cost the company over 100% more than it originally predicted. A second example of the company's unrealistic financial goals was the development of the *Rocketplane XP*. In 2005, the company informed *USA Today* that it would cost approximately $30 million to finish the suborbital vehicle.[214] However, in the contract with Abercrombie & Kent,

---

[207] *See supra* text accompanying note 79.
[208] *See* discussion *supra* pp. 73-75.
[209] *See supra* note 128 and accompanying text.
[210] *See supra* text accompanying note 39.
[211] *See supra* text accompanying note 40.
[212] *See supra* text accompanying note 46.
[213] *See supra* text accompanying notes 58-59.
[214] *See supra* discussion accompanying note 32.

Rocketplane stipulated that it had already raised $40 million in private financing for the *XP*.[215] The company planned to raise another $480 million for completion of the project.[216] Furthermore, RpK was unable to meet its own deadlines. Rocketplane predicted its first commercial passenger flight would be in 2006, but the first projected flight was pushed back until 2007, and then again to 2010.[217]

RpK has been consistently and significantly inaccurate in its predictions of the cost and timelines of its projects, but the greater question is why? One reason could be that the company was trying to lure in investors and publicity with puffery of its own expectations. Conversely, Rocketplane Kistler's persistent inability to follow through with their ambitious goals may have repulsed potential investors after a certain point. Another reasonable explanation is the nature of the new space industry is such a nascent industry, that making accurate predictions regarding the future is next to impossible. However, NASA has been able to run a successful shuttle program for decades under the governance of an Executive budget, most likely providing a template for the expectations of the new space industry.

B. The Increased Privatization of Space

President Obama's new space policy requires a transition from using NASA vehicles for spaceflight towards relying primarily on commercial space transportation.[218] As evidenced by the discussion on antitrust law, the Federal government is not required to open itself up to competitive market forces.[219] If the American government wanted NASA to be a model for regulation, then it could legally make NASA a federal government owned space transportation monopoly.[220] Nevertheless, since the

---

[215] *See supra* text accompanying note 176.
[216] *Id.*
[217] *See supra* text accompanying note 34.
[218] *See supra* text accompanying note 4.
[219] *See* discussion *supra* pp. 66-68.
[220] *See supra* text accompanying note 112.

Bush administration, there has been a push for NASA to help create a commercial space transportation industry.[221]

Private sector competition has been the hailed as the panacea for the high price of space transportation.[222] First and foremost, in order to replace the shuttle program, the private sector must be capable of consistently and safely delivering the LEO transportation services. In order to be an economically viable alternative to the regulation-heavy current shuttle program, it must be able to meet the significant economic objectives of prices roughly equivalent to incremental costs, efficient production processes, and innovation.[223]

As for the capability of private companies to replace the shuttle program, they cannot—not yet.[224] The COTS program gave NASA a chance to experiment with making SAAs with the private sector on a small scale. Recall that the GAO determined the purpose of the COTS SAAs was to "encourage the growth of a future U.S. commercial market in which space transportation services will be available for commercial and Government customers" and not to procure research and development for NASA.[225] Now, as the COTS program winds down, hindsight reveals the successes of NASA's COTS partners in the primary run of the program. Rocketplane Kistler was unable to meet the fourth milestone. While SpaceX has had some recent success with its Falcon 9, the company had three failed rocket launch attempts of the rocket.[226] In addition to the COTS partners' inconsistent performance, no private company has successfully launched a manned spaceship into space.[227] In other words, the Obama Administration is attempting to put the future of the

---

[221] *See supra* text accompanying note 62.

[222] *See* discussion *supra* p. 63.

[223] *See* discussion *supra* pp. 65-68.

[224] *See* discussion p. 57.

[225] *See supra* note 165 and accompanying text.

[226] Stephen Clark, *SpaceX Rocket Countdown a 'Great Success'*, SPACE.COM, Mar. 3, 2010, *available at* http://www.space.com/missionlaunches/spacex-falcon9-launch-rehearsal-sfn-100303.html (recounting SpaceX's successful launch countdown); Tariq Malik, *SpaceX Traces Third Rocket Failure to Timing Error*, SPACE.COM, Aug. 6, 2008 *available at* http://www.space.com/news/080806-spacex-falcon1-update.html (relating the Falcon 9's three consecutive launch failures).

[227] *See supra* notes accompanying note 21.

United States space program in the hands of a market that, for all intents and purposes, does not currently exist.

Furthermore, NASA and the Obama Administration expect that opening up LEO transportation services to the private sector will result in "more scientific work in space sooner, reduc[ing] government investment, and mak[ing] long-term goals more affordable."[228] While this is a worthy goal, it is unproven that the private sector will be able to deliver these objectives more efficiently than the shuttle program. While many industries, like the airline industry, have flourished as a result of privatization, others, like the electric power industry, have been much less successful.[229]

Moreoever, it is likely that within this new private sector initiative, a single company will develop the capabilities of supplying LEO transportation services, while the rest of the market is still developing. This would subject NASA to monopolistic pricing for some time, with the Russian government as the Agency's alternative supplier.[230] Until a private space company emerges with crew transportation capabilities, and without the shuttle, the United States will have to rely exclusively on Russia for transportation to the *ISS*.[231] While international cooperation with Russia with regard to the *ISS* is an admirable goal, especially compared to the countries' poor relationships during the Cold War era, political hot button issues like Georgian independence and the Iranian nuclear weapons program could put the United States' seats on *Soyuz* spacecraft in jeopardy.[232]

It is important to note that the current model for economic regulation seeks to lower prices, increase efficiency, and give rise to innovation.[233] In this author's opinion, the Obama Administration should have waited for a more viable American commercial market to develop before deciding not to extend NASA's use of the shuttle program.

---

[228] *See supra* text accompanying note 67.

[229] *See supra* note 4 and accompanying text; *see generally*, David B. Spence, *Can Law Manage Competitive Energy Markets?*, 93 CORNELL L. REV. 765, 776-791 (2008).

[230] *See supra* discussion accompanying note 11.

[231] *See* Verhovek, *supra* note 6.

[232] *Id.*

[233] *See supra* text accompanying note 87.

CONCLUSION

In 2006, Rocketplane Kistler planned to be the dominate force in the new space industry by simultaneously pursuing both suborbital space tourism and LEO transportation services. Now, the company has abandoned its Oklahoma headquarters and the Oklahoma Spaceport.[234] RpK went from being a rising star in commercial transportation services to a company mired in litigation. With a growing emphasis on the privatization of the shuttle program's transportation services to the *ISS*, NASA and the private sector need to be aware of the difficulties that the new space industry can present. Lessons to absorb from RpK include the importance of setting realistic project goals and meeting contractual milestones. The guidance NASA and the U.S. government need to take from their dealings with Rocketplane Kistler, is that not all of the new space industry is up to the task.

---

[234] Jennifer Palmer, *No Spaceships at Oklahoma's Spaceport but They Are Welcome*, DAILY OKLAHOMAN, Jan. 10, 2010.

TO THE END OF THE EARTH: A STUDY OF THE BOUNDARY BETWEEN EARTH AND SPACE

Theodore W. Goodman[*]

I. INTRODUCTION

With the launch of the diminutive *Sputnik* on 4 October 1957,[1] humankind first left the Earth; or did it? In more than fifty years of space flight and space exploitation, humankind has yet to agree on a seemingly critical question in space development: where does the Earth end and where does space begin? Or, more appropriately for the purposes of this paper, how far above the surface of the Earth does the "territory" of a sovereign state extend? These questions are older than space exploration itself. Eighteen months before the launch of *Sputnik*, a press release of the International Civil Aviation Organization (ICAO) announced that the issue of space sovereignty would be considered at an upcoming meeting:

> *Outer Space Sovereignty Agreement Needed*
>
> Agreement on the use of outer space by the nations of the world will have to be reached soon, according to a report which will be put before the Assembly of the International Civil Aviation Organization when it meets … this June. The report points out that . . . there is good reason to believe that 'mechanical contrivances' will travel beyond the Earth's atmosphere in the near future.
>
> None of the rules which furnish legal guidance to states on problems of sovereignty apply to trips into outer space. The convention on International Civil Aviation, which has been

---

[*] Theodore W. Goodman received his law degree from the University of Tennessee at Knoxville and his undergraduate degree from The University of the South in Sewanee, Tennessee. He currently practices law in Murfreesboro, Tennessee.

[1] NASA, *Sputnik: The fiftieth anniversary*, http://history.nasa.gov/sputnik/ (last visited Jan. 18, 2010).

> ratified or adhered to by all of ICAO's 67 member nations, gives each of these nations complete and exclusive sovereignty over the airspace above its territory, but it makes no mention of whether this sovereignty extends upwards beyond the boundary of the air . . . as any space craft would have to pass through the atmosphere before it reaches outer space, ICAO itself will be interested in the matter.[2]

Fifty years later, this question remains unanswered.

Amazingly, this unresolved issue does not seem to have hampered space development. However, with the limited "territory" above the Earth becoming increasingly crowded with "mechanical contrivances," and with new Nation-States quickly joining the "elite club" of space faring nations, these questions demand an answer.

Perhaps no event in recent memory made this question more urgent than the successful Chinese anti-satellite (ASAT) test, which took place on 11 January 2007. With the successful destruction of its own aging weather satellite, China proved that not only can it lay claim to orbital spheres above its territory, but, more significantly, it can enforce those claims. China is only the third nation to perform a successful ASAT test (the other two being the United States and Soviet Union).[3] Due to its heavy reliance on space-based technology, the United States took notice.[4]

Just over a year later, 15 February 2008, the United States successfully destroyed one of its own satellites for the first time since 1985.[5] Like the Chinese test, the American test utilized an Earth-based missile. According to Jonathan McDowell, an astronomer at Harvard University, the Chinese ASAT Test marks "the first real escalation in the weaponization of space

---

[2] Press Release, International Civil Aviation Organization Aviation Organization, Outer Space Sovereignty Agreement Needed (Apr. 4, 1956), *available at* http://www.icao.int/icao/en/nr/1956/pio195606_e.pdf.

[3] Carin Zissis, *China's Anti-Satellite Test*, COUNCIL ON FOREIGN RELATIONS, Feb. 22, 2007, www.cfr.org/publication/12684/.

[4] *Id.*

[5] William J. Broad and David E. Sanger, *China Tests Anti-Satellite Weapon, Unnerving U.S.*, N.Y. TIMES, Jan. 18, 2007, *available at* http://www.nytimes.com/2007/01/18/world/asia/18cnd-china.html.

that we've seen in 20 years."[6] Now that Nation-States are honing their abilities to exercise control over space, it is imperative that an international consensus be reached as to "the vertical limits of State sovereignty."[7]

II. VARIOUS DESIGNATIONS

As the very premise of this paper suggests, there is no clear boundary delineating the outer limit of airspace and beginning of outer space. As American astronaut, Rhea Seddon, M.D. explained, "space is a continuum."[8] While there are no clear boundaries, there is, however, a series of "arbitrary designations"[9] that have been adopted by custom or convention for the purposes of record keeping, designations, and competitions.[10] In order to give the reader some background knowledge of this issue, a number of the various proposals and designations are discussed below.

A. Ability to Control

Some scholars have suggested that the upper limit of Nation-State sovereignty should be dependant on the subjacent States' ability to exercise control over their airspace.[11] Obviously, such a designation would make the definition of outer space variable across the globe due the inequality of Nation-States' abilities to project force.[12] Such a capability-based designation would be inconsistent and therefore would lack the uni-

---

[6] *Id*. (quoting Jonathan McDowell).

[7] Dean N. Reinhardt, The Vertical Limits of State Sovereignty (June 2005) (unpublished LLM thesis, McGill University, Montreal), *available at* http://www.dtic.mil/cgi-bin/GetTRDoc?AD=ADA436627&Location=U2&doc=GetTRDoc.pdf.

[8] Telephone Interview with Rhea Seddon, M.D., United States Astronaut in Murfreesboro, Tenn. (Mar. 24, 2009)(on file with author) [hereinafter Seddon Interview].

[9] *Id*.

[10] *See* LUCY ROGERS, IT'S ONLY ROCKET SCIENCE, 2 (Springer Science and Business Media 2008).

[11] *See* Stanley B. Rosenfield, *Where Air Space Ends and Outer Space Begins*, 7 J. SPACE L. 137, 140 (1979); Reinhardt, *supra* note 7, at 51.

[12] *See* Rosenfield, *supra* note 11, at 140; Reinhardt, *supra* note 7, at 51.

formity and ease of determination that is necessary for a definition of "space" to be workable.[13]

As well as failing to offer the uniformity that a definition of "space" should provide,[14] a capability-based definition of "space" would also be unjust to smaller, weaker nations that lack the ability to exercise control at higher altitudes:

> This is a harsh rule when applied to sovereignty in space. The richest and most powerful States now have means through high altitude rockets to control more or less effectively the "air-space" over their surface territories. But the weaker states have no such power. . . [T]he rule should be that every State, no matter how small or how weak, as a State of equal sovereignty with every other State, has and should be admitted to have territorial rights upward above its surface territories as high as the rights of every other State no matter how powerful.[15]

While Professor Cooper's considerations of fairness are correct, perhaps even more relevant to the discussion is that such a designation does not provide a workable definition of where space ends and begins. Not only would such a definition evolve with technology, but it would vary by nation,[16] extending as high as hundreds or even thousands of miles over nations such as China and the United States and as low as the range of shoulder fired missiles in the cases of other nations.

Allowing the lower reaches of "space" to be determined by the capabilities of the subjacent states would create the potential for international chaos. Sovereign limits would change with time and location and therefore would do little to resolve the ambiguity of current space sovereignty.[17] Not only would space-faring nations be required to keep abreast of advances in technology, but also, these nations would have to remain aware of

---

[13] Vladimir Kopal, *The Question of Defining Outer Space*, 8 J. SPACE L. 154, 170 (1980); *see generally* Reinhardt, *supra* note 7.

[14] Kopal, *supra* note 13, at 170; *see generally* Reinhardt, *supra* note 7.

[15] Reinhardt, *supra* note 7, at 52, (*quoting* John Cobb Cooper, *High Altitude Flight and National Sovereignty*, 4 INT'L L. Q., at 263-245 (1951)).

[16] *See* Rosenfield, *supra* note 11, at 140.

[17] *Id*.

advances in the capabilities of the subjacent states.[18] Failure to remain so aware could result in the space-faring nation sustaining substantial property damage or loss of life (which would likely lead to strife between the nations). One major goal in defining "the vertical limit of State sovereignty" is to prevent border conflicts.[19] A determination of State sovereignty based on a State's ability to exercise control would only increase the potential for border conflicts as it would encourage Nation-States to demonstrate and enhance the extent of their control. Due to the inherent lack of uniformity that such a system would create, and due to the fact that it would increase the potential for conflict, an ability-based designation is not an acceptable solution to the question of the extent of state sovereignty.

B. Altitude-Based Designation: The von Kármán Line

Other proposals have suggested establishing a uniform altitude at which State sovereignty terminates. Some proposals have offered seemingly arbitrary altitudes while other proposals have been based on some physically significant location. One altitude-based designation is known as the "von Kármán Line," defined as "the point where aerodynamic lift yields to centrifugal force."[20] This is an elevation of approximately 275,000 feet.[21] However, this "line" was established by the nongovernmental organization, Federation Aeronautique Internationale (FAI)[22] and therefore has no governmental significance. Highlighting this point is that the United States recognizes a person as an astronaut once a person has achieved the lower altitude of fifty miles or eighty kilometers.[23] However, like other designations in the "continuum of space"[24] the altitude designation of an astronaut's qualifications is an "arbitrary number" which has no "real significance."[25]

---

[18] *Id.*
[19] Reinhardt, *supra* note 7, at 4, 14, 76.
[20] Rosenfield, *supra* note 11, at 139.
[21] *Id.*
[22] ROGERS, *supra* note 10, at 2.
[23] *See* Seddon Interview, *supra* note 8; ROGERS, *supra* note 10, at 2.
[24] *See* Seddon Interview, *supra* note 8.
[25] *Id.*

C. Not "airspace" as Defined by International Civil Aviation Organization

Another proposal has been to say that "outer space" is any space that is not "air space" as defined by the International Civil Aviation Organization (ICAO). ICAO states that "air space" is only that space in which an aircraft can operate. An "aircraft" is "any machine that can derive support in the atmosphere from the reactions of the air other than the reactions of the air against the earth's surface."[26] While this seems to be a workable definition, Professor Rosenfield notes that the definition is flawed because it will change with advances in technology.[27]

D. Outside the Atmosphere

Another "boundary" that has been proposed is the limits of the Earth's atmosphere. However, this is problematic because, depending on one's definition of "atmosphere," such a designation could range from thirty miles to thousands of miles.[28] As Dr. Seddon noted, designating "space" as being "outside the atmosphere"[29] creates a nebulous designation which "depends on how many air molecules you say is 'atmosphere' . . . it is all arbitrary."[30] Because of the widely varying interpretations of what constitutes the Earth's "atmosphere," to designate "space" as being the area beyond the Earth's atmosphere[31] does nothing to solve the current problem. Quite to the contrary, creating a definition which is vulnerable to such a wide variety of interpretations could exacerbate the problem. Therefore, to define space as being the area "beyond the atmosphere" is not an acceptable point at which to terminate State sovereignty.

---

[26] ICAO, International Standards and Recommended Practices, Annex 13 to the Convention on International Civil Aviation, *Aircraft Accident and Incident Investigation* (9th ed. July 2001).

[27] The information in this paragraph is indebted to Rosenfield, *supra* note 11, at 139 (*quoting* Convention on International Civil Aviation, Chicago, Dec. 7, 1944, 15 U.N.T.S. 295, at Annex 7).

[28] Rosenfield, *supra* note 11, at 138.

[29] *Id.* at 138.

[30] Seddon Interview, *supra* note 8.

[31] *See* Rosenfield, *supra* note 11, at 138.

E. Lowest Possible Orbit

Professor Rosenfield notes that the lowest possible orbit of a satellite has been offered as a possible designation for the upper "limit of state sovereignty."[32] In fact, the lowest possible orbit seems to have been an early proposal for defining space. General A.J. Goodpaster's memorandum concerning the launch of *Sputnik* states that, "the Russians have in fact done us a good turn, unintentionally, in establishing the concept of freedom of international space – this seems to be generally accepted as orbital space, in which the missile is making an inoffensive passage."[33] Interestingly, while the 1957 memorandum states that the "orbital space" was "generally accepted" to be "international airspace," this seems to be less accepted today than it was on the first day of space exploration.

Defining "space" as the lowest possible orbit would – under present technology – establish space as beginning approximately seventy-five to ninety miles above sea level.[34] However, as Professor Cooper's designation – with a fifteen mile variance – suggests, defining space as the lowest possible orbit, like many such definitions, is subject to change with advances in technology.[35] Nevertheless, this designation is advantageous in that it is a "natural criterion" on which to determine the lowest level of space.[36] In addition, as Professor Vladimir Kopal notes, this designation is workable because "[i]t reflects actual practice of States performing space flight and at the same time preserves legitimate interests of subjacent States."[37] The United States has long maintained that orbiting satellites are in "outer space;"

---

[32] *Id.* at 140 (*citing* U.N. Doc. A/ AC. 105 / C. 2/7 (May 7, 1970)).

[33] General A.J. Goodpaster, Memorandum of Conference with President Eisenhower Following Soviet Launch of *Sputnik* (Oct. 8, 1957), *in* ROGER BURNS, ALMOST HISTORY CLOSE CALLS, PLAN B'S, AND TWISTS OF FATE IN AMERICA'S PAST, 193-94 (Fall River Press 2000) [hereinafter Goodpaster].

[34] Kopal, *supra* note 13, at 155 (*quoting* Cooper, *Background of International Public Air Law*, 6 YB. AIR & SPACE L. 26-27 (1965)).

[35] Rosenfield, *supra* note 11, at 140.

[36] Kopal, *supra* note 13, at 172.

[37] *Id*. at 173.

this position gained general acceptance by the mid-1960s.[38] While defining "space" as the lowest possible orbit has many advantages, it is problematic because the lowest possible orbit may vary with advances in technology and is difficult to determine.[39]

F. Law of the Seas Model

In his thoughtful thesis, Major Dean N. Reinhardt, United States Air Force, suggests that the law of the seas model should be applied to determine "the vertical limit on State sovereignty."[40] Major Reinhardt states that the "vertical limit on State sovereignty" should be set at twelve nautical miles, which is twenty-two kilometers or 72,912 feet.[41] Major Reinhardt believes that such a "low limit" is advantageous because it will allow greater access to space.[42] Rejecting security concerns that may be raised against such a low limit on State sovereignty, Major Reinhardt asserts that the capabilities of modern day weapons nullify the benefits that a higher limit would afford.[43] Furthermore, Major Reinhardt believes that fostering greater access to space may actually have a positive impact on space security by giving more nations a vested interest in the security of space.[44]

G. Earth Entry Interface

One designated boundary that seems to have real significance and which seems to be tantamount to a real boundary in outer space is the "Earth Entry Interface."[45] The "Earth Entry Interface" is the point at which a space craft returning to Earth

---

[38] COLONEL DELBERT R. TERRILL, JR., THE AIR FORCE ROLE IN DEVELOPING INTERNATIONAL OUTER SPACE LAW 57 (Air University Press, Maxwell Air Force Base, Alabama 1999) (internal citation omitted).

[39] Rosenfield, *supra* note 11, at 140.

[40] Reinhardt, *supra* note 7, at 58, 65.

[41] *Id.*

[42] *Id.* at 39, 75.

[43] *Id.* at 68.

[44] SPACE SECURITY INDEX, SPACE SECURITY 2008, 80 (2008), *available at* http://spacesecurity.org/SSI2008.pdf.

[45] *See* Seddon Interview, *supra* note 8.

is considered to be reentering the Earth's atmosphere. The Earth Entry Interface is defined as 400,000 feet[46] (approximately seventy-six miles or 120 kilometers) because that is the point at which the space craft begins to experience "noticeable drag" of the Earth's atmosphere. This atmospheric resistance is manifested as heat produced on the spacecraft.[47]

Surprisingly, the Earth Entry Interface does not seem to have been formally proposed as a boundary between space and Earth (at least no person has used that term in defining his or her proposed boundary). Arguably, earlier proposals of defining space as the area outside of the atmosphere[48] is tantamount to defining space based on the Earth Entry Interface. However, the advantage of the Earth Entry Interface designation is that – unlike saying space is that area "outside the atmosphere,"[49] – the Earth Entry Interface has real significance. Like Kopal's proposal to set space as the lowest possible orbit of a satellite, the Earth Entry Interface is based on a "natural criterion" and should "remain constant for years to come notwithstanding the rapid progress in space technology."[50] Additionally, the Earth Entry Interface is tantamount to a real boundary in outer space. An even greater advantage is that the Earth Entry Interface is uniform across the globe and is easily discernable from the ground or by any spacecraft reentering the atmosphere,[51] and as the name implies, marks a change in the physics of the spaceflight.

III. CURRENT U.S. POLICY CONCERNING SPACE SOVEREIGNTY

While, as of this writing, President Obama has yet to articulate a firm space policy, given his stated opposition to space

---

[46] Columbia Accident Investigation Board, *Report Synopsis*, SPACEFLIGHT NOW, http://spaceflightnow.com/columbia/report/011synopsis.html (last visited Jan. 18, 2010).

[47] Seddon Interview, *supra* note 8; ROGERS, *supra* note 10, at 2-3.

[48] *See* Rosenfield, *supra* note 11, at 138.

[49] *See id*.

[50] *See* Kopal, *supra* note 13, at 171.

[51] *Id.* at 170.

weapons,[52] it can be assumed that the President will adopt a "freedom of access" posture. A November 2009 joint U.S.-China Joint Statement between President Obama and President Hu Jintao of the People's Republic of China suggests President Obama's space policy will be one of freedom of access, openness, and cooperation (at least as to China):

> The United States and China look forward to expanding discussions on space science cooperation and starting a dialogue on human space flight and space exploration, based on the principles of transparency, reciprocity and mutual benefit. . . The two sides believed (sic) that the two countries have common interests in promoting the peaceful use of outer space and agree to take steps to enhance security in outer space.[53]

Thus, if the U.S.-China Joint Statement is any indication, the Obama space policy will see greater access to space for a greater number of nations and more international cooperation than in past years.

The George W. Bush Administration also had a freedom of access posture, at least in theory. In his statement to the House Committee on Oversight and Government Reform, Subcommittee on National Security and Foreign Affairs, Major General James Armor, the former Director of the National Security Space Office of the Department of Defense articulated the American policy on space.[54]

Major General Armor explained that the United States takes the position that all States have a right of equal access to outer space for peaceful purposes and that no State can claim its territory extends into space:

---

[52] Glenn Reynolds, *Can Obama Ban Space Weapons Successfully?,* POPULAR MECHANICS (Oct. 1, 2009), http://www.popularmechanics.com/technology/military/4303139.

[53] Press Release, The White House, Office of the Press Secretary, U.S.- China Joint Statement (Nov. 17, 2009), http://www.whitehouse.gov/the-press-office/us-china-joint-statement.

[54] *Weaponizing Space: Is Current U.S. Space Policy Protecting Our National Security? Hearing before the Subcomm. on Nat'l Sec. & Foreign Affairs of the H. Comm. on Oversight & Gov't Reform,* 110th Cong. 32-33 (2007) (statement of Major General James Armor, Jr., Director, National Security Space Office of the Department of Defense [hereinafter Armor Testimony].

> The new Space policy, consistent with previous national Space policies, reaffirms longstanding policy principles, namely: the U.S. commitment to the use of outer Space by all nations for peaceful purposes; international cooperation; and continued adherence to existing international agreements regarding the use of outer Space. These principles also reaffirm that the United States rejects claims of sovereignty by any nation over outer Space and any limitations on the *fundamental right of the United States* to use or acquire data from Space, and the United States *retains the right of free passage* through and operations in Space without interference.[55]

General Armor makes clear that the United States does not recognize any claims of sovereignty in outer space and insists that the United States has a "inherent right" to use space.[56] Furthermore, his statement that the United States "retains the freedom of passage through and in space without interference" implies that the United States has always enjoyed such a right; a statement consistent with the policy of the Outer Space Treaty[57] that outer space is "the province of all mankind" and that all states shall enjoy an equal right of access to and use of space.[58]

America's policy of space for all does not mean that all actions in space will go unchecked by the United States. General Armor stated that the United States is prepared to counter other space actors who interfere with space capabilities:

> Consistent with these principles, the United States views purposeful interference with its space systems as an infringement on its rights and will take actions necessary to preserve its rights, capabilities, and freedom of action in space including denying, if necessary, adversaries the use of space capabilities hostile to U.S. national interests . . .

---

[55] *Id.*

[56] *Id.*

[57] Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, *opened for signature* Jan. 27, 1967, 18 U.S.T. 2410, 610 U.N.T.S. 205 [hereinafter Outer Space Treaty]

[58] *See* Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, art. 11, *opened for signature* Dec. 18, 1979, 1363 U.N.T.S. 21 [hereinafter Moon Agreement].

> The Secretary of Defense is charged with developing capabilities, plans, and options to ensure freedom of action in space, and if directed, to deny such freedom of action to adversaries.[59]

General Armor's statement demonstrates that the United States is sensitive to the vulnerability of its space assets. Furthermore, the General clearly states that the United States is prepared to prevent other parties from enjoying space capabilities that the United States perceives as "hostile."[60]

Significantly, though General Armor's statement concerns American space capabilities, and America's preparations to deny its enemies access to space, General Armor makes no attempt to define "space." He simply explains that the United States "rejects claims of sovereignty by any nation over outer space" but does not define "outer space."[61] This highlights Major Reinhart's concerns that the lack of a definition of outer space creates the potential for conflict.[62] A nation defining the limits of its sovereignty while attempting to avoid conflict with the United States is left simply to guess what the United States (or other nations) consider to constitute outer space. In order to avoid the potential for conflict, the international community must reach a concrete consensus on the meaning of outer space.[63]

IV. DESIRABILITY OF ESTABLISHING A DEMARCATION BETWEEN EARTH AND SPACE

Before setting out to establish a line defining the upper limits of Earth and of a State's control over its territory, policymakers must first determine whether establishing such a designation is advantageous or desirable. In the early days of spacefaring, even before humans had first ventured into space, governments showed reluctance – or even hostility – toward the idea of establishing a line between Earth and space. American officials

---

[59] Armor Testimony, *supra* note 54, at 33.
[60] *Id*. at 38.
[61] *Id.* at 33.
[62] Reinhardt, *supra* note 7, at 4.
[63] *Id*.

were particularly opposed to establishing such a limit. Policymakers did not want to fix an altitude above which a nation had no right to control objects "over" that nation's territory.[64]

United States Air Force officials voiced several justifications for their reluctance to allow such a limit to be established. The first such reason was that space technology was simply too young to be constrained by such agreements. In a 1958 Memorandum, Assistant Secretary of Defense for Internal Security Affairs, Mansfield D. Sprague, articulated the concern that America did not have enough information about the applicability of space technology to place restraints on it: "there is a real danger that we may harm ourselves by too early commitments, before the full implications of space potentials are known. Our policy and national interest should be permitted to develop first: the law, and commitments should follow, and be consonant with the former."[65] For Secretary Sprague, the United States should not close the door to space technologies before the door was even discovered.

The Department of Defense also discouraged the Department of State from adopting or agreeing to a "rigid definition of outer space" before the performance of a "detailed evaluation by *all* agencies concerned of possible consequences of such a definition to the US and its allies."[66] Highlighting the implications that such a definition may have on the development of unforeseen technologies, the statement concluded: "The proposed definition would establish a space floor which might at some future date be lower than the capabilities of very high flying aircraft."[67] The Department of Defense feared that establishing a boundary

---

[64] TERRILL, *supra* note 38, at 37-39, 54-59.

[65] *Id.* at 37 (*quoting* Outline, *Some Elements Requiring Consideration in Formulating a National Policy on Outer Space*, at 6, *attachment to* Mansfield D. Sprague, assistant secretary of defense, to assistant secretary of the Air Force et al., memorandum, subject: Proposal for a National Policy on Outer Space Feb. 25, 1958).

[66] *Id.* at 56 (*quoting* DOD Planning Luncheon, paper, United States Initiative at the 16th General Assembly, at 3 (Sept. 12 1961)) (emphasis added).

[67] *Id.* at 56 (*quoting* DOD Planning Luncheon, paper, United States Initiative at the 16th General Assembly, at 3 (Sept. 12, 1961)).

could have unforeseen consequences that would be revealed only with the advent of future technologies.[68]

In a 1962 memorandum to the Secretary of Defense, the Joint Chiefs of Staff opposed the establishment of a definition of outer space because they felt such a definition would be "premature" and would place unnecessary restraints on military uses of outer space.[69] Such concerns were not without historical foundation. American policymakers had likely learned from the mistakes of the Soviets who had to reverse their policies concerning sovereignty in outer space after the launch of *Sputnik*.[70]

The Assistant Judge Advocate General of the Air Force, Major General Moody R. Tidwell also believed that "it was unwise to attempt to define a line of demarcation where a nation's sovereignty ended."[71] General Tidwell believed that a discussion centered around the altitude of an object or activity was misplaced. For General Tidwell, the concern should be the *activities* carried out over a subjacent state, not the altitude at which the activities are executed.[72] General Tidwell wisely stated that the "agreement to any fixed distance" is meaningless "as long as an equal danger may exist from above such point."[73]

General Tidwell's focus on the function of the spacecraft rather than the craft's location begs the question whether a "vertical limit" of sovereignty is even necessary.[74] However, given the secretive nature of many satellites and other space objects, it seems unlikely that satellite-operating nations would

---

[68] *Id.* at 56 (*quoting* DOD Planning Luncheon, paper, United States Initiative at the 16th General Assembly, at 3 (Sept. 12, 1961)).

[69] *Id.* at 57 (*citing* Will H. Carroll, The Role of the Air Force JAG in the Early Development of the Law of Outer Space, at 7 (unpublished, n.d.)).

[70] *See* Reinhardt, *supra* note 7, at 19 (*citing* MYRES S. MCDOUGAL ET AL., LAW AND PUBLIC ORDER IN SPACE 235 (1963)) Ironically, many believe that the fact that the U.S.S.R. launched a satellite into outer space before the United States actually aided the American Space program in that it "establish[ed] the concept of freedom of international airspace." Goodpaster, *supra* note 33, at 193-95.

[71] TERRILL, *supra* note 38, at 54.

[72] *Id.*

[73] *Id.* at 54 (*quoting* Major General Moody R. Tidwell).

[74] *See also* Rosenfield, *supra* note 11, at 148 ("[a] definition of the geographic point where sovereign air space ends and free outer space begins may never need to developed").

be willing to disclose information about satellites and other space objects.

Even if States were willing to share information concerning the nature and missions of their spacecraft, verification of that information by other nations would be extremely difficult. Therefore, it is unlikely that a workable agreement based on the mission and function of the concerned spacecraft could ever be reached. In his history, Colonel Delbert R. Terrill notes that a 1967 letter between U.S. Military officials "concluded that making a distinction between civil and military satellite observations opened a Pandora's box."[75] Given that the United States has wisely declined to disclose significant information about its satellites, the United States cannot expect other nations to disclose such information. Therefore, it seems unlikely that a standard of State sovereignty based on the activities conducted over a State will be achieved.

Dr. Seddon suggested that there has been an intentional decision not to define "outer space."[76] The astronaut stated that the United States has "not been pushing for anyone to define [space] so there must be some reason; it either has no applicability or people do not want it defined for some reason."[77] Colonel Terrill's history provides evidence that the latter of Dr. Seddon's options is the answer.[78] It seems that, at least historically, U.S. Military officials have feared that defining "space" too early or too concretely could limit American options in this new frontier.[79]

The United States is not the only nation to express reservations about establishing a space boundary. In 1959, The Outer Space Committee of the British House of Lords discussed "what view they [should] take as to the jurisdiction of sovereign powers over outer space and whether this matter has been the sub-

---

[75] TERRILL, *supra* note 38, at 58.
[76] Seddon Interview, *supra* note 8.
[77] *Id.*
[78] *Id.* at 35-39, 54-59.
[79] *Id.*

ject of international discussion."[80] The Lord President of the Council (Lord Hailsham) explained that while there is most definitely a point at which British sovereignty terminates, not enough was known about space to establish that limit:

> My Lords, Her Majesty's Government consider that sovereignty over space above national territory cannot extend indefinitely upwards. . . however . . . International Law has [not] yet determined the exact limit to be placed on the extension of sovereignty upwards or what legal régime should apply in realms of outer space to which sovereignty does not extend. There are still too many unsolved problems in this field to justify the adoption at present of any sweeping legal propositions, in whatever direction they tend.[81]

England, as well as the United States, maintained that nations should not establish the "vertical limit of state sovereignty"[82] while space exploration was still in its infancy. Lord Hailsham's statement "there are still too many unsolved problems" to establish such a limit[83] suggests that Britain, like the United States, feared that to establish such a limit so early in the history of space exploration risked foreclosing opportunities before those opportunities were recognized.

While there has been a traditional reluctance to define space, the time has come to resolve this ambiguity. As Major Reinhardt notes, failing to define such a boundary creates the potential for conflict.[84] With an ever-increasing number of States – and now even some private actors[85] – joining the space community, the potential for conflict will only increase.[86] While we should certainly allow for flexibility so that the rules can

---

[80] OUTER SPACE COMMITTEE OF THE BRITISH HOUSE OF LORDS, 216 PARL. DEB., H.L. (June 11, 1959) § 975-7, at 53 *available at* http://hansard.millbanksystems.com/lords/1959/jun/11/outer-space [hereinafter OUTER SPACE COMMITTEE].

[81] *Id*.

[82] *See* Reinhardt, *supra* note 7.

[83] OUTER SPACE COMMITTEE, *supra* note 80.

[84] Reinhardt, *supra* note 7, at 4, 14, 76.

[85] *See generally* MICHAEL BELFIORE. ROCKETEERS: HOW A VISIONARY BAND OF BUSINESS LEADERS, ENGINEERS AND PILOTS IS BOLDLY PRIVATIZING SPACE (Harper Collins 2007); Reinhardt, *supra* note 7, at 25.

[86] *See* Reinhardt, *supra* note 7, at 4, 14, 76.

adapt with evolving technology, we now have enough information, and know enough about space capabilities and potential, that such an agreement is no longer "premature." [87] The international community must reach a consensus as to the maximum extent of a State's control over its airspace.

V. IMPLICATIONS OF THE CHINESE ANTI-SATELLITE TEST

The Chinese ASAT test of 11 January 2007 shed new light on the old problem of the lack of rules for space. With China on the cusp of superpower status, "the test appears to mark a new sphere of technical and military competition."[88] The test (that was almost certainly intended as a warning to the United States[89]) is particularly concerning because the weather satellite hit by the weapon orbited further from Earth than American spy satellites do.[90] China has long openly expressed an interest in the ability to attack American space capabilities; as early as 2000, *Chinese State News* reported that the Chinese military was creating new methods to counter American space assets.[91] With its ASAT test, China has presumably demonstrated the capability to destroy American spy satellites.[92] Because some Chinese assert that their country's sovereignty extends into outer space, this capability is particularly concerning.[93]

Commenting on China's claim of sovereignty over space, Air Force General Ted Kresge maintained that Chinese claims of sovereignty were "illegitimate" because of international trea-

---

[87] TERRILL, *supra* note 38, at 56.

[88] Broad and Sanger, *supra* note 5.

[89] *See* Zissis, *supra* note 3, at 1-2.

[90] Broad and Sanger, *supra* note 5.

[91] REPORT OF THE COMMISSION TO ASSESS UNITED STATES NATIONAL SECURITY SPACE MANAGEMENT AND ORGANIZATION 22-23 (Jan. 11, 2001), *available at* http://www.fas.org/spp/military/commission/report.htm [hereinafter REPORT OF THE COMMISSION].

[92] Broad and Sanger, *supra* note 5.

[93] Bill Gertz, *U.S. Satellites dodge Chinese missile debris*, THE WASHINGTON TIMES, Jan. 11, 2008, *available at* http://www.washingtontimes.com/news/2008/jan/11/us-satellites-dodge-chinese-missile-debris/; *Disharmony in the Spheres – The Militarization of Space, The Vulnerability of Military Satellites,* THE ECONOMIST, Jan 19, 2008, *available at* http://www.economist.com/displaystory.cfm?story_id=10533205 [hereinafter *Disharmony in the Spheres*].

ties.[94] General Kresge continued that if China intends to "enforce" those claims "we run into a space protection problem, and that is why we are so aggressively working the issue."[95] The Chinese ASAT test makes America's "aggressive" work on this issue all the more urgent.

The urgency of the Chinese ASAT test issue is due largely to the fact that space-based technology is a critical component of American military and economic supremacy.[96] While these capabilities allow the United States to achieve its unprecedented power, America's extensive reliance on space-based technology creates an "Achilles heel," which is vulnerable to any party able to launch an object into space.[97] General Armor warned that, "space is a critical enabler for U.S. forces . . ., and potential adversaries *have and will* continue to seek capabilities to counter this advantage."[98]

Particularly concerning to United States military officials is that they do not know how to interpret the Chinese ASAT Test. The Chairman of the Joint Chiefs of Staff, Marine General Peter Pace explained that the ASAT test concerned "the international community" primarily because, "it was [not] clear what their intent was . . . when things are not clear, and there are surprises, then it tends to confuse people and raise suspicions."[99] General Pace continued that while it is not necessary for nations to "agree or disagree with any particular country's objective . . . it [is] very helpful to understand what those objectives are and why they [are] going in that direction."[100] General Pace suggested the establishment of "officer exchanges" between the two nations.[101] Highlighting the necessity for open communication and understanding between the two powers, General Pace

---

[94] Gertz, *supra* note 93.

[95] *Id.* and accompanying text (*quoting* General Ted Kresge).

[96] Armor Testimony, *supra* note 54, at 32-33; *See generally*, *Disharmony in the Spheres*, *supra* note 93

[97] *Disharmony in the Spheres*, *supra* note 93.

[98] Armor Prepared Statement, *supra* note 54, at 39.

[99] Ben Blanchard, *U.S. general says China missile test "Confusing"*, REUTERS, Mar. 23, 2007, *available at* http://www.reuters.com/article/idUSPEK17108920070323 (*quoting* General Peter Pace).

[100] *Id.*

[101] *Id.*

stated, "[t]he biggest fear I have of the future is miscalculation, misunderstanding based on misinformation."[102] While the capability demonstrated by the ASAT test is sobering, the ambiguous motivation for the test is terrifying.

General Pace is not the only American official concerned about "miscalculation." General Armor explained that China is building a variety of anti-space capabilities. The General continued that, "[t]he lack of transparency into China's . . . overall intentions is most troubling as it could lead to miscalculation of intent and crisis instability."[103] General Armor's statement shows the need for a determination of space. Because China has a demonstrated ability to control outer space, the United States must reach an agreement as to how much of outer space China intends to control – or will be permitted to control – under established principles of international law so that the United States can conduct our space activities accordingly. If China and the United States are not clear as to each other's sovereign claims, this could lead to "miscalculation" and conflict.[104]

One particularly concerning aspect of Chinese space policy is that China does not appear to have a unified space policy. While the Chinese government claims that its sovereignty extends to *all* space above Chinese territory[105] a white paper issued by the China National Space Administration in 2006 insists that "China is unflinching in taking the road of peaceful development, and always maintains that outer space is the common wealth of mankind."[106] The same white paper states that "[a]dhering to the policy of opening up to the outside world, and actively engaging in international space exchanges and cooperation. [sic] China supports all activities that utilize outer space for peaceful purposes."[107] While this statement suggests

---

[102] *Id.* (*quoting* General Peter Pace).

[103] Armor Testimony, *supra* note 54, at 41.

[104] *See id.*; Reinhardt, *supra* note 7, at 4, 14, 76.

[105] Gertz, *supra* note 93 (emphasis added).

[106] Information Office of the State Council of the People's Republic of China, China National Space Administration, *China's Space Activities in 2006*, 1, *available at* http://www.fas.org/spp/guide/china/wp2006.pdf.

[107] *Id.* at 3.

that China supports an "freedom of access" policy, it conflicts with China's stated claims of infinite "vertical sovereignty."[108]

In addition to the contradictions between China's statements and actions, there is concern that the various branches of the Chinese government may not be communicating adequately. The delay between China's ASAT test and the government's confirmation of that test caused some to theorize that China's civilian government and military leaders had not been in adequate communication with each other.[109] Such fears, if true, are particularly alarming. If transparency of action is important between powers, it is essential within a power.[110]

As General Pace's statements suggest, the United States believes that transparency is vital, particularly in the realm of space. In a media roundtable discussion, Secretary of Defense Robert Gates explained that the United States ASAT test was a "very different activit[y]" from the Chinese ASAT test.[111] Secretary Gates explained that the primary differences were that the United States was "open and transparent" about its test, conducted its test at a lower orbit so as to mitigate the creation of debris, and that the United States conducted the test in order to protect human beings from harm by the malfunctioning satellite:

> First of all, we were very open and transparent from the very beginning about the problem that we saw and that we were going to try and modify the software in some of our missile defense capability in order to be able to deal with this threat. Our view was however remote the possibility that this hydrazine tank[112] might harm people here on Earth that the only responsible thing was to try and deal with the problem. We were very open about it. We hit this dead satellite in a very low orbit so that the debris was very limited and would decay and burn up in the atmosphere within a matter of hours to days or weeks.

---

[108] *See* Gertz, *supra* note 93.

[109] Zissis, *supra* note 3, at 1.

[110] *See* Blanchard, *supra* note 99.

[111] Defense Link News Transcript, Media Roundtable with Sec'y of Def. (Feb. 27, 2008), *available at* http://www.defenselink.mil/transcripts/transcript.aspx?transcriptid=4161 (quoting Sec'y of Def. Robert Gates) .

[112] A toxic fuel used to power the satellite.

> The Chinese anti-satellite test was conducted in secret, never explained to anyone, was carried out at an altitude several hundred miles higher than ours and led to a significant debris field that will be in orbit for decades. So I think that there is a significant difference between what we did and the way we approached it and the Chinese anti-satellite test last year.[113]

For Secretary Gates, the American and Chinese ASAT tests are completely different due to the manner in, and the circumstances under, which they were carried out.[114] Like General Pace, Secretary Gates stressed the openness with which the United States conducted its test as the key difference between the American and Chinese ASAT tests.[115] Furthermore, the high altitude of the Chinese test creates a long-lasting debris field: an act not consistent with responsible space citizenship.[116]

As Secretary Gates' statement implies, an ASAT test does not have to directly target or strike an American satellite to effect American space-based interests.[117] The Chinese ASAT tests created a "debris field" in the orbit of some 800 satellites (between 300 and 400 of which are American) satellites.[118] The American satellites alone are valued at approximately $100 billion.[119] The debris is no passing threat; the single Chinese ASAT test added twenty percent more space debris which will remain in orbit for as much as 100 years.[120]

The debris problem demonstrates than an ASAT test does not have to directly impact a nation's satellite to have an impact on the nation. As of 11 January 2008, two U.S. satellites had to alter their orbits to prevent becoming cosmic "road kill."[121]

The debris created by the Chinese ASAT test, and the impact it is having on other nations' space activities demonstrate the need for a clear consensus of sovereignty in space. If China,

---

[113] Defense Link News Transcript, *supra* note 111.
[114] *Id.*
[115] *Id.*
[116] *Id.*
[117] *Id.*
[118] Zissis, *supra* note 3, at 3; Gertz, *supra* note 93.
[119] Zissis, *supra* note 3, at 3.
[120] Gertz, *supra* note 93.
[121] Zissis, *supra* note 3, at 3 (*quoting* Michael Krepon and Michael Katz-Hyman of the Henry L. Stimson Center). Gertz, *supra* note 93.

or other nations, continue to operate in space with such reckless disregard for the welfare of other States – aided no doubt by the Chinese belief that they are sovereign over their territory[122] – then their actions will continue to have a negative impact on the space operations of other States. The international community must reach a clear resolution concerning sovereignty in space to prevent similar acts in the future.

VI. SPACE TERRORISM

America's reliance on space has caused the United States to "identify space capabilities as a top national priority and vital to U.S. National interests."[123] The *Report of the Commission to Assess United States National Security Space Management and Organization* called attention to the gravity of the threat. The Report warned that the United States is "an attractive candidate for a 'Space Pearl Harbor'"[124] and could fall victim to such an attack if it fails to "take seriously the possibility of such an attack on US Space Systems."[125] As the chaos caused by the Chinese ASAT test shows, a party does not have to be able to accurately target the satellite in order to destroy it. Due the "predictable orbit" of satellites, one only has to release "a cloud of 'dumb' pellets in [a satellite's] path – using a shotgun rather than a hunter's rifle to kill the orbiting 'bird.'"[126] Therefore, while China has demonstrated its ability to destroy a particular, targeted satellite, any party with the ability to place an object into orbit poses a potential threat to satellites and therefore to the United States.

Ten nations and two commercial entities have demonstrated capabilities to place satellites into orbit.[127] It is widely known that any object in space can become a space weapon.[128] Thus, any entity – including non-State actors – which have the

---

[122] *See* Gertz, *supra* note 93.
[123] Armor testimony, *supra* note 54, at 57.
[124] REPORT OF THE COMMISSION, *supra* note 91, at 22.
[125] *Id.* at viii-ix.
[126] *Disharmony in the Spheres*, *supra* note 93.
[127] *Id.*
[128] *Id.*

capability to "reach space" have the potential to challenge this key component of American military supremacy.[129]

Using history as a guide, it is clear that technology becomes rapidly cheaper and more widely available with the progression of time. With the 1957 launch of *Sputnik*, it would have been inconceivable that a non-State actor would be able to achieve orbit. Now, at least two commercial entities have demonstrated this capacity.[130] In addition, for a cost of $25 million, the privately developed and owned *SpaceShipOne* successfully put the equivalent weight of three people into suborbital "space" (for the purposes of the *X-Prize*) when it reached an altitude of 367,463 feet (69.6 miles or 112 km).[131] Space is no longer the domain of superpowers; it is not even reserved for State actors. Even private entities have joined the "elite club" of spacefarers.

While *SpaceShipOne* did not achieve an altitude sufficient to pose a direct threat to any orbiting satellite, the accomplishment should raise eyebrows. If a $25 million, privately-funded program, nearly five years ago, demonstrated the capability to propel the equivalent of three human beings to such a height, what capabilities might such private actors have today? Which capabilities might they achieve in the future?

As previously stated, at least two commercial entities have achieved orbit, which gives them the capability to compromise American space assets.[132] Control of these corporate entities could become a matter of national – if not *international* – security. Al-Qaeda and other terrorist organizations are devoted to destroying the United States. Through their actions, these terrorist organizations have proven that they will stop at nothing to inflict damage upon the United States. With non-State actors achieving space capabilities, the age of "space terrorism"[133] may be a future risk.

---

[129] *Id.*
[130] *Id.*
[131] Reinhardt, *supra* note 7, at 25.
[132] *Disharmony in the Spheres*, *supra* note 93.
[133] Gerry Oberst, *Protecting Satellites from "Space Terrorism",* SATELLITE TODAY, Mar. 1, 2009, http://www.satellitetoday.com/via/globalreg/29927.html

The threat posed by the prospect of "space terrorism"[134] should not be overlooked. This author's research did not reveal any government sources predicting such a threat; the prospect appears to be largely ignored. Aside from a report by the European Space Policy Institute stating that the prospect is not getting enough attention, the possibility appears to be largely ignored.[135]

The effects of "space terrorism"[136] would hold the potential to be more spectacular than any act of terrorism the world has ever seen.[137] Due to modern society's heavy reliance on satellite technology, interference with satellite "constellations" could disrupt military operations (particularly those of the United States) and "essential daily functions – from financial transactions to telephone communication to power grids . . ."[138] Commenting on the Chinese ASAT test, Professor William C. Martel explained that the destruction of American satellites could cause the United States to "be propelled back into the nineteenth century."[139] Professor Martel's statement should not be dismissed as alarmist. Even a single satellite attack could have wide sweeping implications. In 1998 one American satellite malfunctioned causing many television video feeds to be lost and eighty percent of pagers in the United States to lose service.[140] Technicians took several weeks to completely restore service.[141]

With more and more States becoming increasingly reliant on space and space assets for their economic and defense operations, States will view space as essential to their national security.[142] This increasing reliance on space will create a greater incentive to protect one's own space assets. Furthermore, the

---

[134] *Id.*

[135] Oberst, *supra* note 133.

[136] *Id.*

[137] *Id.*

[138] Zissis, *supra* note 3, at 2.

[139] *Id.* (*quoting* William C. Martel, "a professor of international security studies at the Fletcher School of Law and Diplomacy and a former member of the U.S. Air Force Scientific Advisory Board").

[140] REPORT OF THE COMMISSION, *supra* note 91, at 22.

[141] *Id.*

[142] SPACE SECURITY INDEX, *supra* note 44, at 63, 67, 136.

increasing importance of space assets will increase the incentive to develop the ability to neutralize the space assets of one's adversaries. In addition, those non-State actors (e.g. terrorists) will view space assets as an increasingly attractive target due to the impact such an action would have on the targeted State or States. Conflicts concerning sovereignty in space will only fuel the flames of disputes concerning the security of space assets. In order to prevent such conflicts, the global community must agree upon an elevation at which the sovereignty of nations terminates.

VII. CONCLUSION

Surprisingly, humankind has been exploring space for over half of a century without yet defining where "space" begins and where the Earth's airspace, and therefore a nation's sovereignty "ends." Even more surprising is that this lack of a definition of the extent of national sovereignty has not sparked any significant international conflict. However, this good fortune cannot reasonably be expected to continue. The world's increasing reliance on space will create a greater incentive to protect one's own space assets. In addition, the increasing importance of space assets will also create a greater incentive for nations and non-State actors to develop the potential to neutralize the space assets of other nations.[143] As the international uproar caused by the Chinese ASAT test demonstrates, the desire to protect one's own space assets while developing the ability to neutralize others' space assets creates the potential for conflict. This potential for conflict will only be exacerbated if there is not an agreement as to the "vertical extent" of the sovereignty of the subjacent nations.[144] As space assets become increasingly integrated into national economic systems and military defenses, space will become an increasingly attractive battleground.[145] The potential

---

[143] *Id.*
[144] *See* Reinhardt, *supra* note 7, at 4, 14, 76.
[145] SPACE SECURITY INDEX, *supra* note 44, at 63, 67, 136.

for a conflict in space will only be increased if there is no clear definition of the extent of a State's sovereignty.[146]

While it is essential that the global community come to a consensus on the "vertical limit of State sovereignty,"[147] reaching such a consensus will be a difficult task. Because space is a continuum, there is no clear physical boundary which could be established as the end of the Earth's airspace.[148] However, as stated above, there are a number of different elevations and designations in the "continuum" of the atmosphere[149] which have been suggested as the boundary between Earth's airspace and space and therefore the upper extent of State sovereignty.

The most logical boundary to establish as the "vertical limit of State sovereignty"[150] is 400,000 feet, a number based on astronaut Rhea Seddon's proposal: the Earth Entry Interface. This limit should be defined and established as the static elevation of 400,000 feet above sea level. To define the limit simply as the Earth Entry Interface would be unwise, as a limit so defined would be open to interpretation and could change with advances in technology or changes in the climate. Basing a limit on the Earth Entry Interface is the most attractive designation to establish as the upper extent of State sovereignty. The Earth Entry Interface is tantamount to a physical boundary and is presently detectable in space.[151] Furthermore, ground-based systems can easily verify the altitude of an object to determine whether the sovereignty of a State has been violated. It has many of the characteristics of a boundary because it has a physical impact on objects that encounter it (the drag of the atmosphere and the heat produced on the space craft).[152] As the name implies, the Earth Entry Interface is a point at which it is logical to say an object has "entered" the Earth's atmosphere. As nations are considered to be Earthly entities, it is only logical that they should extend to the outer limit of the Earth's atmos-

---

[146] Reinhardt, *supra* note 7, at 4, 14, 76.
[147] *See generally id*.
[148] *See* Seddon Interview, *supra* note 8.
[149] *See id*.
[150] *See* Reinhardt, *supra* note 7.
[151] *See* Seddon Interview, *supra* note 8.
[152] *Id.*; ROGERS, *supra* note 10, at 2-3.

phere. While this paper proposes establishing the altitude of 400,000 feet as the extent of State sovereignty, the fact that this altitude is based upon the Earth Entry Interface should allow the established altitude of 400,000 feet to enjoy the same benefits of logic afforded to the Earth Entry Interface.

The inherently logical nature of the Earth Entry Interface should make it more likely to be accepted by other nations. Because the Earth Entry Interface is a number based on real significance, rather than an arbitrary number selected with no independent importance, it should be easier to convince other nations to agree to it. Furthermore, it is a high enough elevation that it will not have to be adjusted to allow for underlying geographical features.[153]

In addition to being logical, the Earth Entry Interface is also practical. The fact that it is far higher than any conventional aircraft can fly[154] should help to assuage many security concerns from over flight. However, the standard would infringe minimally, if at all, on the lowest possible orbit.[155] Therefore, it is a level high enough to prevent over flight by conventional aircraft while low enough that it would not significantly interfere with space activities. The Earth Entry Interface is high enough, without being too high.

The need for a clear definition of the upper limit of State sovereignty will only become more urgent. With space assets becoming increasingly important, space is becoming an increasingly attractive battlefield.[156] This battlefield will attract not only State actors, but also terrorists.[157] Nations can be expected to execute at least those actions which they feel are necessary to protect their national interests. Each State will likely do everything in its power to prevent threats to its interests from persisting in what the State considers to be its sovereign domain. A failure to establish an international standard defining the

---

[153] *See* Reinhardt, *supra* note 7, at 65.

[154] Rosenfield, *supra* note 11, at 139.

[155] Kopal, *supra* note 13, at 155 (*quoting* Cooper, *Background of International Public Air Law*. 6 YB. AIR & SPACE L. 26-27 (1965)).

[156] SPACE SECURITY INDEX, *supra* note 44, at 63, 67, 136; REPORT OF THE COMMISSION, *supra* note 91, at 22; Oberst, *supra* note 133.

[157] Oberst, *supra* note 133.

altitude termination of State sovereignty will create the potential for conflict.[158] With space becoming increasingly important – not only to the security of nations, but also in the day-to-day lives of people across the globe – and the looming threat of space terrorism,[159] the need for a clear definition of the extent of State sovereignty has never been more acute.

---

[158] Reinhardt, *supra* note 7, at 14, 76.

[159] SPACE SECURITY INDEX, *supra* note 44, at 63, 67, 136; REPORT OF THE COMMISSION, *supra* note 91, at 22; Oberst, *supra* note 133.

THE MARCH OF SCIENCE: FOURTH AMENDMENT IMPLICATIONS ON REMOTE SENSING IN CRIMINAL LAW

*Surya Gablin Gunasekara**

The government's use of technology must be weighed in the Fourth Amendment balance not because the Constitution constrains the government to employ antiquated surveillance techniques but because the march of science over the course of this century has time and again laid bare secrets that society had (erroneously) assumed to lie safely beyond the perception of government.[1]

INTRODUCTION

Technology has become entrenched in society and it has permeated through every aspect of our lives. Its application in law enforcement is no exception, and agencies across the United States have consistently developed new and improved ways of fighting crime. In particular, the use of satellite technology, a method of remote sensing,[2] has become a viable law enforcement tool. Satellite sensors can now penetrate through cloud cover and forest canopies, and also have the ability to track human movements on the ground.[3] Currently, the images produced by satellites are being used by law enforcement agencies to identify

---

* B.A., University of Colorado-Boulder, 2004; M.R.L.S., University of Denver-Strum College of Law, 2006; J.D., University of Mississippi School of Law, 2010. This article was produced through a research scholarship provided by the National Center for Remote Sensing, Air and Space Law. The author would like to thank his family for all their love and support, as well as dedicate this piece to memory of Kenneth and Dorthy Gablin.

[1] United States v. Cusumano, 83 F. 3d 1247, 1261 (10th Cir. 1996) (McKay, J., dissenting).

[2] For the purposes of the article remote sensing shall be defined as "the science and art of obtaining information about an object, area, or phenomenon through the analysis of data acquired by a device not in contact with the object, area or phenomenon under investigation." *See* THOMAS LILLES & RALPH KIEFER, REMOTE SENSING AND IMAGE INTERPRETATION 1 (1994).

[3] Robert Block, *U.S. to Expand Domestic Use of Spy Satellites*, WALL ST. J., Aug. 15, 2007, *available at* http://online.wsj.com/article/SB118714764716998275.html.

agricultural fraud,[4] observe environmental infractions,[5] and catch producers of illegal drugs.[6] The potential applications of satellite imaging, however, are virtually unlimited. For example, such uses could include: monitoring suspected criminals, analyzing crime scene patterns, and assessing local natural disaster damage.[7]

The difficulty with the evolution of law enforcement technology is how to apply existing law to new developments, while maintaining an acceptable level of privacy. Although the U.S. Supreme Court has upheld the validity of aerial surveillance of private property by law enforcement aircraft without a warrant, no court has applied these decisions with regard to the use of satellite technology.[8] Furthermore, the Court has restricted law enforcement technology to that which is in general public use, so it is difficult to conclude with any certainty how a court will treat the use of satellite remote sensing by law enforcement.[9]

This article will attempt to resolve the potential constitutional issues that may arise as satellite imaging and remote sensing technologies become a mainstream part of modern law enforcement. Section I examines how the Fourth Amendment has attempted to keep pace with technology. Section II details the application of remote sensing in law enforcement, as well as the constitutionality of employing certain technologies. Section III provides a glimpse into how the Supreme Court of Canada has dealt with remote sensing employed in law enforcement activities. Finally, section IV analyzes the status of the Fourth Amendment today and how it should be applied to the use of remote sensing and satellite technology in criminal law in the future.

---

[4] *See* United States v. Fullwood, 342 F.3d 409 (2003).

[5] *See* Dow Chem. Co. v. United States, 476 U.S. 227 (1986).

[6] *See* California v. Ciraolo, 476 U.S. 207 (1986); Florida v. Riley, 488 U.S. 445 (1989); Kyllo v. United States, 533 U.S. 27 (2001); United States v. Garcia, 474 F. 3d 994 (2007).

[7] Block, *supra* note 3.

[8] *Id*.

[9] *Kyllo*, 533 U.S. at 40 ("Where, as here, the Government uses a device that is not in general public use, to explore details of the home that would previously have been unknowable without physical intrusion, the surveillance is a 'search' and is presumptively unreasonable without a warrant.").

I. THE FOURTH AMENDMENT AND TECHNOLOGY

The Fourth Amendment guarantees freedom from unreasonable searches by providing that:

> [t]he right of the people to be secure in their persons, houses, papers, and effects, against unreasonable searches and seizures, shall not be violated, and no Warrants shall issue, but upon probable cause, supported by Oath or affirmation, and particularly describing the place to be searched, and the person or things to be seized.[10]

More than a century after the ratification of the Bill of Rights the Supreme Court articulated the scope of the Fourth Amendment.[11] Whereas early court decisions relied on a property-based rationale, the Fourth Amendment was only applied where there was a physical invasion of property.[12]

The application of the Fourth Amendment based upon physical intrusion is exemplified by the Supreme Court's decision in *Olmstead v. United States*.[13] In *Olmstead* the defendants were convicted of conspiracy to violate the National Prohibition Act.[14] The evidence, which led to the discovery of the conspiracy, was largely based on wiretapped conversations between the defendants by four government agents.[15] The government agents, without trespassing, inserted small wires along the telephone lines and testified as to the criminal content of the conversations they overheard.[16]

The Supreme Court found that the purpose of the Fourth Amendment "was to prevent the use of governmental force to search a man's house, his person, his paper and his effects; and

---

[10] U.S. CONST. amend. IV.

[11] James J. Tomkovicz, *Technology and the Threshold of the Fourth Amendment: A Tale of Two Futures*, 72 MISS. L.J. 317, 327 (2002) (*citing Boyd v. United States*, 116 U.S. 616 (1886)).

[12] Reginald Short, *The Kyllo Conundrum: A New Standard to Address Technology that Represents a Step Backward for the Fourth Amendment Protections*, 80 DENV. U. L. REV. 463, 466 (2002).

[13] 277 U.S. 438 (1928).

[14] *Id*. at 455.

[15] *Id*. at 456.

[16] *Id*. at 456 – 57.

to prevent their seizure against his will."[17] The Court ultimately concluded that the wiretapping did not constitute a search or seizure, since there was no taking of "tangible material effects" or "physical invasion" of a home, property or "curtilage."[18] *Olmstead* marks the first case in a series where the Court's decisions were predicated by government officials' exploitation of advances in technology.[19]

The ruling in *Olmstead,* requiring physical intrusion for a Fourth Amendment violation, prevailed for almost forty years. In 1967, however, the *Olmstead* doctrine was essentially overruled by the Supreme Court in *Katz v. United States*.[20] The Court in *Katz* recognized that privacy was not rooted in physical property but rather the Fourth Amendment protected "people, not places."[21] The petitioner in *Katz* was charged on eight counts of "transmitting wagering information by telephone from Los Angeles to Miami and Boston in violation of a federal statute."[22] At trial the government introduced evidence of telephone conversation, which FBI agents had recorded using a listening device.[23] The eavesdropping machine was attached to the outside of a public phone booth, from which Mr. Katz placed his calls.[24] The Supreme Court declined to address whether the petitioner had a right to privacy in a public phone booth, under the Fourth

---

[17] *Id*. at 463.

[18] *Id*. at 466.

[19] Tomkovicz, *supra* note 11, at 334, *see Goldman v. United States*, 316 U.S. 129 (1942) (holding a detectaphone placed against a shared wall to amplify conversations did not constitute a Fourth Amendment search); *On Lee v. United States*, 343 U.S. 747 (1952) (finding that conversations recorded by a wired narcotics agent did were not a Fourth amendment search since there was no physical invasion required by the *Olmstead* doctrine); *but see Silverman v. United States*, 365 U.S. 505 (1961) (concluding that eavesdropping accomplished by means of an electronic device that penetrated the premises occupied by the petitioner was in violation of the Fourth Amendment).

[20] 389 U.S. 347 (1967), *see also id*. at 362 (Harlan, J., concurring) ("[T]oday's decision must be recognized as overruling *Olmstead v. United States*, which essentially rested on the ground that conversations were not subject to the protection of the Fourth Amendment.").

[21] *Id*. at 351.

[22] *Id*. at 348.

[23] *Id*.

[24] *Id*.

Amendment, based upon property rights.[25] Rather, the Court found what a person knowingly exposes to the public is not protected, however, what a person seeks to keep private even in a public area, may be protected.[26] Thus, the Court concluded that a private conversation recorded by government agents constituted a search requiring Fourth Amendment protections.[27] This decision represented a shift in Fourth Amendment jurisprudence away from a protected area towards a protected person.[28]

While the plurality opinion in *Katz* made progress in protecting Fourth Amendment rights in the wake of technology, Justice Harlan's concurrence provided the test for constitutionality. The two-prong test required: "first that a person have exhibited an actual (subjective) expectation of privacy and, second, that expectation be one that society is prepared to recognize as 'reasonable.'"[29] The subjective nature of the first prong has been widely dismissed,[30] however, the second prong "has come to reflect a balancing test between the needs of law enforcement and the importance of the individual interest threatened."[31] For example, if society holds that there is a lower threshold of privacy in a particular area, then the scope of invasiveness may be allowed to increase.[32] The test in *Katz* has been employed by the courts as technology advanced to balance the investigative ne-

---

[25] *Id*. at 350 ("In the first place the correct solution of Fourth Amendment problems is not necessarily prompted by incantation of the phrase 'constitutionally protected areas.'").

[26] *Id*. at 351 ("What a person knowingly exposes, even in his own home or office, is not a subject of Fourth Amendment protections. But what he seeks to preserve as private, even in an area accessible to the public, may be constitutionally protected.").

[27] *Id*. at 353.

[28] Short, *supra* note 12, at 467.

[29] *Katz*, 389 U.S. at 361 (Harlan, J., concurring).

[30] *See* Short, *supra* note 12, at 468 (Justice Harlan appeared to reject the first prong of his *Katz* test in *United States v. White*). *See also*, *United States v. White,* 401 U.S. 745, 786 (1971) (Harlan, J., dissenting) (explaining that legal analysis must "transcend the search for subjective exceptions or legal attribution of assumptions of risk. Our expectations, and the risks we assume, are in large part reflections of laws that translate into rules the customs and values of the past and present.").

[31] *Id*.

[32] *Id*. at n. 44 (*comparing United States v. Ross*, 465 U.S. 798, 811 (1982) (noting that expectations of privacy in personal luggage and other closed containers must be substantially greater than in the area of an enclosed automobile), *with Arkansas v. Sanders*, 442 U.S. 753 (1979) (noting if the personal luggage is found in a car, the expectation of privacy must correspondingly be less)).

cessity with individual's rights. It would, however, be years until the Forth Amendment and the *Katz* test would be applied to remote sensing.

II. REMOTE SENSING IN LAW ENFORCEMENT

It is undeniable that surveillance technology has vastly improved over the course of this century. These technological improvements have given the government and law enforcement agencies the tools to investigate criminals, but they have also created legal conundrums for courts as they attempt to determine how new technologies should be constrained by the Fourth Amendment.[33] Some of these remote sensing technologies involve devices which allow the government to gather information that would otherwise be impossible to detect.[34] In recent years, the use of aerial surveillance, thermal imaging, and satellite imaging have emerged as methods of modern law enforcement, and the courts have struggled to reconcile these technologies with the sphere of privacy.

A. Aerial Surveillance

In the past three decades law enforcement officials have used warrantless aerial surveillance to identify criminal activities, from drug production[35] to environmental infractions,[36] and the Supreme Court has time and again found these observations to be constitutionally permissible. Beginning with *California v. Ciraolo*, the Court examined a case where police officers, acting on a tip, used a plane to fly over the defendant's home and photograph the defendant's backyard where he was growing marijuana.[37] Police were unable to observe the marijuana from the

---

[33] Ric Simmons, *Why 2007 is Not Like 1984: A Broader Perspective on Technology's Effect on Privacy and Fourth Amendment Jurisprudence*, 97 J. CRIM. L. & CRIMINOLOGY 531, 541 (2007).

[34] *Id.* at 541 – 42 (noting that "[i]on scanners can be waved over any surface to detect the presence of drugs or explosives; airplanes fly over our fenced-in fields, allowing law enforcement agents to view our backyards; and satellites in space can take pictures of these backyards with a stunning level of detail.").

[35] *See Ciraolo*, 476 U.S. 207; *see also Riley*, 488 U.S. 445.

[36] *Dow Chem. Co.*, 476 U.S. 227.

[37] *Ciraolo*, 476 U.S. at 209.

ground level, as the backyard was obstructed by a 6-foot high outer fence and a 10-foot high inner fence.[38] Instead the officers procured a private plane to fly in navigable airspace over the defendant's backyard at an altitude of 1,000 feet; the officers readily identified marijuana plants 8 to 10 feet high and photographed the area with a standard 35mm camera.[39] Based upon the officers' observations and the anonymous tip, a warrant was executed and 73 marijuana plants were seized.[40]

Applying the two part test in *Katz*, the Court held that the defendant's Fourth Amendment rights had not been violated by the observations of his curtilage, since the backyard was visible to anyone traveling at such an altitude.[41] Applying the first prong stipulated in *Katz*, the Court was not entirely clear whether the defendant manifested a subjective expectation of privacy from all surveillance of his backyard.[42] Therefore, the Court turned to the second prong and found that because the defendant knowingly exposed his backyard to observation from navigable airspace, he did not have a reasonable expectation of privacy.[43] Specifically, "[t]he Court found it important that the plane was traveling at an altitude that was within navigable airspace and that the marijuana plants could be seen from that altitude with the naked eye."[44] As a result, the Court found that the police observations did not violate the Fourth Amendment.[45] The Court, however, did not address the constitutionality of using the photograph as an exhibit, since the warrant was sup-

---

[38] *Id.*

[39] *Id.*

[40] *Id.* at 209 – 10 (It should be noted that the photograph was attached to the officers' affidavit as an exhibit and was not the basis of the warrant.)

[41] *Id.* at 211 -216 (Curtilage is defined as "the area to which extends the intimate activity with the 'sanctity of a man's home and the privacies of life.' ").

[42] *Id.* at 212.

[43] *Id.* at 214 ("[W]e readily conclude that respondent's expectation that his garden was protected from such observation is unreasonable and is not an exception that society is prepared to honor.").

[44] Melissa Deal, *Can Big Brother Watch You? The Implications of the Department of Homeland Security's Proposed National Applications Office for Fourth Amendment Protections*, 73 J. AIR L. & COM. 407, 415 (2008) (citing *Ciraolo*, 476 U.S. at 209, 215).

[45] *Ciraolo*, 476 U.S. at 215.

ported by the officers' observations and not the photograph itself.[46]

Fortunately, it would not be long before the constitutionality of warrantless aerial surveillance was resolved. Decided the same day as *Ciraolo*, the Supreme Court, in *Dow Chemical Co. v. United States,* addressed the issue of whether aerial photography constituted a search without a warrant, thereby violating the Fourth Amendment.[47] In *Dow Chemical Co.*, the Environmental Protection Agency (EPA) acquired consent for an on-site inspection of the petitioner's 2,000 acre chemical manufacturing plant.[48] When the EPA requested a second inspection, Dow refused.[49] Instead of seeking an administrative search warrant, the "EPA employed a commercial aerial photographer, using standard floor-mounted, precision aerial mapping camera, to take photographs of the facility from attitudes of 12,000 ft, 3,000 ft, and 1,200 ft."[50] Upon learning of the EPA's activities, Dow brought suit in District Court alleging that the EPA's actions violated the Fourth Amendment.[51]

The Court examined whether the area of the facility observed fell under the curtilage doctrine[52] or the "open fields" doctrine.[53] The Court acknowledged that the chemical plant had elements of both a curtilage and an open field. However, it decided "such an industrial complex is more comparable to an open field and as such it is open to the view and observation of persons in aircraft lawfully in the public airspace immediately

---

[46] *Id*. at 212, n. 1 ("It was the officer's observations, not the photograph, that supported the warrant.").

[47] *Dow Chem. Co.*, 476 U.S. at 234.

[48] *Id*. at 229.

[49] *Id*.

[50] *Id*. ("At all times the aircraft was lawfully within navigable airspace.").

[51] *Id*. at 230.

[52] *Id*. at 235 (citing *Ciraolo*, 476 U.S. at 213) (noting that the "curtilage area immediately surrounding a private house has long been given protection as a place where the occupants have a reasonable and legitimate expectation of privacy that society is prepared to accept" and the curtilage doctrine has "evolved to protect much the same kind of privacy as that covering the interior of a structure.").

[53] *Id*. (citing *Oliver v. United States*, 466 U.S. 170, 179 (1984)) ("[T]he Court has drawn a line as to what expectations are reasonable in open areas beyond the curtilage of a dwelling: 'open fields do not provide the setting for those intimate activities that the [Fourth] Amendment is intended to shelter from governmental interference or surveillance.'").

above or sufficiently near the area for the reach of cameras."[54] In reaching its final ruling, the Court emphasized the fact that the camera was "commonly used in mapmaking," and that the EPA was within navigable airspace when the photographs were taken.[55] While the Court recognized that the camera could distinguish wires that were half an inch in diameter, it was not able to penetrate the walls of the plant.[56] In dicta, the Court explained that surveillance equipment not available to the public, such as satellite technology, may violate the Fourth Amendment absent a warrant because they have the ability to provide highly "intimate details."[57] Ultimately, the Court held that taking aerial photographs of a chemical manufacturing plant was not a search prohibited by the Fourth Amendment.[58]

The most recent Supreme Court case involving aerial surveillance was *Florida v. Riley* in 1989.[59] In *Riley*, law enforcement officers used a helicopter to determine that the defendant was growing marijuana in his greenhouse.[60] The helicopter was flown at an altitude of 400 ft, and the investigating officers were only able to observe the marijuana because two panels of the greenhouse roof were missing.[61] Based upon these observations a warrant was executed, the subsequent search revealed marijuana being grown and the defendant was arrested pursuant to Florida laws.[62]

Again, the Court in a plurality opinion acknowledged that the greenhouse was part of the defendant's curtilage, however, the defendant's expectations that his "crops" were unobservable were unreasonable.[63] The helicopter was within navigable air-

---

[54] *Id*. at 239.

[55] Deal, *supra* note 44, at 416, *see also Dow Chem. Co.*, 476 U.S. at 238.

[56] *Dow Chem. Co.*, 476 U.S. at 238.

[57] *Id*. ("It may well be, as the Government concedes, that surveillance of private property by using highly sophisticated surveillance equipment not generally available to the public, such as satellite technology, might be constitutionally proscribed absent a warrant."); *see also id*. at 239, n. 5 (explaining that "intimate detail" is being able to identify human faces or read documents).

[58] *Id*.

[59] *Riley*, 488 U.S. 445 (plurality opinion).

[60] *Id*. at 448.

[61] *Id*. (noting that 10 percent of the roof area was missing).

[62] *Id*. at 449.

[63] *Id*. at 450.

space, thus the observations were made from a "public vantage point."[64] The plurality opinion established three factors which it deemed essential to invoking Fourth Amendment protection: (1) the surveillance was sufficiently rare; (2) the surveillance interfered with the normal use of the curtilage; or (3) the surveillance detected intimate details connected with the use of the home or curtilage.[65] In the end, the Court determined that the aerial observation in *Riley* did not meet any of the aforementioned factors; as a result, aerial surveillance by helicopter was not considered a search under the Fourth Amendment.[66]

In these three aerial surveillance cases the Supreme Court did not find any of the law enforcement observations to be a search under the Fourth Amendment.[67] This line of cases has validated law enforcement agencies' ability to observe criminal behavior from the public vantage point of navigable airspace.[68] The Supreme Court has also recognized that the use of aircraft and sense-enhancing technology, does not automatically give rise to constitutional problems.[69]

B. Thermal Imaging

Despite giving virtually free reign to law enforcement officers in aerial surveillance, the Supreme Court began to limit the scope of Fourth Amendment protections in regard to sense-enhancing technology. Twelve years after *Riley*, the Court in *Kyllo v. United States* held that the warrantless surveillance of a home using a thermal imaging device was a search under the Fourth Amendment and therefore was an unconstitutional invasion of privacy.[70] In *Kyllo*, Department of Interior (DOI) agents suspected the petitioner of growing marijuana in his Oregon triplex.[71] The agents used the Agema Thermovision

---

[64] *Id*. at 450 - 51.

[65] *Id*. at 452; *see also* Deal, *supra* note 44, at 417.

[66] *Id*.

[67] *See id*., *see also Dow Chem. Co*., 476 U.S. at 239; *Ciraolo*, 476 U.S. at 215.

[68] *Id*.

[69] *Dow Chem. Co.*, 476 U.S. at 238 ("The mere fact that human vision is enhanced somewhat, at least to the degree here, does not give rise to constitutional problems.").

[70] *Kyllo*, 533 U.S. at 40.

[71] *Id*. at 29.

210,[72] a thermal imaging device to scan the triplex.[73] This sense-enhancing device detects the infrared spectrum that is invisible to the naked eye.[74] By analyzing the data gathered by this device the agents were able to determine that petitioner's garage roof was substantially hotter than those of his neighbors.[75] The DOI agents believed that the heat was coming from halogen lights typically used in the cultivation of marijuana.[76] "Based on tips from informants, utility bills, and the thermal imaging, a Federal Magistrate Judge issued a warrant authorizing a search of petitioner's home, and the agents found an indoor growing operation involving more than 100 plants."[77]

The Court distinguished *Kyllo* from the aerial surveillance cases by virtue of the thermal imager's ability to observe the inside of the house rather than the outside as in *Riley* and *Ciraolo*.[78] The Government contended that the thermal imager was constitutional because it only detected heat emanating from the outside of the house, and it did not reveal activities in private areas.[79] The majority noted that they rejected the mechanical interpretation of the Fourth Amendment in *Katz*, where the listening device only picked up sounds projected outside the walls of the phone booth.[80] The consequence of this reversed approach would in effect leave the "homeowner at the mercy of advancing technology including imaging technology that could discern all human activities in the home."[81] The Court also concluded that the imaging device did discern intimate details, simply because the details were those within the sanctity of the

---

[72] *Id*. at 30 ("The imager converts radiation into images based on relative warmth-black is cool, white is hot, shades of gray connote relative differences; in that respect, it operates somewhat like a video camera showing heat images.").

[73] *Id*.

[74] *Id*. at 29.

[75] *Id*. at 30.

[76] *Id*.

[77] *Id*.

[78] *Id*. at 37 – 38.

[79] *Id*. at 35 – 37.

[80] *Id*. at 35.

[81] *Id*. at 35 – 36; *see also id*. at 36, n. 3 ("The ability to 'see' through walls and other opaque barriers is a clear, and scientifically feasible, goal of law enforcement in research and development.").

home.[82] In this respect, the Court distinguished *Kyllo* from *Dow Chemical Co.*, in that the enhanced aerial photography in *Dow* did not involve the heightened Fourth Amendment protections of a home.[83] The final effect of *Kyllo* is to prohibit the warrantless use of devices not in general public use, which have the capability to explore "details of the home that would previously have been unknowable without physical intrusion."[84]

C. Satellite Imaging

While no court has ruled on the warrantless use of satellite surveillance, the Supreme Court, in *Dow Chemical Co.* stated that satellites may pose constitutional problems because of their ability to provide intimate details.[85] This statement, however, was made in dicta over twenty years ago, before satellite were an integral part of society. In 2008, the Department of Homeland Security (DHS) established a new branch called the National Applications Office (NAO), which was chartered to use classified satellite reconnaissance for law enforcement purposes.[86] With the creation of the NAO it was widely speculated that soon the warrantless use of satellite surveillance would come under constitutional scrutiny. In fact, DHS Secretary Janet Napolitano ended the NAO program after little more than a year, citing the need to protect civil liberties and the privacy of the American people.[87] This, however, does not mean that the use of satellite imaging will no longer be prevalent in criminal law. Perhaps one of the largest emerging applications of satellite images is their use in agricultural fraud.

Farming in the United States is no easy task; farmers have to combat the weather, commodity prices, insects and diseases.[88]

---

[82] *Id*. at 37 -38.

[83] *Id*.

[84] *Id*. at 40.

[85] *See supra* note 57 and accompanying text.

[86] Deal, *supra* note 44, at 408.

[87] *Secretary Napolitano Announces Decision to End National Applications Office Program*, Department of Homeland Security Press Releases, Jun. 23, 2009, *available at* http://www.dhs.gov/ynews/releases/pr_1245785980174.shtm.

[88] Laura Rocchio, *Fighting Crop Insurance Fraud with Landsat*, 72 PHOTOGRAPHIC ENGINEERING & REMOTE SENSING 725 (2006).

The United States Department of Agriculture (USDA) helps to reduce the perils of farming by allowing farmers to manage their risks through the Federal Crop Insurance Program.[89] Over the years, however, the program has been threatened by a small percentage of fraud leading the USDA to crackdown and step up enforcement.[90]

In order to combat crop insurance fraud the USDA uses *Landsat*[91] satellite images to analyze suspected fraudulent crops insurance claims.[92] *Landsat* imagery is employed when a USDA investigator determines that it is necessary to verify an insurance claim.[93] The image is either examined internally by the USDA's Risk Management Activity (RMA), or contracted out to private remote sensing experts, such as Dr. John Brown.[94] Over the past several years the RMA has used an average of 600 *Landsat* scenes per year covering an area of 7.6 million acres.[95] "Typically, about half of the Landsat Image analyses support a farmer's insurance claim and half indicate fraud."[96] Conservative estimates put the government's savings from the use of *Landsat* images at 100 million dollars annually.[97]

When Dr. Brown is employed to investigate potential fraud, he examines the satellite images to determine whether or not the farmer actually planted or harvested what was claimed.[98] If there is satellite imagery that does not support the farmer's claim, Dr. Brown will testify to that fact.[99] "Brown testifies in

---

[89] *Id.*

[90] *Id.* (A study done by the Center for Agribusiness Excellence at Tarleton State University and the RMA's Strategic Data Acquisition and Analysis unit estimates fraudulent activity among 0.18% of insured farmers.).

[91] *Landsat* is the world's oldest civilian land remote sensing satellite system. It is a national program with global functions, providing crop forecasting for national markets and national security. Joanne Irene Gabrynowicz, *The Perils of Landsat from Grassroots to Globalization: A Comprehensive review of US Remote Sensing Law with a Few Thoughts for the Future*, 6 CHI. J. INT'L L. 45, 45-47 (2005).

[92] Rocchio, *supra* note 88, at 725.

[93] *Id.*

[94] *Id.*

[95] *Id.*

[96] *Id.*

[97] *Id.* at 725 ("A conservative estimate would be that Landsat save the U.S. government $100 million per year.").

[98] *Id.*

[99] *Id.*

cases across the nation involving cotton, sorghum, tomato, soybean, and corn crops among others."[100] In many cases the *Landsat* data explained by Dr. Brown is challenged on the basis of admissibility.

For instance, in the Fifth Circuit Court of Appeals case *United States v. Fullwood*,[101] the defendant, Fullwood, argued that the expert testimony of Dr. Brown should not have been admitted by the district court.[102] In *Fullwood*, the defendant participated in farm assistance programs administered by the federal Farm Service Agency (FSA).[103] During the 1999 season, the defendant farmed cotton and grain sorghum, however, he did not plant all the acreage that he certified with the FSA, nor that which he insured.[104] Fullwood proceeded to make fraudulent insurance claims, maintaining that hail and excess precipitation had damaged his cotton crops. Ultimately, the defendant requested more than $310,000 and received more than $235, 000.[105]

At trial, Dr. Brown testified that based upon the satellite images of Fullwood's farm, it was clear that the defendant did not plant the crops on the dates that were certified with the FSA.[106] Fullwood claimed that the district court abused its discretion by allowing Dr. Brown's testimony.[107] Federal Rule of Evidence 702 sets the standard for the admission of expert testimony:

> If scientific, technical, or other specialized knowledge will assist the trier of fact to understand the evidence or to determine a fact in issue, a witness qualified as an expert by knowledge, skill, experience, training, or education, may testify thereto in the form of an opinion or otherwise, if (1) the testimony is

---

[100] *Id*. at 725 – 26.

[101] 342 F.3d 409 (5th Cir. 2003) (holding that the government expert's testimony, based on satellite imagery, which demonstrated that the defendant did not plant crops that he submitted insurance claims for, was properly admitted).

[102] *Id*. at 411 – 12.

[103] *Id*. at 410.

[104] *Id*. at 411 ("In connection with these claims, he executed various cotton appraisals and production worksheets.").

[105] *Id*. (A substantial portion of the funds were withheld because Fullwood was under investigation).

[106] *Id*. at 412.

[107] *Id*. at 411.

> based upon sufficient facts or data, (2) the testimony is the product of reliable principles and methods, and (3) the witness has applied the principles and methods reliably to the facts of the case.[108]

Even though Fullwood conceded that Dr. Brown was a highly qualified expert,[109] the defendant still contended that "there was too great a gap between the premise of satellite imagery, as it relates to crop cultivation," and the conclusion reached by the testimony that certain crops were not planted.[110]

The court dismissed Fullwood's contentions as "conclusory and without merit."[111] The Fifth Circuit noted that the Eight Circuit had already upheld the admission of satellite image-based testimony.[112] The court also acknowledged that remote sensing technology has been around for decades, and that the techniques used in Dr. Brown's testimony were used every day by science, industry, and government.[113] In short, the court concluded that the use of satellite images supported by expert testimony was methodologically sound, and the district court by no means abused its discretion by admitting the evidence.[114]

Agricultural fraud is one of the few areas of criminal law where satellite imaging is being used with great success to put

---

[108] Fed. R. Evid. 702.

[109] Dr. Brown's credentials include a Ph.D. in horticulture and numerous publications. *Fullwood*, 342 F.3d at 412. "During his dissertation, Brown worked extensively with Magnetic Resonance Imaging (MRI), and imaging technique used extensively in the medical field, to investigate plant water relationships and root hydrodynamics. After earning his Ph.D., Brown applied his experience with imaging science to aerial analysis and in 1993 started Agricultural Investigation and Research Corporation (AIR Corp.)." AIR specializes in analysis of both aerial photography and satellite imagery for crop insurance fraud investigations, but also uses Landsat to help farmers do crop analysis, property damage assessments, and establish water rights. Rocchio, *supra* note 88, at 725.

[110] *Fullwood*, 342 F.3d at 412.

[111] *Id.*

[112] *Id.*; *see also United Stated v. Larry Reed & Sons P'ship*, 280 F.3d 1212, 1215 (8th Cir. 2002) (holding that the district court did not abuse its discretion in admitting reliable evidence expert testimony about soil preparation of an agricultural partnership's farmland, which based on the computer analysis of satellite images demonstrated the submission of false cotton crop insurance claims).

[113] *Id.*

[114] *Id.*

people behind bars, and save taxpayers money.[115] Courts have clearly established that expert testimony aided by satellite imagery is an acceptable practice.[116] However, as remote sensing and satellite imaging technology becomes increasingly available and accessible for all levels of law enforcement, courts will be forced to address potential constitutional violations. By examining how other jurisdictions have handled advances in technology with privacy rights, one can begin to grasp how U.S. courts may reconcile warrantless satellite surveillance and remote sensing with the Fourth Amendment.

III. AERIAL SURVEILLANCE, THERMAL IMAGING AND CANADA

A. Comparative Constitutional Rights

In both the United States and Canada citizens enjoy the same reasonable expectation of privacy and are afforded constitutional protections against government intrusions.[117] Individuals are protected by the Fourth Amendment, and Section 8 of the Charter of Rights and Freedoms, in the United States and Canada respectively.[118] These two constitutional provisions are nearly identical in scope, both protecting the right to be secure against unreasonable searches and seizures.[119] In both countries, when a court determines that there is no reasonable expectation of privacy in relation to a surveillance technique, there is no

---

[115] In *Fullwood* alone the defendant was convicted of: conspiracy to commit mail fraud, violating the False Claims Act, making false statements to the Government, in violation of 18 U.S.C. §§ 371 & 2; making false statements to agencies of the United States, in violation of 18 U.S.C. § 287; mail fraud, in violation of 18 U.S.C. § 1341; and, making false statements in a matter with the jurisdiction of an agency of the United States, in violation of 18 U.S.C. § 1001. He was sentence to nearly three and a half years in prison an ordered to pay $235,000 in restitution. 342 F.3d at 411.

[116] *Id.* at 412; *see also Larry Reed & Sons P'ship*, 280 F.3d 1212.

[117] Steven Penney, *Reasonable Expectations of Privacy and Novel Search Technologies: An Economic Approach*, 97 J. CRIM. L. & CRIMINOLOGY 477, 478 (2007).

[118] *Id.*

[119] *Compare* U.S. CONST. amend. IV ("The right of the people to be secure in their persons, houses, papers, and effects, against unreasonable searches and seizures, shall not be violated, and no Warrants shall issue, but upon probable cause, supported by Oath or affirmation, and particularly describing the place to be searched, and the person or things to be seized."), *with* CANADIAN CHARTER OF RIGHTS AND FREEDOMS § 8 ("Everyone has the right to be secure against unreasonable search or seizure.").

constitutional protection.[120] In such cases, law enforcement officers are free to exploit the technique without first obtaining a warrant. Conversely, when there is a reasonable expectation of privacy, law enforcement must generally obtain a warrant based upon probable cause before conducting a search.[121]

Despite the similarities in constitutional protections, the U.S. and Canadian courts often do not agree on what constitutes a reasonable expectation of privacy. Although the Supreme Court of Canada has never dealt with traditional aerial surveillance, the lower courts have typically rejected the American approach and found a reasonable expectation of privacy.[122] In direct contrast, however, the Supreme Court of Canada moved in the other direction, with regards to warrantless aerial surveillance using an infrared camera, ushering in a new era in law enforcement surveillance capabilities.[123]

B. R. v. Tessling

In 2004, the Supreme Court of Canada examined whether the use of Forward Looking Infra-Red (FLIR) violated the defendant's constitutional right to be free from unreasonable searches.[124] In *R. v. Tessling*, the Royal Canadian Mounted Police (RCMP) began to investigate the defendant in 1999. Based upon information provided by two informants, the RCMP believed that the defendant, Tessling, was producing and trafficking large amounts of marijuana.[125] The indoor production of marijuana typically requires the use of high energy halide lamps, which generate a significant amount of heat.[126] The RCMP contacted the electrical company, but found that the en-

---

[120] Penney, *supra* note 117, at 478.

[121] *Id*. at n.4 (noting that in Canada "probable cause" is know as "reasonable and probable grounds.").

[122] *Id*. at 489; *see also R. v. Cook*, [1999] A.B.Q.B. 351 ¶¶55-62 (Alta. Q.B.) (Can.) (holding that unaided visual surveillance of a residential lot from 50 -100 (but not 1,000) feet invades a reasonable expectation of privacy); *R. v. Kelly*, [1999] 169 D.L.R. (4th) 720, 735 – 37 (N.B. C.A.) (Can.) (ruling that unaided aerial surveillance of a residential garden from any altitude invades a reasonable expectation of privacy).

[123] *R. v. Tessling*, [2004] 3 S.C.R. 432 (Can.).

[124] *Id*. ¶3.

[125] *Id*. ¶4.

[126] *Id*.

ergy meter indicated a normal level of usage, and the use of traditional visual surveillance also did not suggest a large scale growing operation.[127]

On April 29, 1999, the investigating police used an RCMP airplane equipped with a FLIR camera to conduct aerial surveillance over the area where the defendant lived.[128] A FLIR camera can measure and record the amount of heat that escapes from a building; it cannot, however see through the external surfaces of a building.[129] The FLIR image only shows a distribution of heat that escapes from a home, which is not discernible to the naked eye.[130] In this case, there was a large amount of heat escaping from the defendant's home, which was believed to be the result of a marijuana growing operation.[131] Based upon the aerial images generated by the FLIR camera and the information provided by the informants, the RCMP obtained a warrant.[132] Upon entering the home, the law enforcement officers found a "large quantity of marijuana, two sets of scales, freezer bags, and several guns."[133] The defendant was charged with several offenses. Tessling contended that the warrantless FLIR overflight constituted an illegal search in violation of his constitutional rights.[134] The defendant further argued that absent a valid warrant for the FLIR images, the evidence obtained inside the house must

---

[127] *Id.*

[128] *Id.* ¶5. ("FLIR technology records images of thermal energy or heat radiating from a building. Once a baseline is calibrated, cooler areas show up as darker, and warmer areas are lighter. FLIR imaging cannot, at this stage of its development, determine the nature of the source of heat within the building. It cannot distinguish between heat diffused over an external wall that came originally from a sauna or a potter kiln, or between heat that originated in an overheated toaster or heat from a halide lamp.")

[129] *Id.* (In the U.S. this distinction is know as "off-the-wall" opposed to "through-the-wall" technology.); *see also Kyllo*, 553 U.S. at 41 (Stevens, J., dissenting) (arguing there is a constitutional distinction between "through-the-wall" surveillance that gives the observer direct access to information in a private area and "off-the-wall" surveillance which merely involves indirect deductions from information emanating from the exterior of a home).

[130] *Id.* ¶5.

[131] *Id.*

[132] *Id.* ¶6.

[133] *Id.* ("The street value of the marijuana was between $15,000 and $22,500.").

[134] *Id.*

be excluded, thereby, resulting in insufficient evidence to support a conviction.[135]

At trial the judge found that the use of the FLIR technology was unobjectionable, although even if there was a constitutional problem the evidence ought to be admitted because its exclusion would bring the administration of justice into disrepute.[136] The defendant was convicted and sentenced to six months imprisonment for the possession of marijuana for the purposes of trafficking, six months concurrent for the related drug offenses, and another twelve months for the weapons charge.

Tessling appealed his conviction, contending that the protected privacy interest in the home extends to heat generated inside the home, which is reflected on the outside.[137] The Ontario Court of Appeals noted that the defendant had a reasonable expectation of privacy within his home and the only reasons the RCMP conducted the FLIR overflight was to determine what was happening inside the residence. The court concluded that:

> The FLIR represents a search because it reveals what cannot otherwise be seen and detects activities inside the home that would be undetectable without the aid of sophisticated technology. Since what is being technologically tracked is the heat generated by activity inside the home, albeit reflected externally, tracking information through FLIR technology is a search within the meaning of s. 8 of the *Charter*.[138]

Since the court found that that the FLIR overflight was a serious intrusion into the home, consequently, the evidence found inside the home had to be excluded and the defendant was entitled to acquittal.[139]

---

[135] *Id*.

[136] *Id*. ¶7.

[137] *Id*. ¶8; *see also R. v. Tessling*, [2003], 63 O.R. (3d) 1, at ¶33 (Can.).

[138] *Id*. ¶11 (quoting *Tessling*, 63 O.R. (3d) 1, at ¶68); *see also Kyllo*, 533 U.S. at 40 (holding that where the Government uses a device that is not in general public use, to explore the details of the home that would have been unknowable without physical intrusion, the surveillance is a "search and is presumptively unreasonable without a warrant).

[139] *Id*. ¶11.

In review, the Canadian Supreme Court acknowledged that within the home there is no greater expectation of privacy.[140] In addressing where the line of a reasonable expectation of privacy should be drawn, the Court examined whether the technology revealed intimate details of the lifestyle and personal choices of the individual.[141] Since the information generated by the FLIR overflight did not reveal any intimate details, the Court found that, "external patterns of heat distribution on the external surfaces of a house is not information in which the respondent had a reasonable expectation of privacy."[142] While FLIR has the ability to show some of the activities in the house that generate heat that was not enough to reach the constitutional threshold.[143] In concluding that the FILR overflight was a permissible surveillance technique, the Supreme Court of Canada noted that technology must be evaluated according to its current capability, and that courts must deal with technology step by step as it evolves.[144]

IV. THE FUTURE OF REMOTE SENSING IN CRIMINAL LAW

There is no doubt that as technology progresses, courts will be forced to reconcile constitutional privacy rights with the continued advance of law enforcement technology. Recall the Supreme Court's decisions in *Kyllo* and the Canadian Supreme Court's decision in *Tessling*, both of these cases involved the use of infrared imaging, and like many other search technologies the uses and capabilities are developing rapidly.[145] These two cases provide a glimpse into the contrasting approaches courts

---

[140] *Id*. ¶22.

[141] *Id*. ¶¶59 – 61 (The reasonableness line must be determined by focusing on the nature and quality of the information which FLIR can actually provide, and then examining the impacts on privacy).

[142] *Id*. at ¶¶62 – 63 (Everything shown in the FLIR images exists on the external surfaces of the building and in that sense FLIR only records information that is expose to the public. Although the information is not available to the public by way of the naked eye, FLIR does not expose the intimate details of the home).

[143] *Id*. ¶62.

[144] *Id*. ¶¶55-66 ("FLIR technology at this stage in its development is non-intrusive in its operations ability and mundane in the data it can produce").

[145] Penney, *supra* note 116, at 511.

have taken to address new technology and constitutional privacy.

A. The Bright-line Rule Approach

The majority opinion in *Kyllo* illustrates how in the United States, the Court has attempted to create a "bright-line rule capable of anticipating future technological developments."[146] The majority explained their rule stating that "obtaining by sense-enhancing technology any information regarding the interior of the home that could not otherwise have been obtained without physical 'intrusion into a constitutionally protected area,' constitutes a search-at least where (as here) the technology in question is not in general public use."[147] The phrase "general public use" is left undefined by the majority, leaving a considerable amount of room for interpretation.[148] In the years since *Kyllo* was decided, infrared cameras have become more affordable and available, and are in use throughout "law enforcement, immigration, military, and civilian applications, including construction, manufacturing, testing and inspection."[149] This leads to the inevitable question of how exactly are courts supposed to determine what sense-enhancing technologies are in general public use?

Some scholars have commented that if a majority of Justices were to ever conclude that satellite technology was generally available to the public, then its use for government surveillance would not constitute a search regulated by the Fourth Amendment.[150] Others have argued that now the Fourth Amendment is "defined solely by the degree of sophistication

---

[146] *Id*. at 512; *see also Kyllo*, 533 U.S. at 36 ("While the technology used in the present case was relatively crude, the rule we adopt must take account of more sophisticated systems that are already in use or development.").

[147] *Kyllo*, 533 U.S. at 34 (quoting *Silverman*, 365 U.S. at 512) (citation omitted).

[148] *Id*. at 47, n. 5 (J., Stevens dissenting) (citation omitted) (The dissent in *Kyllo* even argues that the thermal imager used was "readily available to the public for commercial, personal or law enforcement purposes, and is just an 800-number away from being rented from 'half a dozen national companies' by anyone who wants one.").

[149] Penney, *supra* note 116, at 512.

[150] Morgan Cloud, *Pragmatism, Positivism, and Principles in Fourth Amendment Theory*, 41 UCLA L. REV. 199, 262 (1993).

used in the surveillance and the speed by which technological advances become generally disseminated and available to the public."[151] In application, however, lower courts do not merely dwell upon determining whether or not a technology is in general public use; rather the courts also look to whether the technology substitutes for an activity traditionally considered a search under the Fourth Amendment.[152]

A recent Seventh Circuit case, *United Sates v. Garcia*,[153] demonstrates how courts are balancing technological advances and privacy rights in the wake of *Kyllo*. In this case, law enforcement officers placed a global positioning system (GPS)[154] memory tracking unit beneath the rear bumper of the defendant's vehicle.[155] Using the information provided by the GPS device, police were eventually led to the location where the defendant manufactured methamphetamines.[156] Since the police had not obtained a warrant to place the GPS device on the vehicle, the defendant moved to suppress the evidence gained as a result of the GPS tracking device, arguing that it was an unconstitutional search and seizure.[157] The court quickly dismissed the defendant's contention that attaching the GPS device constituted a prohibited Fourth Amendment seizure, because "[t]he device did not affect the car's driving qualities, did not draw power form the car's engine or battery, did not take up room that might otherwise have been occupied by passengers or packages, did not even alter the car's appearance, and in short did not 'seize' the car in any intelligible sense of the word."[158]

The court then determined whether the GPS tracking device constituted a search under the Fourth Amendment. While

---

[151] Melvin Gutterman, *A Formulation of the Value and Means of the Fourth Amendment in the Age of Technologically Enhanced Surveillance*, 39 SYRACUSE L. REV. 647, 720 (1988).

[152] *Deal*, supra note 44, at 425.

[153] 474 F.3d 994 (2007).

[154] *Id*. at 995 (These tracking devices receive and store satellite signals that indicate the vehicles location. GPS is a form of navigation, and not sense enhancing technology. This case, however, sheds light on how courts address advancing technology).

[155] *Id*.

[156] *Id*.

[157] *Id*. at 996.

[158] *Id*.

the Seventh Circuit did not specifically address the issue of general public use, the court did note that the tracking device utility was "commercially available for a couple hundred dollars."[159] The court compared the use of the GPS device to the less sophisticated tracking mechanism (a beeper), which the Supreme Court held was not a search.[160] The court even likened the tracking of the vehicle by GPS to observing the route by means of cameras mounted on lamp posts or satellite images, stating that such observances would not be a search under the Fourth Amendment.[161] The court noted the difference between GPS tracking and satellite imaging, but found that this technology was on the same side, "and if what they do is not searching in Fourth Amendment terms, neither is GPS tracking."[162]

The Seventh Circuit, however, made an important distinction between GPS tracking and the thermal imaging device used in *Kyllo*.[163] The court explained that in *Kyllo*, the technology provided a substitute for a form of search plainly governed by the Fourth Amendment, by revealing details of the interior of a home that would not be discovered without physical entry.[164] However, the substitute technology in the *Garcia* case, specifically, following a car on a public street, is explicitly not a search within the meaning of the Fourth Amendment.[165] Finally, the court concluded that GPS tracking was not a search, and that the Fourth Amendment "cannot sensibly be read to mean that

---

[159] *Id*. at 995.

[160] *Id*. at 996 (*citing United States v. Knotts*, 460 U.S. 276, 284 – 85 (1983)).

[161] *Id*. at 997 ("If a listening device is attached to a person's phone, or to the phone line outside the premises on which the phone is located, and phone conversations are recorded, there is a search (and it is irrelevant that there is a trespass in the first case but not in the second), and a warrant is required. But if the police follow a car around, or observe its route by means of cameras mounted on lampposts or of satellite imaging as in Google Earth, there is no search. Well, but the tracking in this case was by satellite. Instead of transmitting images, the satellite transmitted geophysical coordinates. The only difference is that in the imaging case nothing touches the vehicle, while in the case at hand the tracking device does. But it is a distinction without any practical difference.").

[162] *Id*.

[163] Deal, *supra* note 44, at 425.

[164] *Garcia*, 474 F.3d at 997.

[165] *Id*.

police shall be no more efficient in the twenty-first century than they were in the eighteenth."[166]

In essence the rule emerging from *Kyllo,* as interpreted by the Seventh Circuit in *Garcia*, is that sense-enhancing technology, which is in general public use, can be employed by law enforcement to substitute for activities traditionally not subject to Fourth Amendment scrutiny. Applying this test to advanced law enforcement activities demonstrates the usefulness of a bright-line rule.

For instance, if a court were faced with determining the constitutionality of satellite surveillance over an individual's property, this rule would provide some level of guidance. First, the court would have to determine if satellite technology is in general public use. Over the years, satellite technology has become quite common.[167] While in *Dow Chemical Co. v. United States,* the Supreme Court, in dicta, stated that satellite surveillance technology not generally available to the public might be constitutionally prohibited, note that this decision was rendered more than two decades ago.[168] Since *Dow*, however, the availability of satellite imaging has grown exponentially, is used every day by millions of people, and could be considered in general public use under *Garcia v. United States*.[169] Therefore, it is possible that satellite imaging could be considered in general public use, thus, fulfilling the first prong of the test.

The second prong of the rule would require the courts to determine if the technology was a substitute for an activity which would traditionally be constitutional.[170] Determining constitutionality under this prong requires a more fact specific analysis. Courts would almost certainly allow satellite imaging to be used over an "open field" because there is a lower expectation of privacy.[171] Moreover, courts have already allowed such images to be admitted into evidence during agricultural fraud cases.[172] If,

---

[166] *Id*. at 998.
[167] Deal, *supra* note 44, at 430.
[168] *See supra* note 57, and accompanying text.
[169] *See supra* note 160, and accompanying text.
[170] *Garcia*, 474 F.3d at 997.
[171] *See supra* note 53, and accompanying text.
[172] *See Fullwood*, 342 F.3d at 412.

however, the area under satellite surveillance was a home, there would be a heightened expectation of privacy.[173] Thus, if the satellite imagery revealed any "intimate details"[174] of a home or curtilage, the surveillance would constitute an unconstitutional search.[175] Yet, if the same surveillance was conducted on the curtilage of a home the courts might not find a Fourth Amendment violation.[176] Currently, the available satellite imaging only has a resolution of six inches, and in *Dow,* the aerial mapping camera had a resolution as high as half an inch.[177] Based upon the Supreme Courts definition of "intimate details" articulated in *Dow* and *Kyllo*, it is unlikely that data gathered by satellites could render their use unconstitutional.[178]

Certainly the bright-line rule approach has some benefits in that it provides guidance for courts as they address advances in technology. As the above example demonstrated, it is plain to see how a court might address technology and Fourth Amendment issues. This rule, however, does not provide all the answers in reconciling advancements in law enforcement technology with privacy rights. One particularly troubling issue is the term "general public use," which is both vague and ambiguous. As technology progresses, certain surveillance tools may become more affordable and available to the public; therefore, what was once an unconstitutional search could become constitutional with the passage of time.[179] This type of logic seems to be at odds with the fundamental expectation of privacy, which the Supreme Court had long interpreted as the foundation of Fourth Amendment rights.

---

[173] *Kyllo*, 533 U.S. at 33 (*quoting Dow Chemical Co.*, 476 U.S. at 237).

[174] In a footnote the Supreme Court defined intimate details as the ability to make out human faces or read documents. *Dow Chemical Co.*, 476 U.S. at 238 n.5 ("[N]or are there any identifiable human faces or secret documents captured in such a fashion as to implicate more serious privacy concerns."). However, this definition was expanded in *Kyllo* to include details which would otherwise be unknowable without physical entry. *See supra* note 9, and accompanying text.

[175] *See supra* note 9, and accompanying text.

[176] *See Riley*, 488 U.S. at 452; *see also Ciraolo*, 476 U.S. at 215.

[177] Deal, *supra* note 44, at 429 ("In fact, the mapping camera used in *Dow* could distinguish widths a low as half an inch, whereas the satellite imagery may only have a resolution of six inches.").

[178] *Id.*

[179] Penney, *supra* note 117, at 512.

B. Evolutionary Approach

In direct contrast to the majority's decision in *Kyllo*, the Supreme Court of Canada ruled unanimously in *Tessling* that the warrantless use of a thermal imaging device was not a search under the meaning of Section 8 of the Canadian Charter of Rights and Freedoms.[180] The Court in *Tessling* distinguished its decision from *Kyllo*, by stating that the issues were not whether the technology was in general public use, or if the police gained information about the inside of the home, "but rather the nature and quality of the information about activities in the home that the police are able to obtain."[181] The Court found that information displayed by the thermal imager showed activities in the home which generated heat but that did not reveal intimate details of the defendant.[182] Since Section 8 protects people not places, there was no reasonable expectation of privacy requiring constitutional protection.[183] The Court concluded that technology must be evaluated by its present capabilities, and that any development in the future must be addressed by the courts, on a case-by-case basis.[184]

The evolutionary approach taken by the Canadian Supreme Court echoes back to the U.S. Supreme Court case *Katz*, where the Court stated that the Fourth Amendment protects people, not places.[185] This approach relies on the deeply rooted common law precept of a reasonable expectation of privacy. In regards to the heat emanating from an individual's home, the Canadian Supreme Court found no reasonable expectation of privacy with the current level of technology.[186] As technology advances, however, the Court acknowledged that "[c]oncerns should be addressed as they truly arise." [187] If one day, thermal imaging has the ability to detect bodies through walls, a court may deem

---

[180] *Tessling*, 3 S.R.C. at ¶62.
[181] *Id*. ¶58.
[182] *Id*. ¶62.
[183] *Id*.
[184] *Id*. ¶55.
[185] *Katz*, 389 U.S. at 351.
[186] *Tessling*, 3 S.R.C. at ¶¶55 - 65.
[187] *Id*. ¶55.

that to be an unconstitutional search. The advantage of the evolutionary approach is its ability to adapt to developing technologies.

CONCLUSION

New technologies are being developed and implemented everyday. The improvements that they have made throughout society are immeasurable, from the industrial age to the information age. Sense-enhancing technology has rapidly emerged as an excellent means of law enforcement. Currently, aerial surveillance, thermal imaging and satellite imagery all play a vital role in criminal law. Yet, this technological progress poses a serious threat to privacy, by enabling law enforcement with probative abilities not imagined when the Constitution was ratified.

Over the years the Fourth Amendment has evolved to meet the challenges of advancing technology. The bright-line rule created by the majority in *Kyllo*, has halted the adaptability of the Amendment. By making technologies in general public use constitutional, the Supreme Court has in effect eroded the historical interpretation of privacy under the Fourth Amendment. The fact of the matter is that, even the most advanced technologies will inevitability wind up in the hands of the general public. By attempting to draw a line in the sand, the Court has tied its hands and opened the door for new technologies to strike at the very core of the Fourth Amendment.

Using an evolutionary approach towards advancing technology the Supreme Court could have continued to determine constitutionality based upon a reasonable expectation of privacy. This line of reasoning would have granted the Court the ability to determine the constitutionality of surveillance techniques instead of attempting to predetermine the fate of future technologies with ambiguous terminology. By adopting an evolutionary approach to remote sensing in criminal law the United States courts will allow the Fourth Amendment to "keep pace with the march of science."[188]

---

[188] *Garcia*, 474 F.3d at 997.

PROMETHEUS UNBOUND? PROPOSAL FOR A NEW LEGAL PARADIGM FOR AIR LAW AND SPACE LAW: ORBIT LAW

C. Brandon Halstead[*]

I. INTRODUCTION[1]

Despite the "common bond" of flight shared by both air and space travel, these two realms of transit are governed by separate and distinct legal regimes. Since the late 1950's, the boundary between where air flight ends and space flight begins has been much debated, but has yet to be determined. For flights which occur solely within the airspace atmosphere, aviation law or air law has emerged to govern such travel; should those flights cross international boundaries or the high seas, international air law applies. However, missions and vehicles intended for outer space launches are governed by what can be collectively referred to as space law.

Two schools of thought have therefore emerged to distinguish between airspace and outer space. Although there is no scientifically-measurable line of demarcation between these two realms, spatialists wish to establish a clear boundary between State-sovereign airspace and unencumbered outer space. With two separate and distinct legal regimes currently in existence for each region, delimitation and clear establishment of borders should be accomplished once and for all.

---

[*] C. Brandon Halstead, B.S., Psychology, The University of Alabama; J.D., The University of Alabama School of Law; LL.M., Institute of Air and Space Law, McGill University; Lieutenant Colonel, U.S. Air Force Judge Advocate General's Corps. The submissions in this article represent the ideas of the author and do not reflect any official position of the U.S. Air Force.

[1] C. Brandon Halstead, *Hybrid Hops On (and Over) the Horizon: The Future Has Arrived, and Requires a New Look at Air and Space Law*, 34 ANNALS AIR & SP. L. 775 (2009) [hereinafter *Hybrid Hops*]. This article takes many of the questions posed in the *Hybrid Hops* cite and provides additional details and solutions to the proposals in the earlier text.

A second school of thought sees airspace and outer space as a continuum where the activity taking place within that realm governs the applicable law. These functionalists believe if the activity is aeronautical, then air law should apply; if the activity is a space-based mission, then space law should apply. In the absence of a clear break point between one region and the other, functionalists believe that the endeavor rather than a random border should determine the appropriate law.

Although air and space transit were inventions of the 20th century, State apprehension over sovereignty and liability are longstanding and deeply-rooted concerns. International air law has only recently modernized[2] its methods for holding air carriers accountable for accidents, whereas space law continues to struggle with inconsistent determinations of liability for damage on Earth versus outer space. Air law also adheres to strict protection of a State's airspace as sovereign territory, while space law emphatically proclaims freedom of outer space as *jus cogens*.

In the early days of space flight, the limited capabilities of space craft and few launching States effectively ignored the academic questions of liability and sovereignty during launch or descent through the air-space realm. However, the recent growth of space commerce is making space more accessible. Modern "hybrid" craft have increased the altitudes and decreased the orbits at which air-space flight is possible, yet defy a clear answer as to which legal regime should apply to them. Accordingly, the questions of liability and sovereignty remain unanswered for flights which operate in both legal realms of air and space. Given the differences in aviation liability and potential State responsibility for public and private space actions, and the conflict between State sovereign airspace and the freedom of outer space, these issues remain at the forefront of State concern.

Rapidly advancing technology and improvements in flight components have brought the worlds of air and space travel closer together than ever before. The historical development of

---

[2] Convention for the Unification of Certain Rules Relating to International Transportation by Air, *opened for signature* May 28, 1999, ICAO Doc. 9740 [hereinafter Montreal Convention].

space flight limited such activity to a few State powers. However, technological advancements and an increase in private commerce have brought outer space within reach of businesses, local municipalities, multinational consortiums, and former "non-space-faring States." Commercial enterprise now leads the way in development of new launch and flight systems, often uniting with international conglomerates to create a truly multinational partnership. The evolution in public and private space ventures has seen rapid growth and development of hybrid craft which are able to function both within and beyond Earth's orbit, combining the properties of both air travel and space transport. For example, even older equipment such as the U.S. *Space Shuttle*, and recent inventions such as *SpaceShipOne*,[3] are able to bridge the gap between both airspace and outer space. During much of its ascent and/or descent, such vessels perform like an aircraft, but the ability to ascend above atmospheric limitations and extend flight into outer space appears to qualify as a spacecraft. As these craft combine both air and space transit into one mission, it is uncertain whether air or space legal principles (or both) should apply to the craft, the mission, and its personnel. Accordingly, the increased prevalence of air-space flight systems amplifies the longstanding legal dilemma: how to differentiate between these two mediums of flight, and how to apply the current differing legal regimes to such flights.

Given the growing prevalence and capabilities of hybrid craft, spatialist attempts to establish a boundary line are premature. On the other hand, the buffer between air and space has not only met, but overlapped, thereby defying a functionalist distinction of the mission. It is this dysfunctional and obsolete attempt to bifurcate flights as solely air or space without recognizing that the realms have now been blended, and the corresponding unanswered concerns over liability and sovereignty, which necessitate consideration of a new legal regime for all flights.

---

[3] Scaled Composites, LLC, *SpaceShipOne Captures X-Prize*, http://www.scaled.com/projects/tierone/041004_spaceshipone_x-prize_flight_2.html (last visited Dec. 23, 2009).

Because air law and space law have been unsuccessful in distinguishing such hybrid craft as "air" or "space," or in determining which rule(s) of law should be applied throughout its flight, this article introduces a new legal approach to bridge the uncertain gap between airspace and outer space. This new legal paradigm, collectively known as "Orbit Law," proposes to synergize the functional/spatial demarcation of flight and recommend new legal guidelines blended from existing air law and space law. Relying on *orbital status* rather than air-space segregation to determine the applicable legal principles applied to such flight, Orbit Law seems to be the logical moniker for such a regime.

The first premise of Orbit Law begins with the application of existing public and private international air law tenants to suborbital flights only. The next premise of Orbit Law includes the application of current space law treaties to all orbital and inter-orbital flights. Although Orbit Law's maturation will eventually generate its own *corpus juris spatialis internationalis* founded in air law and space law precedence, its genesis must begin from these existing legal foundations before such an evolution may occur.

The need for uniformity across the boundaries of airspace and outer space, with innovative solutions to the longstanding problems of air and space sovereignty and liability will be suggested as a model for the merger of air and space legal systems. This newly-suggested legal paradigm called Orbit Law proposes to distill the best applications from existing air and space treaties and jurisprudence, and slowly siphon these relevant components away from the bifurcated air law and space law regimes into a blended Orbit Law system.

II. CHAPTER I: HISTORY OF AIR & SPACE LAW AND THE "GREAT DEBATES"

"To use an analogy, this notion of Orbit Law might serve as a 'zincir'[4] to unite and strengthen the tapestry of international

[4] A "zincir" is a weaving along the end of a carpet between the warp and the fringes which serves to strengthen the carpet and prevent the pile knots from shifting or drop-

air law and space law, and weave these separate strands of law into one artful composition that covers all forms of flight – a 'magic carpet'," so to speak.[5] However, one divergent segment of this composition which must somehow be harmonized includes the notion of absolute State sovereignty above its territory.[6] Legal scholars have advocated that it was not logical or desirable to extend State sovereignty beyond its airspace, even before the launch of the first satellite on October 4, 1957.[7] Over time, the absence of State protests after satellites crossed over their territory came to be considered "tacit or implied consent or agreement" and the emergence of "free passage"[8] through outer space, which was later incorporated into the 1967 Outer Space Treaty:[9] "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 . . . ."[10] However, it is also noteworthy that throughout the years of space launches, a number of satellites have passed through other States' *airspace* while going to or coming from space without State protest.[11]

A second major gap in the legal tapestry of aero-space law revolves around the uncertainty of public and private-party responsibility, and the crucial item of liability for space activities. Although the Montreal Convention has provided recent solutions to issues of aviation liability, the twin concepts of overall State *responsibility* for any deviations from the corpus of space

---

ping out of the warp. MEHMET ATEŞ, TURKISH CARPETS, THE LANGUAGE OF MOTIFS AND SYMBOLS 20-22 (1995). Literally translated, zincir (pronounced "zin-jer") is a chain, or fetters. H.-J. KORNRUMPH, LANGENSCHEIDT'S UNIVERSAL DICTIONARY, TURKISH-ENGLISH, ENGLISH-TURKISH 196 (Resuhi Akdikmen ed., 1998).

[5] *Hybrid Hops*, *supra* note 1, at 780-81.

[6] Convention Relating to the Regulation of Aerial Navigation, art. 1, Oct. 13, 1919, 11 L.N.T.S. 173 [hereinafter Paris Convention].

[7] *See* Ram S. Jakhu, *International Law Governing the Acquisition and Dissemination of Satellite Imagery*, 29 J. SPACE L. 65, 73 (2003) [hereinafter *Satellite Imagery*].

[8] *Id*.

[9] Treaty of Principles Governing the activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, *opened for signature* Jan. 27, 1967, 18 U.S.T. 2410, 610 U.N.T.S. 205 [hereinafter Outer Space Treaty].

[10] *Id*. at art. 1.

[11] *See* MYRES S. MCDOUGAL, ET AL., LAW AND PUBLIC ORDER IN SPACE 203 (1963) (emphasis added).

law, and ultimate State *liability* for any damage caused by space objects, are likely the most significant and fundamental issues of space transit during this increasing era of public and private space activities.[12] Therefore, for these space endeavors the topic of primary State interest, as well as private enterprise, is liability.[13]

Rapidly evolving technology should not degrade the fundamental protocols of the Outer Space Treaty and other air and space treaties designed to preserve international cooperation.[14] This article will therefore examine the interconnectivity between technological advancements and air-space flight, and the concerns over liability which stem from such progress. Orbit Law's methods for assignment of boundary, responsibility, and liability for all flights, should alleviate much of the apprehension that both States and private entities share regarding transportation between airspace and outer space. Therefore, in order to gain a broader understanding of this synthesis of two separate legal regimes of air and space into one overarching new system, it is necessary to conduct an overview of the fundamental historical premises which form the foundation for Orbit Law.

A. Debate Over the Boundary Between Airspace & Outer Space

The debate on how to distinguish airspace from outer space is as old as the space age itself. The problems emerging from space exploration first entered the agenda of the United Nations in 1957, and were later placed on the agenda before the General Assembly through the establishment of an *Ad Hoc* Committee on the Peaceful Uses of Outer Space (COPUOS) in 1958.[15] Although this Committee initially focused on the debate of disarmament, its status was later made permanent in 1961 while its

---

[12] *See generally* FRANS G. VON DER DUNK, PRIVATE ENTERPRISE AND PUBLIC INTEREST IN THE EUROPEAN 'SPACESCAPE' – TOWARDS HARMONIZED NATIONAL SPACE LEGISLATION FOR PRIVATE SPACE ACTIVITIES IN EUROPE 25 (1998).

[13] *Id*. at 24.

[14] *See* Eilene Galloway, *Space Law in the 21st Century*, 26 (2) J. SPACE L. 187, 190-91 (1998).

[15] *See generally* MANFRED LACHS, THE LAW OF OUTER SPACE – AN EXPERIENCE IN CONTEMPORARY LAW-MAKING 30 (1972).

charter was expanded to include examination of all issues relating to the field of exploration and use of outer space by governmental and non-governmental organizations.[16] In 1962 the Scientific and Technical Sub-Committee and Legal Sub-Committee began their true substantive work and became the main center of international cooperation and coordination for exploration of peaceful uses of outer space.[17] Successive sessions focused on general and specific issues of space law, including the establishment of a frontier between outer space and atmospheric space.[18]

However, one of the early problems encountered by these Committees emerged from the fact that there "exist no physical bases which might be used as a sound[scientific] reason for defining a boundary between air space and outer space."[19] Although a great variety of various physical phenomena have been analyzed over the years, including "state of matter," "gravitational field," "electromagnetic," "geometrical/geographical," "biological/environmental," and "technological" bases for demarcation, no scientifically based boundary has been discovered.[20] Arguments for a "physical boundary" versus a "functional boundary" therefore emerged to address the legal status of various space activities.[21]

However, COPUOS did not initially believe that the boundary problem deserved a priority consideration at that time because the absence of such demarcation did not create any serious problems.[22] Both space powers (the U.S. and U.S.S.R.) did not believe it was in their interest to establish boundaries which might restrict their freedom to operate in space, whether for

---

[16] *Id*. at 30-31.

[17] *Id*. at 30.

[18] General Assembly, *Report of the Legal Subcommittee*, pp. 3-9, U.N. Doc. A/AC.105/6 (July 9, 1962) (28 May – 20 June 1962).

[19] *See generally* S. Mishra & T. Pavlasek, *On the Lack of Physical Bases for Defining a Boundary Between Air Space and Outer Space*, 7 ANNALS AIR & SPACE L. 399, 412 (1982).

[20] *Id*.

[21] *Id*.

[22] *See* Ram S. Jakhu, *The Legal Status of the Geostationary Orbit*, 7 ANNALS AIR & SPACE L. 333, 336 (1982) [hereinafter *Geostationary Orbit*].

peaceful or military purposes.[23] At the other end of the spectrum, though, early scholars noted that even a UN resolution urging free use of outer space did not infer "a legal right for any State to propel its spacecraft through the national airspace of . . . other State[s] merely to ascend or descend from free outer space . . . ."[24] "International law has never accepted the view" that a right of transit passage through one medium automatically carries with it the same right through other areas as well.[25] Therefore, the debate over a boundary between airspace and outer space was not simply theoretical, but embodied a conflict between exclusive State sovereignty over airspace, and freedom of outer space.[26] The height of any upper boundary of national airspace would be a limiting factor in the development of orbital flight, and unless the boundary was established fairly close to Earth's surface, few States would be able to launch or receive a satellite in its national territory without passing through the national airspace of other States.[27] Thus with the advent of the space age, the stage was also set for a conflict between traditional international law, which was developed by a relatively small number of countries on the basis of strict observation of sovereignty, versus international space law, which was developed by the international community as a whole on the basis of international cooperation and co-sharing of international resources.[28]

B. Examination of the Spatial Approach

Different and inconsistent legal regimes therefore emerged over the boundary between air space and outer space, which

---

[23] *Id.*

[24] John Cobb Cooper, *Legal Problems of Spacecraft in Airspace, reprinted in* EXPLORATIONS IN AEROSPACE LAW – SELECTED ESSAYS BY JOHN COBB COOPER 1946-1966 305, 310 (Ivan A. Vlasic ed., McGill University Press 1968) (1964).

[25] *Id.* at 310.

[26] Ram S. Jakhu, *Application and Implementation of the 1967 Outer Space Treaty, in* PROCEEDINGS OF THE FORTIETH COLLOQUIUM ON THE LAW OF OUTER SPACE 442, 443 (1997) [hereinafter *1967 Outer Space Treaty*].

[27] Cooper, *supra* note 24, at 311.

[28] *See* Ram S. Jakhu, *Developing Countries and the Fundamental Principles of International Space Law, in* NEW DIRECTIONS IN INTERNATIONAL LAW 351, at 363 (R. G. Girardot, et al. eds., 1982) [hereinafter *Developing Countries*].

still represents the longest unresolved legal problem of the UN COPUOS Legal Subcommittee.[29] One school of thought stressed the need for a clear internationally agreed upon boundary between the two regions, thereby regulating activities according to the place where they occurred – the so-called "spatial" approach to standardization.[30] "Spatialists stress[ed] the need for clear demarcation between airspace and outer space," as each country exercised complete and exclusive sovereignty over its territory, while outer space remained "free for exploration and use by all States."[31] Delimitation remains necessary to provide and facilitate application and development of outer space law, to define the upper limit of State sovereignty and safeguard national air space, and avoid State disputes over such boundaries.[32]

Some scholars proposed a "new international convention fixing the height of the upper boundary of national territorial airspace."[33] Forty kilometers was originally estimated to be the maximum height to which normal aircraft could be flown, while 80 kilometers represented the approximate upper limit of aerodynamic lift.[34] One hundred twenty kilometers was also proposed as an early estimate of "the lowest practical altitude of free orbital flight."[35] This later notion gained support in 1968 from the International Law Association, who proposed that the term "outer space" should include "all space at and above the lowest perigee achieved" by any satellite put into orbit as of 27 January 1967 (the date when the Outer Space Treaty was opened for signature).[36] This same association later recognized that an altitude of 100 km had been "growingly acknowledged by States" and space experts as "outer space."[37]

---

[29] *1967 Outer Space Treaty, supra* note 26, at 443.

[30] *Id.*

[31] *Geostationary Orbit, supra* note 22, at 338.

[32] *Id.*

[33] Cooper, *supra* note 24, at 311.

[34] *Id.* at 311-12.

[35] *Id.*

[36] International Law Association, *Report of the Fifty-Third Conference Held at Buenos Aires – August 25th to August 31st, 1968*, 53 INT'L L. ASS'N REP. CONF. xxii (1969).

[37] International Law Association, *Report of the Fifty-Eighth Conference Held at Manila – August 27th, 1978 to September 2, 1978*, 58 INT'L L. ASS'N REP. CONF. 2 (1980).

Through the years a demarcation has been tacitly acknowledged and variously based on the lowest altitude at which Earth orbit can be maintained by a satellite, a somewhat randomly selected altitude of 100 kilometers, or an *a priori* notion regarding how little air might exist before a sector is deemed "outer space" and not "airspace."[38] Many States which were formerly proponents of the functionalist approach gradually shifted their beliefs over the years. One such shift occurred within the Soviet Union, a former functionalist State, when they published a working paper in 1979 proposing an "Approach to the Solution of the Problems of the Delimitation of Airspace and Outer Space."[39] This tripartite proposal stated that the region above 100 (110) kilometers altitude above sea level is outer space, that this boundary between airspace and outer space should be established by treaty, and that States' space objects shall retain the right of overflight at altitudes lower than 100 (110) kilometers for the purpose of reaching orbit or returning to the launching State.[40]

The U.S.S.R. reiterated this approach in a 1983 working paper as well. Once again they recommended that "outer space" should be established at an altitude not exceeding 100 kilometers and confirmed by an international agreement.[41] The right of innocent (peaceful) passage over other State territories at altitudes below 110 kilometers would also be recognized in this proposed instrument.[42]

But in the twenty years that followed these proposals, little progress was made in resolving the boundary problem. In 2003, the Report of the Legal Sub-Committee of COPUOS revealed that this Committee continues to struggle with the same defini-

---

[38] *See* Martine Rothblatt, *Legal Aspects of Geostationary Platforms in the Stratosphere*, *in* AMERICAN INSTITUTE OF AERONAUTICS AND ASTRONAUTICS 1 (1999).

[39] *See* Bin Cheng, *The Legal Regime of Airspace and Outer Space: The Boundary Problem Functionalism Versus Spatialism: the Major Premises, in* STUDIES IN INTERNATIONAL SPACE LAW 425, at 427 (Bin Cheng ed., 1997).

[40] *Id.*

[41] Union of Soviet Socialist Republics: Working Paper, U.N. Doc. A/AC.105/C.2/L.139 (April 4, 1983) [hereinafter U.S.S.R. Working Paper].

[42] *Id.*

tional problems presented decades earlier.[43] Despite the reestablishment of a Working Group to address "Matters Relating to the Definition and Delimitation of Outer Space," little headway has been made to find an approach suitable to all delegates.[44] While some delegations expressed the view that a "functional approach should be taken in relation to the exploration and use of outer space," others believed that such an approach would have a negative impact on State sovereignty over national airspace.[45] Other delegates also expressed support for the delimitation of outer space at an altitude of 100-110 kilometers and the right of innocent passage during space launches and returns to Earth[46] – the same proposal championed by the former Soviet Union many years before. Given the lack of agreement on such issues, delegations continued to express concern that the "lack of a definition and delimitation of outer space would bring about legal uncertainty with regard to space law, which provided that outer space was free for exploration and use by all States, and air law, which provided for sovereignty over national airspace."[47]

Australia has fully embraced the spatial approach as one of the first countries to use domestic legislation to set a particular altitude as the official boundary between airspace and outer space.[48] As part of its official legislative definitions, "launch," "launch vehicle," "return," and "space object" each incorporate specific references to objects and/or payloads which exceed a distance "of 100 km above mean sea level."[49] These specific references setting 100 km as the official boundary were added to the original 1998 Act through the Space Activities Amendment Act 2002,[50] due in part because the former "lack of a precise

---

[43] *See* U.N. Comm. on Peaceful Uses of Outer Space [COPUOS], Legal Subcomm., *Report of the Legal Subcommittee on the Work of Its Forty-Second Session, Held in Vienna from 24 March to 4 April 2003*, ¶¶ 77-82, U.N. Doc. A/AC.105/805 (Apr. 10, 2003).

[44] *Id.* ¶ 8(b).

[45] *Id.* at Annex II, ¶ 5-6.

[46] *Id.* at Annex II, ¶ 7.

[47] *Id.* ¶ 77.

[48] Space Activities Act 1998, Austl. Acts No. 123 (1998), *available at* http://www.unoosa.org/oosa/en/SpaceLaw/national/australia/space_activities_act_1998E.html [hereinafter 1998 Act].

[49] *Id.* § 8.

[50] Space Activities Amendment Act 2002, Austl. Acts No. 100, §§ 2-5 (2002), *available at* http://www.austlii.edu.au/au/legis/cth/num_act/saaa2002247/.

definition of the term 'outer space' had led to uncertainties with respect to what launch activities were covered by the Australian *Space Activities Act* of 1998."[51]

South Africa has also taken a similar approach in its division of air from space through official domestic legislation.[52] But rather than setting a particular altitude as the breakpoint between one region and another, the South African law instead simply defines outer space as "the space above the surface of the Earth from a height at which it is in practice possible to operate an object in an orbit around the Earth."[53] Ironically this boundary effectively sets outer space at the point of lowest perigee of a satellite, which in some instances could be at altitudes of as low as 80 km for highly-elliptical orbits – a location much lower than that (100 km mark) traditionally favored by the spatial approach.[54] It is also worth noting that the South African definition for *suborbital* flight includes "the trajectory of any object which leaves the surface of the earth due to a launch, but returns to the surface of the earth without completing an orbit around the earth."[55] The South African approach might represent an initial fledgling solution to functional-spatial differences, as the orbital components of these definitions are one precursor for solving the problems of an air-space boundary, and in fact comport precisely with the notions of Orbit Law proposed and explained later in this article.

The European Union (EU) also appears to be favoring the spatialist approach in recent legislation. In a recent EU Council Regulation referencing "space qualified" materials, items which are launched to heights of 100 km or more qualify for this special status.[56] "'Space Qualified' refers to products designed, manufactured and tested to meet the special electrical, me-

---

[51] Peter van Fenema, *Suborbital Flights and ICAO*, 30 AIR & SP. L. 396, 398 (2005).

[52] *See* Space Affairs Act, JSRSA No. 84 of 1993 (1993) (S. Afr.), *available at* http://www.space.gov.za/docs/Space_Affairs_Act_84_of_1993.pdf.

[53] *Id.* § 1.

[54] Peter van Fenema, Lecture at the Faculty of Law, McGill University: Law of Space Applications (Mar. 19, 2007) (on file with author).

[55] Space Affairs Act, *supra* note 52, § 1.

[56] Council Regulation 1334/2000, Setting Up a Community Regime for the Control of Exports of Dual-Use Items and Technology, 2000 O.J. (L 159), Annex I, 25.

chanical or environmental requirements for use in the launch and deployment of satellites or high altitude flight systems operating at altitudes of 100 km or higher."[57] Although there are currently no other known domestic instances of official spatial demarcation by European States, this action by the EU Community represents a significant, and perhaps premature, step towards "uniformity" which might bind and limit its members in future air/space activities. For each of those States which side with the spatial approach, all activity falling below that ultimate boundary between air and space is no longer protected by the "freedoms" of space.[58]

C. Examination of the Functional Approach

The second approach which emerged to offer guidance across the expanse between airspace and outer space saw no need for boundaries, because all activities should instead be regulated according to their nature and purpose rather than a location of occurrence – a "functional" determination of applicable law.[59] These proponents found nothing "magic" about an altitude of 100 kilometers or fractions of difference in air pressure, and instead believed that law should be based on function and desired result, not happenstance coordinates.[60] For example, if an object were able to function like a satellite as a result of helium pressure instead of orbital mechanics, it should be treated like a satellite.[61] Functionalists saw no need to establish a fixed boundary, as airspace and outer space existed as a continuum in which the *activity* should dictate the law governing it – aeronautical activities governed by aeronautical law, and space activities by space law.[62] Some early authors predicted that adherence to "fixed lines or putative horizontal sheets" cre-

---

[57] *Id.*
[58] *See* Outer Space Treaty, *supra* note 9, arts. I, II.
[59] *1967 Outer Space Treaty*, *supra* note 26, at 443.
[60] Rothblatt, *supra* note 38, at 4.
[61] *Id.*
[62] *Geostationary Orbit, supra* note 22, at 337-38.

ated legal difficulties, and that this problem would eventually "transform itself from one of boundaries to one of activities. . ."[63]

While this functionalist prediction had the initial support of a number of States, including both major space powers, its emergence as a unifying policy never came to pass.[64] But a number of States including the United States, United Kingdom, and Federal Republic of Germany continued to argue against the imposition of a fixed boundary between airspace and outer space.[65] The inability of most countries to monitor such a boundary; inadequate examination of relevant scientific, legal, technical, and political factors; and potential inhibiting effect that a fixed boundary might impose on future space use and exploration negated any boundary-based justifications.[66]

During the evolution of space flight, no State ever objected to the overflight of artificial Earth satellites above their territories, during which time some craft ascended and descended through the territorial air spaces of different States.[67] Therefore, some scholars proposed that such passage coupled with the cardinal freedom of exploration and use of outer space appeared to have created a limited international custom.[68] Analysis of this implied freedom to go into outer space and return to Earth while traversing foreign airspace led those authors to support the functionalist cause.[69] If an aerospace object was used for the primary purpose as a device operating in outer space, space law should apply to it.[70] Stephen Gorove summarized it thusly:

> Once the primary purpose of the object is determined, the corresponding legal regime applicable to it should continue to be applied for the duration of the object's flight, whether in the airspace or outer space, at a particular time. Attempting to

---

[63] Cheng, *supra* note 39, at 425-26 (citing Leon S. Lipson & Myres S. McDougal, *Perspectives for a Law of Outer Space in* STUDIES IN WORLD PUBLIC ORDER 937 (Myres S. McDougal, ed., 1987)).

[64] *See id.* at 426-28.

[65] *Id.* at 428.

[66] *Id.*

[67] *See* Stephen Gorove, *Aerospace Object – Legal and Policy Issues for Air and Space Law*, 25(2) J. SPACE L. 101, at 109 (1997).

[68] *Id.* at 110.

[69] *See id.* at 110.

[70] *Id.*

> proceed otherwise would lead to conflicting interpretations with respect to the applicable law and would greatly confuse the problem.
>
> If the primary function of the aerospace object was to operate as a spacecraft, then air law would not be applicable to it except in situations in which the craft returns in a non-accidental situation to a non-launching state. Aerospace objects launched into outer space are subject to the rules governing the registration of objects so long as the primary purpose of the object has been to operate as a spacecraft. Such an object should be governed by the national laws of the launching state, or if it was launched from a platform in outer space, it should be governed by outer space rules. As long as the object's primary function was to operate as a spacecraft – its safe passage to and from outer space has now attained the status of international customary law.[71]

Although the functionalist approach appears to bestow more potential freedoms on those activities destined for space, it still fails to successfully address dual-use (airspace-outer space) craft mentioned elsewhere in this article, and leaves other questions such as the extent of State-sovereign airspace unanswered.

D. Common Issues to Both the Functionalist and Spatialist Approach – State Sovereignty

Despite the apparent contradictory methods of division between airspace and outer space, it should be noted that the notion of a physical boundary examines physical *conditions*, while the functional boundary approach analyzes physical *applications*.[72] Both methods of analysis are therefore "physical" and represent no real difference between the two – there is merely a change in vantage point and perspective.[73] The attempt to impose a boundary is therefore an arbitrary and artificially-conceived decision with no physical foundation behind it, but

---

[71] *Id.*
[72] Mishra & Pavlasek, *supra* note 19.
[73] *Id.*

has nonetheless emerged as a result of social, cultural, economic, historical, and political forces influencing the perception that a definition or differentiation between airspace and outer space is needed.[74]

The aforementioned issue of State sovereignty has been one of the primary reasons for the perceived need for a boundary. At one end of the spectrum are scholars such as Cheng, Dembling, and Terekhov, who do not believe customary international law allows free passage of aerospace objects through sovereign airspace – State sovereignty reigns supreme.[75] Other scholars have taken a middle-ground approach recognizing limited incursions by space objects into State airspace, while Finch and Christol have asserted the outright existence of such a right of passage.[76]

It should not be surprising that the International Civil Aviation Organization (ICAO) was brought into the debate in recent years as well. In 1986, a Draft Brief for the ICAO Observer to the Legal Sub-Committee of the U.N. Committee on the Peaceful Uses of Outer Space (COPUOS) was prepared and of particular interest to ICAO.[77] As the Legal Sub-Committee continued to examine the definition and delimitation of outer space and the character and utilization of the Geostationary Orbit, a study of the Chicago Convention and other international air law instruments was recommended.[78] Because ICAO's input was confined to factual information on the Chicago Convention with respect to the concept of airspace, it did not formulate any specific policies to be presented to COPUOS. ICAO did bring to the attention of the Legal Sub-Committee that ICAO was "responsible for developing the position of international civil aviation in all matters related to the study of questions involving the use of space technology for air navigation purposes" and "for stating the position of international civil aviation on all

---

[74] *See id.* at 412-13.

[75] Gorove, *supra* note 67, at 109.

[76] *Id.*

[77] Draft Brief for the ICAO Observer to the Legal Sub-Committee of the United Nations Committee on the Peaceful Uses of Outer Space (UNCOPUOS), C-WP/8158 15/1/86 (Jan. 15, 1986) [hereinafter Draft Brief for the ICAO Observer].

[78] *Id.*

related outer space matters."[79] As such, ICAO came to a highly noteworthy finding in its interpretation of the Chicago Convention and international air law to be presented to the Legal Sub-Committee of UNCOPUOS: "The right of innocent passage of spacecraft through the sovereign airspace is a proposal *de lege ferenda* (i.e. a legislative proposal not reflecting the existing law); such right *does not exist* under the present international law of the air; an unconditional right of passage through the sovereign airspace does not exist even with respect to civil aircraft and is specifically subject to special authorization with respect to State aircraft and pilotless aircraft."[80]

UNCOPUOS also submitted a number of questionnaires to various States in an effort to refine the legal status of aerospace objects.[81] The insights and recommendations offered by this diverse group of States yielded significant legal observations. State sovereignty versus freedom of space remained at the forefront of these studies, while several States' analysis appeared to support a functionalist position. For example, the Czech Republic observed that there has not yet been sufficient support for the right of innocent passage of ascending or descending space objects to recognize it as a customary rule of international law.[82] However, they did highlight that no protests against such passage have occurred, and that an explicit admission and eventual regulation of truly innocent passage should be considered.[83] Accordingly, the norms of national and international air law would only be applicable to aerospace objects whose purpose was aeronautics, not aerospace vehicles which would be considered space objects.[84] The Czech Republic also concisely summarized liability issues for both regimes – aircraft liability being governed by international treaties and some national law, and attributable to private persons; whereas space object liability is governed by

---

[79] *Id.*

[80] *Id.* (emphasis added).

[81] *See* U.N. GA Questionnaire on Possible Legal Issues with Regard to Aerospace Objects: Replies from Member States, U.N. Doc. A/AC.105/635 (1996) [hereinafter U.N. GA Questionnaire].

[82] *Id.* at 10.

[83] *Id.*

[84] *Id.*

international law and attributable to international persons.[85] Unfortunately, due to problems with the extent and bases of liability, jurisdictional concerns, and myriad other differences between aircraft and spacecraft flights and registration, the Czech Republic believed the likelihood of establishing a legal regime to govern such air and space activities was remote.[86]

Despite Russia's former transition from a functionalist approach to an apparent belief in the spatialist system,[87] many of its questionnaire answers seemed to revert back to functionalist frames of reference. They, too, believed that the issue of paramount importance was whether or not procedures should be brought into effect for regulating and notifying States of the passage of aerospace objects through the airspace of its territory.[88] However, the legal regime applicable to such flights must differ according to its purpose; for aerospace objects undertaking an Earth-to-Earth mission without entering outer space, international air law would apply.[89] Objects undertaking an Earth-orbit mission would fall within the jurisdiction of international space law.[90] As discussed later in this article, these recommendations are quite similar to the proposals for an orbital law system. But the Russians distinguished their recommendations for aerospace objects based on the object's designation, i.e. whether the object was a transportation system intended for carrying payload from one Earth-point to another, or whether it was designated to be launched into outer space.[91] While the object's intent or designation will play a role in the new Orbit Law proposals, other factors will also influence the application of appropriate legal standards.

Germany remained true to its functionalist roots in their answers to the questionnaire. Preferring the term "space transportation system" to the ambiguous and yet-defined term "aerospace object," Germany's delegates believed that space transpor-

---

[85] *Id.* at 6-7.
[86] *Id.*
[87] *See* Cheng, *supra* note 39, at 427; *See also* U.S.S.R. Working Paper, *supra* note 41.
[88] U.N. GA Questionnaire, *supra* note 81, add. 1, at 4.
[89] *Id.*
[90] *Id.*
[91] *Id.*

tation systems were space objects and subject to international space law throughout its flight through airspace and outer space.[92] They also concluded that elaboration of a common legal solution for space objects re-entering the airspace of foreign States is appropriate, as sovereignty remained a particular concern of many other legal regimes.[93] An interesting portion of the German analysis included references to the flight of the U.S.S.R. spacecraft *Buran* in 1988. Because the craft's trajectory and re-entrance into Baikonur apparently took it through the airspace of Turkey, this flight provided some precedence for overflight of a space object with no known (Turkish or other) State objection to such territorial infringement.[94] Although the delegation was quick to point out that no customary international law exists since the one and only known precedent of the *Buran* overflight did not constitute international *practice*,[95] this event remains an important factor in the evolution of air and space law and highly relevant to proposals for an Orbit Law system.

Russia referenced a very similar instance of international overflight by a space object in their delegation's response to this questionnaire. Regarding precedents for the passage of aerospace objects re-entering Earth's atmosphere, Russia referred to the flight of the U.S. *Space Shuttle Atlantis* in March 1990.[96] A few hours before the *Shuttle*'s trajectory would bring it over certain eastern regions of the U.S.S.R., the United States furnished data about its planned flight to the Soviet Union as a matter of courtesy and on the basis of goodwill.[97] However, Russia indicated that the fact that such information was furnished should not be deemed to set a precedent.[98]

The absence of other State responses to this questionnaire due to the limited number of relevant and noted flights does not support a right of passage for ascending or descending space

---

[92] U.N. GA Questionnaire, *supra* note 81, at 3.
[93] *Id* at *5*.
[94] *Id* at 7, 11.
[95] *Id* at 11.
[96] U.N. GA Questionnaire, *supra* note 81, at 6-7.
[97] *Id.*
[98] *Id.* at 7.

objects as a customary rule of international law.[99] But as previously mentioned, several States including Germany and Russia explicitly stated that a right of *innocent* passage which was not prejudicial to the peace, good order, or security of subjacent States *should* be considered as a way to legalize the actual practice, while support for customary international law enabling passage of aerospace objects after re-entry into Earth's atmosphere was evolving.[100] It is also momentous that these two episodes referenced in the questionnaires represent uncontested overflights into State airspace by space objects (i.e. *Space Shuttles*) designed for the transport of astronauts, and not simply satellite overflights. Although the *Buran* flight was unmanned,[101] its ability to carry passengers marries well to the Russian emphasis of examining the space object's designation as a sub-orbital or space-bound transportation system for cargo and/or passengers.[102]

There also appear to be additional instances of overflight, but few details on the particulars of those launches, from the Russian cosmodrome of Baikonur. The cosmodrome, which is 125 kilometers (75 miles) long and 85 kilometers wide, borders the Syr Daria river in southwestern Kazakhstan and is wholly administered by Russia,[103] but is described as not allowing due-east launches (the most efficient) due to lower stages impacting China.[104] Although no details could be found describing former eastern launches which may have crossed Chinese airspace, or lower stages of launch vehicles landing in China, these descriptions and the current prohibition against such launch trajectories tends to support their occurrence at some point in previous launches. Of equal significance is the fact that no record of

---

[99] Gorove, *supra* note 67, at 108.

[100] *Id* (citing U.N. GA Questionnaire, *supra* note 81, at 4-5).

[101] Felicity Barringer, *Soviet Space Shuttle Orbits and Returns in Unmanned Debut*, N.Y. TIMES, Nov. 16, 1988, at A1.

[102] U.N. GA Questionnaire, *supra* note 81, at 4.

[103] *Russia, Kazakhstan extend Baikonur cosmodrome lease to 2050*, SPACEDAILY.COM (Sept. 12, 2004), http://www.spacedaily.com/2004/040109151358.forhgci8.html.

[104] Rocket & Space Technology, *World Space Centers*, http://www.braeunig.us/space/center.htm (last visited Apr. 26, 2010).

Chinese protests over such launches or impacts could be found either.

In the Republic of Korea's U.N. General Assembly questionnaire responses regarding aerospace objects, they also acknowledged the special problems that "sovereignty over airspace, aerial safety and so on" posed during the flight of an aerospace craft, and recommended that the "spatial approach has more merit than the functional approach under the present international legal system because the former can more easily decide the law to be applied."[105] Their observations also included a considerably different approach to objects passing through other State airspace when entering or leaving orbit, recommending that international air law or the relevant State's domestic law be applied to the space object to address any problems of sovereignty or security.[106] The Korean delegation also believed that simply because countries did not raise any objection to the passage of space objects over their airspace did not signify approval of such passage as international practice or precedence; rather, they speculated that those States simply did not have information about the passage and there was no perceptible disadvantage with such passage at that time.[107]

In a more recent related case of overflight concerns, the U.S. and Canada engaged in diplomatic negotiations regarding the planned launch of a rocket scheduled to fly over the area of Newfoundland.[108] Canadian officials expressed concern over the planned 2005 launch of a *Titan IV* missile by the U.S. Air Force from Cape Canaveral, Florida after learning that its flight path would take the missile over the Grand Banks off Newfoundland.[109] Fearing that debris from the launch would endanger Canadian oil platforms in this area, officials from Ottawa contacted the United States government and obtained an "indefinite

---

[105] U.N. GA Questionnaire, *supra* note 81, at 5.

[106] *Id.*

[107] *Id* at 6.

[108] *Missile Test Delayed After Sparking Scare at Oil Platforms*, CBC NEWS CANADA, Apr. 8, 2005, http://www.cbc.ca/canada/story/2005/04/07/nfld-oil-050407.html [hereinafter *Missile Test*].

[109] *Id.*

delay" for such testing.[110] However, it is important to note that the basis for the Canadian objection stemmed from concerns over the potential hazard posed by falling debris from the launch to the Hibernia and Terra Nova oil platforms – debris which included a 10-ton solid rocket booster which was estimated to fall in an area within 27 kilometers of the Hibernia oil rig.[111]

As negotiations continued between the two governments, Canada ultimately capitulated and withdrew their objections to the launch after receiving "written assurances that any risk to offshore activity has been mitigated."[112] After receiving "precise assurance[s] . . . that the US Air Force would be able and prepared to destroy the rocket in the unlikely event that unforeseen circumstances arise that could result in the rocket booster falling outside of the identified safety zone," Deputy Prime Minister and Minister of Public Safety and Emergency Preparedness Canada Anne McLellan provided officials in Newfoundland written declarations that all safety mechanisms were in place to protect all offshore operations.[113] The launch ultimately occurred on April 30, 2005 without incident.[114]

There was no objection noted by Canadian officials that such a launch would be in violation of Canadian airspace, but simply concerns by Newfoundland and Labrador premier Danny Williams that the rocket could cause damage to the oil platforms if it dropped any debris.[115] Given the distance between Cape Canaveral and Newfoundland for this projected polar launch, it is highly unlikely that the rocket's trajectory and altitude obtained by the time it overflew the Grand Banks would still be in an area possibly considered to be Canadian airspace (less than 100 km). Therefore, this episode of diplomatic

---

[110] *Id.*

[111] *Id.*

[112] Press Release, Government of Newfoundland and Labrador- Canada, Premier Williams Pleased to Receive Requested Assurances from Federal Government on Safety of Offshore Vessels During Launch of Titan IV Rocket (Apr. 14, 2005), http://www.releases.gov.nl.ca/releases/2005/exec/0414n02.htm.

[113] *Id.*

[114] *Controversial U.S. Rocket Launches as Planned,* CTV NEWS, Apr. 30, 2005, http://www.ctv.ca/servlet/ArticleNews/story/CTVNews/1114869332393_5/?hub=TopStories.

[115] *Id.*

negotiations for space object overflight can be distinguished by concerns over safety rather than sovereignty. Although State interests in safety are also often linked with matters of sovereignty, in this instance corporate concerns raised to the Canadian government prompted the Canadian-U.S. intervention.[116]

E. Common Issues to Both the Functionalist and Spatialist Approach – Liability

Although later sections of this article will more closely examine the bases and solutions for *liability* in air and space flights, it is useful to first examine the topic from the shared perspective of a functional-spatial interest. By looking at the risks of error and concerns over accountability shared by all flight participants regardless of location or function, one might gain valuable insight into possible solutions to this financial burden and danger shared by all who fly in air or space.

Various commercial industries have increased their involvement in space activities which were formerly under State control, such as space transportation, satellite communications, remote sensing, and even commercial launch ventures.[117] However, such developments create unanswered questions about the accession of international organizations to the existing body of space law, and issues of responsibility and liability for private operators.[118] Unfortunately, the development of space law in this area remains sluggish, with little to no enthusiasm to rewrite or codify international principles and rules to address these new developments.[119] Not only have "major [State] players in space politics" been reluctant to create too stringent a body of space law, but new commercial players have also resisted the introduction of a legal framework they consider to be an artificial barrier to their activities.[120] It therefore remains debatable

---

[116] *See Missile Test*, *supra* note 108.

[117] Peter Jankowitsch, *The Role of the United Nations in Outer Space Law Development: Past Achievements and New Challenges*, 26(2) J. SPACE L. 101, at 108 (1998).

[118] *Id.*

[119] *Id.*

[120] *Id.* at 109.

to what extent economic globalization can safely and successfully continue without some degree of regulation.[121]

This stagnation of *corpus juris spatialis internationalis* represents the single most important gap opening up in international space law proper: the absence of regulation of economic and commercial aspects of space activities.[122] Because the fundamental freedom to undertake space activities applies to private space activities also, the related obligations of Article VI of the Outer Space Treaty of authorization and continuing supervision should be a principle concern for States.[123] However, these obligations and their connection to liability in Article VII (as well as indirectly in Article VI) and the Liability Convention constitute only a minor part of the body of space law.[124] Despite the devotion of these treaty areas to this subject, this category has received very little elaboration through the years, while State implementation at the national level has taken rather different directions.[125]

The exclusive character of State liability and responsibility would seem to necessitate careful regulatory measures at the national level.[126] National legislation is indispensable in implementing international space law; indeed a number of rules on the public international level call for national implementation by individual States vis-à-vis the non-governmental entities under their jurisdiction.[127] And the twin concepts of responsibility and liability should prompt States to take domestic action to monitor and control those activities for which they could be held accountable at the national level.[128] Frans von der Dunk emphasized the importance of such State action when he stated:

> Only once such States have taken up the baton and indeed have started to exercise some substantial measure of authorization and supervision – in other words: jurisdiction – the

---

[121] *Id.*
[122] *See* VON DER DUNK, *supra* note 12, at 24.
[123] *See generally id.* at 25.
[124] *Id.*
[125] *Id.* at 24.
[126] *Id.*
[127] *Id.*
[128] *Id.* at 25.

> question becomes acute for private enterprise, whether this freedom has also been translated on the national and private level.[129]

The Convention on the International Liability for Damage Caused by Space Objects (Liability Convention)[130] and the Outer Space Treaty[131] set no limits on the amount of potential compensation for damages caused by space activities. The liability system therefore provides relevant States the choice either to transfer this unlimited liability to the private entities to be licensed (and thereby making it largely impossible for private enterprise to take insurance), or to establish a limit of reimbursement nationally (acting as a re-insurer for damage claimed internationally above the national limit).[132] While some States have maintained jurisdiction over private entities through the establishment of a national licensing system for space activities,[133] a number of States have not yet taken any legislative activities to regulate those private activities for which they might be held responsible and/or liable at the international level.[134] Accordingly, accountability at the international level suffers from considerable uncertainties and inconsistencies.[135]

Von der Dunk argues that States are obviously the best controllers of private enterprise, possessing the legislative machinery to monitor and enforce compliance with established norms.[136] However, he believes that international legislation is necessary to define the parameters and scope within which such control of private space activities should take place.[137] In other words, international action is needed to determine substantive guidance (including uniformity of regulation), and structural

---

[129] *Id.*

[130] Convention on the International Liability for Damage Caused by Space Objects, arts. I, II, III, *opened for signature* Mar. 29, 1972, 24 U.S.T. 2389, 961 U.N.T.S. 187 [hereinafter Liability Convention].

[131] *See* Outer Space Treaty, *supra* note 9, at arts. VI, VII.

[132] VON DER DUNK, *supra* note 12, at 17.

[133] *Id.* at 25.

[134] *Id.* at 26.

[135] *Id.* at 25.

[136] *Id.* at 26.

[137] *Id.*

guidance (minimizing State discretion to decide which categories of private activities they are answerable for at the international level).[138]

Orbit Law will hopefully provide the necessary framework and guidance sought by von der Dunk and needed by the space industry to chart its course and determine liability risks with some stability and predictability. Later portions of this article will explain Orbit Law's ability to mesh State action, private action, liability, and responsibility into one comprehensive system of apportionment. The solutions begin with both functional and spatial notions that have come full-circle and are now considered "customary space law."[139] First, that no nation objected to satellites flying over its territory, leading to the conclusion that a right developed for such flights.[140] Second, there is no legal distinction between airspace and outer space, but such activities have thus far been conducted on the basis that airspace extends to the height where planes can fly, while outer space begins where objects can remain in orbit.[141]

States are currently charged with responsibility for authorizing and continually supervising national governmental and nongovernmental entities,[142] thereby ensuring *State* involvement in all issues of satellite overflight and the air/space distinction. Said another way, States are so intricately tied to the issues of sovereignty and liability that Orbit Law will use this "common ground" as the building blocks for its initial structure. Both national and international legislation begin with State involvement, interaction, and cooperation. Orbit Law will initially maintain this *status quo* of State predominance over all issues of flight. However, *orbital status* will also be a factor in determining which principles of tort law are applicable to each particular flight situation. Ceilings of liability may also play a role in Orbit Law to alleviate the heavy financial burden that both States and private parties share when trying to insure space

---

[138] *Id.*
[139] Galloway, *supra* note 14, at 188.
[140] *Id.*
[141] *Id.*
[142] Outer Space Treaty, *supra* note 9, art. VI.

operations. As Orbit Law matures, notions of sole-State responsibility may be phased out over time in favor of more progressive apportionment of liability, updated principles of tort law, and equitable division of risk and insurance costs between actors.

III. CHAPTER II: THE NEW ORBIT LAW REGIME

Although international air and space law has historically been one of the few legal arenas where its drafting and development usually preceded its need for application,[143] it is apparent that advances in technology and the increased prevalence of hybrid flight participants may now be outpacing (and thereby creating) the need for new legal principles. Flight capabilities now exceed the traditional boundaries of both location and function (i.e. spatialist and functionalist approaches to air-space demarcation). Yet there remains a common factor which restricts a legal determination of the boundaries of flight under both the functional and spatial approach. That restrictive factor is encompassed in the attempt to determine either a certain functional event or break point at which a craft "breaks free" from the airspace realm and enters into outer space, rather than recognizing the ability to traverse both domains and embracing the capacity to function within both spheres of flight. New legal determinations of flight status based on a craft's orbital operation bridge the gap between airspace and outer space, location versus function, and application of the appropriate legal regime.

A. Explanations of Orbital Law and the "Blended Approach"

Although technology has merged air flight with space flight, current laws do not comport with such dual ambit capabilities, thus requiring a new approach to overcome the limitations of the air law and space law "either-or" determination based *solely* on flight status or location. The common flaw that both regimes

---

[143] "The Outer Space Treaty was prospective in nature, establishing laws for future actions. Most international law and treaties are reactive in nature, responding to the practice of nations." Ram S. Jakhu, Lecture at the Faculty of Law, McGill University: Space Law: General Principles (Oct. 10, 2006).

share includes trying to make a mission-based (functional) or linear (spatial) determination of that boundary, both of which seem tied to *atmospheric*[144] restraints. While spatialists are looking for a dividing-line within the atmosphere, functionalists limit flight activities as either purely aeronautical or space-based, without being able to categorize these new craft which cross and function within both spheres of operation.

The more logical approach to distinguish between different types of flight would focus on time and gravitational (i.e. orbital) boundaries. This new approach would determine whether and for how long the craft were able to remain *in orbit* above Earth's gravitational force, instead of simply "aloft" in or above any certain point in its atmosphere, or simply performing a particular air or space flight duty. Identifying a craft's orbit under Orbit Law will actually reflect a blending of both the functional approach (by examining whether or not the craft is *engaged* in or *intended* for an orbital rendezvous with Earth or some other celestial body) and the spatial approach (by examining the craft's *location* and *distance* covered to determine whether it meets orbital requirements). This new method of examining a craft's orbital status (which includes an analysis of the aspects of time, space, and function) might finally overcome the arbitrary and limiting factors of examining *only* location *or* function to determine its legal status.

For example, the spatial measurement of altitude *alone* would not be a factor in determining whether a craft was in an orbital status or not. If advances in technology enabled a craft to maintain an altitude of approximately 30 miles (well below the spatialists' traditional line of demarcation between airspace and outer space), yet complete one orbit around Earth, it should

---

[144] The term "atmosphere" is used in the broadest sense here. Although "space" is not typically thought of as having any atmosphere, Earth's atmosphere does extend far enough above the planet into regions that are generally agreed to constitute outer space. While the troposphere extends from Earth's surface up to a height varying from 8-14.5 km, the stratosphere begins at the top of the troposphere and extends upwards to approximately 50 km. Above that region lies the mesosphere up to approximately 85 km, after which extends the thermosphere to approximately 600 km. The outer most region of Earth's atmosphere includes the exosphere, which extends to an altitude of approximately 10,000 km. *See generally* NASA, *Earth's Atmosphere*, http://www.nasa.gov/audience/forstudents/9-12/features/912_liftoff_atm.html (last visited Apr. 26, 2010).

qualify for orbital status. But if this same craft touched down at some point before completion of one revolution around Earth, it would remain in a suborbital status.

A "time aloft" standard would also dictate whether a craft were in orbital or suborbital status. A craft which was able to remain above Earth for a certain period of time might qualify for orbital status. The ability of a craft to "hover" above Earth and qualify as an orbital flight would be logically based on comparison to satellites which appear to "hover" in the Geostationary Orbit.

By re-categorizing flights and determining a craft's legal status based on their orbital standing, rather than solely as an "aircraft" or "spacecraft," a new legal regime can be established that blends the best aspects of both air law and space law. The current trans-atmospheric capabilities of "space planes" and similar hybrid craft, and the benefit of replacing the "airspace versus outer space" dichotomy with an orbital regime, is advantageous for confronting the complex legal scenarios that modern technologies have created, and as increased actors continue to evolve.

i. The Science of Orbit and the Art of Orbit Law

In order to fully explore the prospects of Orbit Law, a brief explanation of the science of orbital motion is appropriate. In order for an object to achieve orbit with Earth, it must have sufficient boost to escape the initial pull of gravity and accelerate to the point that once it begins to fall back towards the surface, it essentially falls completely around the planet.[145] The minimum necessary speed to escape Earth's gravitational field and reach orbit is 7.9 km/sec, which is also known as First Cosmic Speed.[146] If the craft does not have enough thrust and/or speed (also approximately calculated at 30,000 km/hr) to attain suffi-

---

[145] *See generally* Jet Propulsion Laboratory, California Institute of Technology, *Basics of Space Flight*, http://www2.jpl.nasa.gov/basics/index.php (last visited Apr. 26, 2010) [hereinafter *Basics of Space Flight*].

[146] *See* Thomas Beer, *The Specific Risks Associated with Collisions in Outer Space and the Return to Earth of Space Objects – the Legal Perspective*, 25 AIR & SPACE L. 42, at 44 (2000).

cient altitude and overcome gravity, the effects of gravity and atmospheric drag will cause the object to follow its ballistic arc and return to Earth.[147] For purposes of the new Orbit Law regime, such flights are considered *suborbital flights*.

But for those objects obtaining the necessary orbital launch propulsion, that object can remain in orbit for months, years, or even longer (depending on its altitude) before its orbital status begins to degrade.[148] Altitude also affects the time it takes the object to complete its orbit, which is known as the orbit period.[149] Because of the marked reduction in gravitational effects with distance, an object in low Earth orbit needs significantly more speed to maintain its orbit than an object in higher orbit.[150] These principles of physics apply not only to satellites, but to any craft engaged in *orbital flight* with Earth. For example, while the *International Space Station* located nearly 250 miles above Earth's surface makes one complete Earth orbit approximately every 90 minutes, a satellite positioned above Earth's equator in what is known as the Geostationary Orbit will take one day to complete a single circuit.[151] Each of these satellite's voyages would be considered an *orbital flight* under the Orbit Law system.

As previously mentioned, Orbit Law would include a "time aloft" standard to also qualify for orbital flight based on the comparison with satellites which appear to hang motionless above a particular point on Earth. Craft positioned at an altitude of 22,300 miles (approximately 36,000 km) will take precisely one day to complete a single circuit above Earth in what is known as the geosynchronous orbit (GEO).[152] GEO is a prograde, circular orbit having a period of 23 hours, 56 minutes, 4 seconds.[153] If the craft is placed in this orbit directly above

---

[147] *Basics of Space Flight*, *supra* note 145.

[148] *Id.*

[149] *Id.*

[150] *See* Lawrence D. Roberts, *A Lost Connection: Geostationary Satellite Networks and the International Telecommunication Union*. 15 BERKELEY TECH. L.J. 1095, at 1099 (2000).

[151] *Id.*

[152] *Id.*

[153] *Basics of Space Flight*, *supra* note 145.

Earth's equator with an inclination of zero degrees, its flight will not only be synchronized with Earth's rotation, but also appear from the surface to be stationary and is commonly known as the Geostationary Orbit (GSO).[154] Based on this orbital epoch taking 23 hours, 56 minutes, 4 seconds to qualify as one geosynchronous or geostationary orbit, the new Orbit Law standard will also include the same measurement of time as one qualifier for a craft to be considered in Earth orbit.

However, as inter-planetary (or even inter-stellar) travel becomes feasible, one must also consider the potential application of Orbit Law beyond Earth's orbit. Therefore, another orbital consideration includes the launch of an object from one (planetary) orbit to another. This process is currently accomplished using Hohmann Transfer Orbits, while the portion of that orbit which takes the object to its next location is known as its trajectory.[155] Such orbital transfers would qualify as an *inter-orbital* flight in the new Orbit Law scheme. For example, if a craft were to travel from Earth to Mars, where it then remained in orbital status above that planet, the craft would be considered to accomplish *inter-orbital flight* during its transit between Earth and Mars, and then enter into *orbital flight* once it took its orbital position around the Red Planet. Although these Orbit Law proposals will apply the same legal standards to orbital and inter-orbital flights, it is nonetheless important to distinguish between these two cosmic realms.

As each planet's rotational period varies, the "time aloft" standard to qualify for orbital status will vary from planet to planet. Mars' rotation period takes 1.027 Earth days to complete one rotation, while Mercury takes 175.942 Earth days to complete its rotation; Venus' retrograde rotation results in a -116.75 Earth days comparison for its completion of one rotational cycle.[156] Jovian planets typically have much faster rotation periods; Jupiter takes only 9.9 hours to complete one rotation, Saturn requires 10.7 hours, Uranus takes 17.2 hours, and

---

[154] *See* Roberts, *supra* note 150.
[155] *Basics of Space Flight*, *supra* note 145.
[156] *Id.*

Neptune needs 16.1 hours for its revolution.[157] Therefore, in order for a craft to be considered "in orbit" based on a synchronous "time aloft" above that planet, the standard will vary from planet to planet.

ii. The Need for a "Blended Approach"

Many authors have foreseen the problems posed by craft that are able to function in both air and space environments. Dr. Eilene Galloway provided an excellent overview of the problem in 1998 when she observed:

> Defining the difference between sovereign airspace and nonsovereign outer space has been a continuing concern for lawyers seeking a definite basis for legal situations involving airplanes and satellites. COPUOS sought, but found it impossible to obtain, a scientific basis for demarcation. Meanwhile, space activities flourished on the basis that airspace extends to the height that planes can fly while outer space begins where satellites can go into orbit. Proposals for an artificial line have not found acceptance, probably because there have been no problems since the space age began that required for their solution a line between airspace and outer space. . . . The probability of spaceplanes that can fly in both airspace and outer space will add a new dimension to this problem, and it will be necessary to find out what functions such an object performs and how it is to be regulated. . . . We shall need a new definition of the entire problem: the relation of this new technology to sovereignty; the effects on the International Civil Aviation Organization, and how spaceplanes fit into regulation for international security.[158]

G. P. Zhoukov's observations also provided support to the notion of a blended approach for objects based on their orbital status. Zhoukov noted that functionalists categorize space objects by referring to its propulsion systems, as opposed to aircraft which

---

[157] *Id.*

[158] Eilene M. Galloway, *Guidelines for the Review and Formulation of Outer Space Treaties, in* 41ST COLLOQ. L. OUTER SPACE 245, 251-52 (1998).

rely on the properties of air for their flight.[159] However, such a functionalist approach did "not sufficiently take into consideration the potential developments of space travel – particularly the advent of reusable space ships fitted with air reactors that use the aerodynamic properties of air for their return to Earth."[160] Spatialists preferred the location in which the object was to operate, and suggested that a space object's defining characteristic be the fact that it was intended for flight operation in outer space.[161] But this approach did not account for "space objects" not yet launched into space, and would therefore not appear to meet the definition of a space object despite its locational qualifier.[162] Although space objects are technical devices, they do not qualify for treatment under international space law unless the object has been launched into or constructed in space – when the object enters artificial Earth satellite orbit or travels farther away, or is constructed in space or on some other celestial body, the international legal provisions of space law remain applicable until its landing or destruction upon re-entry into the atmosphere.[163]

Under either the functional or spatial approach, there comes a time during any craft's flight that it will likely transit national, and perhaps international, airspace. One country's methodology for combined use of airspace by aircraft and spacecraft compared the need for new regulations against the possibility that existing legal guidelines were sufficient for such transit.[164] In this study, it was discussed how Germany has structured its airspace under the supervision of the DFS (Deutsche Flugsicherungs GmbH), and that the operator of a *spacecraft* who wished to use national airspace would have to

---

[159] G. P. Zhukhov, *Definition and Classification of the Space Object: An Important Issue in International Space Law, in* LIBER AMICORUM HONOURING NICHOLAS MATEESCO MATTE: BEYOND BOUNDARIES 361 (Guido Rinaldi Baccelli ed., 1989).

[160] *Id.*

[161] *Id.*

[162] *See id.* at 362.

[163] *Id.*

[164] Marina Köster, *Legal Problems Related to a Combined Use of Airspace by Air and Spacecraft*, *in* PROJECT 2001 WORKSHOP ON COMMERCIAL LAUNCH SERVICES 137 (Bremen, Germany, Jan. 19, 2000).

accept air traffic management instructions just like an airline.[165] The United States Federal Aviation Administration (FAA) also planned for a combined use of airspace by aircraft and spacecraft using the "Space and Air Traffic Management System (SATMS Project)."[166] But while these States appeared to be getting a grasp on a functional combined management system, the more difficult challenge posed by these flights focused on management of *international airspace* being used by *spacecraft*.

The main international legal instrument for all civil aviation is the Chicago Convention; given the fact that 185 States have ratified this treaty, it can be regarded not only as multilateral but as universal.[167] However, its application to spacecraft and the corresponding traffic is still subject to question. Because the Convention and it Annexes have all been released without any inclusion or reference to spacecraft, Köster believed that application of this treaty by analogy would be against the declared text and intention of this legal work.[168] As such, the Convention should not be considered applicable to spacecraft, and transit of a spacecraft through international airspace, as well as launches and re-entries from international territory, is free.[169] Köster stated that because civil aviation and spaceflight are two equal users of international airspace, and with the increasing number of space-related launches and re-entries, consideration should be given to a new international agreement to manage such traffic and ensure its safety.[170]

Stephen Gorove also predicted the potential need for new pioneering legislation:

> [I]f future technological developments were to create a hybrid vehicle capable of moving freely in the air like an aircraft and also moving at will in outer space, a consideration of new laws, both domestic and international, may become necessary in or-

---

[165] *Id.* at 140.
[166] *Id.* at 141.
[167] *Id.*
[168] *Id.* at 142.
[169] *Id.*
[170] *Id.*

> der to adjust legal regulations to the latest scientific and technological innovations.[171]

Suffice it to say, each of these author's predictions have come to pass with the numerous advents in technology, thereby spurring the need for new legal considerations for blended air and space flights.

B. Examination of Sub-Orbital Flights & Progression of Orbit Law

As referenced in the introduction, the first fundamental premise of the new Orbit Law legal system includes the *application of all current public and private international Air Law tenants* to *all suborbital flights*. It should be noted that Stephen Gorove's article on *Aerospace Objects*[172] provided much of the impetus behind an orbital-based legal framework. However, one major difference between Gorove's analysis and these new proposals is that Gorove seemed to focus on the aerospace *object*, as opposed to the orbital flight emphasis of this new regime. Gorove differentiates simple "aerospace objects" from "space transportation systems," the latter having broader meaning and including space-shuttle-type transportation systems as well as typical rocket carriers.[173] "Aerospace objects" would therefore not be an appropriate term for hybrid systems that might be used for both air flights and outer space missions.[174]

Gorove also examined the Russian proposal for "aerospace objects" and its two distinct purposes as outlined in their response to the UNCOPUOS Legal Sub-Committee Questionnaire of 1996.[175] The Russian answer identified one possible aerospace object's purpose as flight from one point on Earth to another (a part of which might occur in space, but not attaining cosmic speed), while the other purpose included delivering crew and/or payload into outer space and later returning back to Earth (as

---

[171] Gorove, *supra* note 67, at 112.
[172] *See generally id.* at 101-112.
[173] *Id.* at 103.
[174] *Id.*
[175] U.N. GA Questionnaire, *supra* note 81, at Add.1, 4-5.

well as being able to remain in airspace for a certain period of time).[176] Gorove stated that an appropriate legal regime for these two distinctly different aerospace objects needed to be identified, and he based his analysis of the aerospace objects on a comparison of their status as an *aerospace plane* versus a space-shuttle-type vehicle, i.e. a "*space object*."[177]

Gorove foresaw early versions of the aerospace plane as designed for terrestrial transportation purposes – taking off from a point on Earth, and flying in airspace and traversing the fringes of outer space without completing an orbit, all for the sole purpose of reaching another point on Earth.[178] He also identified the main problems with such a versatile vehicle – delimitation and definition of airspace and outer space; the status of astronauts; and issues of liability, registration, and jurisdiction.[179] While some new international agreement or other accommodation might be necessary to resolve disputes between traditional (national) airspace and outer space, Gorove suggested that if the aerospace plane only operates as an Earth-bound transportation system and incidentally reaches the fringes of outer space, then air law should be applicable to it.[180]

This proposal mirrors that of the Orbit Law regime for a craft meeting the criteria of "suborbital" status, yet with different qualifiers. While Gorove focused on the aerospace *object* itself and *functional* qualifiers, Orbit Law instead looks at the orbital status achieved, coupled with the intent of the mission. As explained in the section on Orbital Qualifiers in paragraph C below, a craft *intended* for orbital flight would maintain that status for the duration of its mission (whether or not it actually achieved orbit). But a suborbital craft which accomplishes one orbit based on the qualifiers explained in this article would <u>also</u> qualify for orbital status. In other words, suborbital flights might also qualify for orbital status, but the reverse scenario of orbital flights reverting back to suborbital status would not be

---

[176] *Id.*; Gorove, *supra* note 67, at 104.
[177] *See id*. at 105-111.
[178] *Id.* at 105.
[179] *Id.*
[180] *Id.* at 106.

true under the current Orbit Law proposals. Although such a status was not discussed as an option by Gorove, justification for this one-sided consistency will follow in forthcoming sections.

Gorove also proposed that aerospace planes (i.e. suborbital craft under Orbit Law) might be expected to comply with space debris mitigation, rules of the road, and other requirements while operating on the fringes of space.[181] He also questioned whether space law would govern an object orbiting Earth at a height of 30 km if new technology enabled it to maintain that orbital height, but speculated that new technology would not likely lead to an acceptance of lowering the height of outer space to 30 km.[182] As explained in the section detailing orbital flight status, Orbit Law would not lower outer space to a different altitude, it would simply apply existing space law (and eventually new Orbit Law concepts) to all orbital flights, with air law being applicable to suborbital trips.

Therefore, the remainder of this section will analyze the importance of liability and insurance considerations for suborbital flights. Status of the craft itself and State versus private responsibility for flights will be the focus of Section C on orbital flights. But for suborbital considerations, these hybrid vehicles will essentially be treated as space-capable objects subject to air law. The considerations of public international air law and corresponding issues of State sovereignty for suborbital flights will be reserved for discussion in Section E of this chapter under the Open Skies proposal.

C. Liability & Insurance Considerations

The obligation of States to otherwise prevent harm, and provide restitution in the event of its actual occurrence, is firmly rooted in international law. *Corfu Channel* held that:

> [F]ormerly, the misuse of a right had no place in law. Anyone could exercise his rights to their fullest extent, even if the effect was prejudicial to others; in such cases there was no duty

---

[181] *Id.*
[182] *Id.*

> to make reparation. That is no longer the case . . . . [T]here are two questions to be determined: (a) when is there a misuse of a right; and (b) what should be the penalty? In regard to the former point, the facts must be evaluated in any given case; and in regard to the penalty, this may consist, according to circumstances, of an apology, a rebuke or even compensation for the injury caused.[183]

These requirements and methods for reimbursement of wrongs were embraced by the Montreal Convention of 1999.[184] With the initial application of private international air law to suborbital flights during the early years of an Orbit Law administration, the suborbital system should develop a stable regime of liability similar to that of air law.

Unlike space law's system of automatic application of absolute liability as contained in Article II of the Liability Convention, a number of scholars have observed that the Warsaw-Montreal systems are a fault-based regime akin to *res ipsa loquitur*.[185] *Res ipsa loquitur* requires that (1) the accident is of a kind that does not ordinarily occur in the absence of someone's negligence; (2) it was caused by an agency or instrumentality within the exclusive control of the defendant; and (3) it must not have been due to any voluntary action or contribution on the part of the plaintiff.[186] Although the Montreal Convention creates a rebuttable presumption of carrier liability, ultimate liability is still dependent upon proof of fault.[187] The plaintiff does not have to prove negligence or misfeasance on the part of the carrier, but does carry the burden of proving that an accident has occurred.[188]

Under an Orbit Law system, suborbital flights might also be able apportion damages similar to the Montreal Convention's Article 21, and its assignment of liability under Article 17 acci-

---

[183] Corfu Channel Case, (Alb. v. U.K.) 1949 I.C.J. 4, at 47-48 (1949).

[184] *See* Montreal Convention, *supra* note 2.

[185] PAUL S. DEMPSEY & MICHAEL MILDE. INTERNATIONAL AIR CARRIER LIABILITY: THE MONTREAL CONVENTION OF 1999, 137 (Montreal: McGill University Centre for Research in Air & Space Law, 2005).

[186] *Id.*

[187] *Id.*

[188] *Id.* at 141.

dents.[189] Given the likely similarities, and low survivability, of accidents or crashes involving aircraft or suborbital craft, the victim-oriented compensation scheme of the Montreal Convention should provide levels of stability and known insurable amounts to successfully finance suborbital development without overburdening insurable risks. For comparison, one insurance expert recently observed that it was not the compensation methods of the Montreal Convention which increased insurance costs for aviation, because similar recovery schemes were already known and in place before the 1999 Convention was eventually ratified.[190] Rather, it was the unknown and unforeseeable risks of the terrorist hijackings of 9/11 which drove up insurance costs.[191] Another danger to the aviation insurance industry includes the risks of litigation in U.S. courts, which typically award greater damages than courts in other countries.[192] However, the reverse of this tenant is often true as well – other countries regularly place a much lower value on losses, including loss of life.[193] Standardization of compensation for suborbital flight accidents like the Montreal Convention's Article 21 reflects a more equitable reimbursement plan; insurance actuaries should accordingly be able to predict appropriate insurance rates.[194] A clause for periodic reviews of limits of liability like that imposed by Article 24 of the Montreal Convention[195] would also be included under Orbit Law.

Certain space law principles such as State responsibility[196] are at loggerheads with the existing air law structure of private party liability. This dichotomy will be dissected in Section C on Orbital Principles. But in the initial analysis of suborbital flights (and eventually including orbital flights), Orbit Law holds the *carrier* liable for any negative outcome, subject to a

---

[189] Montreal Convention, *supra* note 2, arts. 17, 21.

[190] Ulla Norrhäll, Lecture at the Faculty of Law, McGill University: Private International Air Law (Oct. 26, 2006) (on file with author).

[191] *Id.*

[192] *Id.*

[193] *Id.*

[194] *See generally* DEMPSEY & MILDE, *supra* note 185, at 183.

[195] Montreal Convention, *supra* note 2, art. 24.

[196] *See* Outer Space Treaty, *supra* note 9, art. VI.

rebuttable presumption of fault. Section C will elaborate the extent of responsibility based on the corporate structure of each carrier (along with any/all subsidiaries) and their involvement in the suborbital or orbital endeavor, but a preliminary explanation of this proposal will help prepare the playing field.

For example, sole-State airlines (e.g. Aeroflot) would bear primary responsibility for its flights, just as private carriers (e.g. United Airlines, U.S. Airways, etc.) would bear any burden of liability for its flights. Orbit Law proposes to establish an international structure for recovery regardless of national laws, sovereign status, or location of incorporation – each carrier would be ultimately responsible for any damages it causes from suborbital (or orbital) accidents. For those carriers with multiple "personalities" (e.g. sole State carriers, multi-national entities, inter-governmental enterprises, private corporations, etc.), the extent of each party's supervision and exercise of control over operations should likewise dictate responsibility over all legal matters, fiscal accountability, and corporate "ownership" of all suborbital events.[197] In other words, Orbit Law recovery for suborbital wrongs will initially mirror that system in place for private air law. Allocation of damages among the various entities[198] within a multi-partner corporate structure can be negotiated during the evolution of Orbit Law, but should be based on general principles of tort law apportioning blame based on the extent of involvement. Those carriers (public or private) which refuse to honor payment of damages which have been formally adjudicated may be subject to I.C.J. action, ICAO sanctions, and

---

[197] *See generally* Bin Cheng, *Article VI of the Space Treaty Revisited: "International Responsibility," "National Activities," and "The Appropriate State,"* 26(1) J. SPACE L. 7, 20-29 (1998) [hereinafter *Article VI*] ("[W]hile the function of control may be delegated to another State, the State's responsibility and liability under Articles VI and VII of the Space Treaty or the 1972 Liability Convention cannot. Consequently, even where a State has absolute confidence in the State designated to discharge this task, and however watertight the hold-harmless clauses in the agreement may appear to be, in practice, it may not be entirely wise for it no longer to concern itself with the matter. . . . All in all 'the appropriate State' appears thus to be a rather elusive notion. In practice there may well be more than one 'appropriate State,' *de facto* or even *de jure*.").

[198] *See generally* Dimitri Maniatis, *The Law Governing Liability for Damage Caused by Space Objects: From State Responsibility to Private Liability,* 22(1) ANN. AIR & SP. L. 369, 387-88 (1997).

possibly unilateral action by States forbidding suborbital spaceplanes from entering their airspace.[199]

As Section E in this chapter on Sunset Clauses will eventually discuss, it is also proposed that a more streamlined system of liability and recovery will eventually emerge, and suborbital flights' reliance on the current private international air law system will eventually melt away. Although the Montreal Convention serves as an excellent starting point for suborbital liability determinations, it is not a perfect product. Precise definitions of "accident," the possibility (or impossibility) of punitive damages for deliberate misfeasance, and potential recovery for mental or other injuries are some of the many issues debated by air law which must be addressed and revisited during Orbit Law's growth and development. As part of this streamlining process, the next section discussing Orbital Flight Liability considerations will also propose a morphing of suborbital liability components into orbital flights as well. The two separate systems of liability for air law and space law, or suborbital/orbital law, will eventually meld into one overarching method of accountability.

D. Examination of Orbital Flights & Progression of Orbit Law

The next fundamental premise of Orbit Law includes the *application of current space law principles and treaties* to *all orbital flights*. Gorove's *Aerospace Objects* article again provided inspiration for the idea of legal determinations for flight based on orbital status, yet Gorove remained focused more on the (space) object and its functional intent rather than orbital qualifiers. He proposed defining a space object as:

> an object launched or attempted to be launched in orbit around the earth or beyond. Such object (or a part of it) is a space object (or a part of it) from the time of its launch or attempted launch, through its ascent from earth to outer space or while

[199] PAUL S. DEMPSEY, PUBLIC INTERNATIONAL AIR LAW 373 *et seq.* (Montreal: McGill University Centre for Research in Air & Space Law, 2008).

> in outer space, as well as during its orbit, deorbit, reentry and landing on Earth."[200]

Under the current space law regime, such objects represent national assets over which the *State* wields jurisdiction and control.[201] Because spacecraft may be a more valuable bases of power than aircraft or ships, States might be unwilling to yield their jurisdiction over such craft, and will likely maintain a substantial proprietary interest in protecting its assets.[202] Contrast this sovereign stance of States and the sole-State responsibility of the Outer Space Treaty[203] (and other space instruments) against the increased role of private party action in space, and the stage is set for potential conflict between public and private international law. Although the existing space treaties attempt to resolve this problem by simply imposing State responsibility and liability for all space actions,[204] they are insufficient to adequately address today's technological and corporate spikes in space activity. Orbit Law will hopefully quell the "danger of chipping away at the 1967 Outer Space Treaty by protocols instead of adding more agreements"[205] by imposing new legal guidelines across orbital and suborbital flight.

However, Judge Manfred Lachs also cautioned that:

> [T]he interdependence of the traffic in the air and outer space should not subject the activities of States to unnecessary limitations. To survive in the world today States need to open the frontiers of the air to other States unless they prefer to live in complete isolation, where very few, if any, could survive and develop.[206]

With this frame of reference, this section will explore the strictures to qualify for orbital status, and ponder whether the exist-

---

[200] Gorove, *supra* note 67, at 107.
[201] *See* Outer Space Treaty, *supra* note 9, art. VIII.
[202] *See* MCDOUGAL, ET AL., *supra* note 11, at 523-24.
[203] *See* Outer Space Treaty, *supra* note 9, art. VI.
[204] *See id.* at arts. VI, VII. *See also* Liability Convention, *supra* note 130.
[205] *See* Galloway, *supra* note 14, at 190-91.
[206] Manfred Lachs, *Freedom of Air – the Way to Outer Space, in* AIR AND SPACE LAW: *DE LEGE FERENDA* 244 (T. L. Masson-Zwann and P.M.J. Mendes de Leon, eds., 1992).

ing parameters of liability for space law are appropriate for application to Orbit Law. An analysis of whether the notion of State sovereignty over airspace is an outdated principle will be reserved for Section E under the Open Skies proposal.

i. Orbital Functions & Qualifiers

The 1975 Convention on Registration of Objects Launched into Outer Space (Registration Convention) calls for the registration of space objects only upon their placement in *orbit* around Earth or farther away.[207] However, a question of great significance is whether objects *designed and destined* for orbital flight, but return to Earth before one complete revolution (i.e. a fractional orbital flight), should be considered as a space object.[208] Under the Orbit Law guidelines, an object *intended for* <u>*or*</u> *accomplishing orbital status* would qualify as an orbital flight.

Some jurists maintain that the international space agreements would only apply to devices which complete one revolution around the Earth, whereas fractional orbital flights such as those used in intercontinental ballistic missiles (ICBM's) would not qualify.[209] However, ICBM's are distinguished from traditional orbital objects based on their design and flight; whereas ICBM's follow a ballistic trajectory, space objects reach sufficient fractional speed to enter Earth's orbit.[210] Space objects which leave orbit to return to Earth use braking devices, and by virtue of their design and operation fall within the scope of the Registration Convention and other space treaties.[211] Such comparisons between (suborbital) fractional orbit devices and "true" (orbital) space objects fit nicely within the Orbit Law gambit.

For example, a suborbital craft which remained aloft for sufficient time to qualify for orbital status, or completed one revolution around Earth, would qualify for orbital treatment.

---

[207] Convention on Registration of Objects Launched into Outer Space, art. II, *opened for signature* Jan. 14, 1975, 28 U.S.T. 695,1023 U.N.T.S. 15 (emphasis added) [hereinafter Registration Convention].

[208] Zhukhov, *supra* note 159, at 364.

[209] *Id.*

[210] *Id.* at 365.

[211] *Id.*

But the reverse would not be true. If an orbital craft intended for orbital flight returned to Earth before meeting orbital time requirements, or before completing one revolution around the Earth, it would nonetheless still be considered an orbital flight. This one-sided approach is proposed to attain and ensure some consistency for orbital flights, especially considering the issues of liability, State responsibility and sovereignty discussed elsewhere in this article. Because the application of current space law principles to orbital flights under this newly-proposed program will initially subject States to greater potential risk through the "absolute liability" of the Liability Convention,[212] but eventually provide greater legal protections during the evolution of Orbit Law, applying orbital status to all orbital flights (intended and accomplished, as well as all flights *servicing* orbital objects) should ensure stability to adequately insure, support and promote this burgeoning industry.

Although qualifying for orbital flight under Orbit Law is based on the blended approach of location *and* function, this functional emphasis has precedence in former discussions about reusable space ships. Although some States have proposed that such space ships be considered aircraft when re-entering the lower layers of the atmosphere, prevailing opinions (including the U.S. and former U.S.S.R.) refer to such craft as space objects during *all* phases of their flight.[213]

Support for the "time aloft" standard as a second qualifier for orbital status can be referenced back to the discussion on Geostationary Orbit objects, in addition to comparing its applicability to HAPS and geostationary stratospheric platforms. Martine Rothblatt's article on such platforms speculated that a literal interpretation of current space law treaties would likely exclude such stratospheric objects as space objects, but that certain space law treaties should be amended and would be better served by defining geostationary stratospheric platforms as objects in outer space.[214] It makes no sense that one satellite located at 40,000 km is deemed a space object, when another one

---

[212] *See* Liability Convention, *supra* note 130, at art. II.
[213] Zhukhov, *supra* note 159, at 365 (emphasis added).
[214] Rothblatt, *supra* note 38, at 1.

serving with identical functions at 20 km would be considered an "aircraft" subject to air law.[215] For a legal regime to apply space law for communication platforms from 40,000 km to 100 km, but then instantly "transmogrify into a regime of air law once the communication platform is located in the 20-30 km range," is illogical given their identical use and purposes.[216] In fact, Rothblatt notes that application of the principles of space law to these low Earth orbit objects, such as demilitarization, liability, and the rescue and return of stratospheric platforms, are in the interests of all countries.[217] "Based on the advent of stratospheric platforms, it is now time to extend the range of space law down to the 20 km regime above controlled airspace where the satellites of tomorrow will reside."[218]

Even at these lower altitudes where suborbital (and orbital) craft may soon transit and share airspace with HAPS, the author acknowledges that air law *currently* subjects aircraft to two different legal applications – international air law over the high seas and domestic law over the territory of sovereign States. The same tenets of international law and adherence to notions of State sovereignty hold true for ships on the high seas, versus those in a State's territorial waters. By applying Orbit Law principles based on *orbital* status (regardless of *altitude or location* over State territory, and irrespective of *transit* or *maintenance of orbital position*), this common qualifier may unite the differing and inconsistent standards that plague successful unification of an air law system across national and international borders. Open Skies enabling such trans-boundary flights will be discussed later in this chapter. Perhaps the acceptance of universal safety Standards and Recommended Practices (SARPs) much like those based on the ICAO model might serve as a unifying starting point to promote one overarching code of flight – Orbit Law. As Jasentuliyana proposed:

> A solution would be for COPUOS, like ICAO, to separate the political and technical aspects of space technology and formu-

---

[215] *Id.* at 2.
[216] *Id.* at 3.
[217] *Id.* at 4.
[218] *Id.*

> late international standards and recommended practices for the regulation of space activities. The time has come to consider this option, and to lay out a basic institutional framework so that the future use of space science and technology is not hindered by protracted political discussions.[219]

For stratospheric platforms or any other craft intended to or achieving continuous and/or geostationary flight for a period of 23 hours, 56 minutes, 4 seconds (the minimum time qualifier for one geosynchronous orbit), application of orbital status and the principles of space law would prevail under the Orbit Law regime. One interesting logical extension of this orbital qualifier would create "orbital status" for many flights that are currently deemed subject to air law. Examples include aircraft missions which refuel and continuously fly beyond the approximately 24-hour requirement. Balloons which remain aloft beyond that time would also enter into orbital status. However, given the circumstance that both types of flights remain for an extended period of time above Earth's surface, albeit at lower altitudes than one might ordinarily be considered to be "in orbit," under Orbit Law it is a fact that these air refueling missions or balloon flights are maintaining an aerial presence that meet or exceed the time required for one geosynchronous orbit above the planet. It therefore does not seem too great a stretch of logic to apply orbital status, and thereby the principles of space law, under the new Orbit Law proposal. Whether exceptions or "opt out provisions" should be made for traditional yet extended air flights such as these is beyond the scope of this article's analysis.

ii. Liability & Insurance Considerations

Freedom of space and an obligation of space actors not to adversely interfere in the enjoyment of these rights[220] is founded in a "universe of law postulated that the freedom of each of its

---

[219] Nandasiri Jasentuliyana, *Celebrating Fifty Years of the Chicago Convention Twenty-Five Years After the Moon Landing: Lessons for Space Law*, 19(2) ANN. AIR & SP. L. 429, 445 (1994).

[220] *See* Jakhu, *Satellite Imagery, supra* note 7, at 75.

subjects should be bounded by equal respect for the freedoms of other subjects; that States engaging in an activity which might cause injurious consequences internationally should take reasonable account of the interests and wishes of other States likely to be affected."[221] As previously mentioned, the initial application of space law principles to orbital flight will provide the starting point for Orbit Law. Application of absolute liability during the launch phase, and fault-based liability during the orbital phase of space flight,[222] should initially provide new orbital flights with the historical foundation and existing structure to support Orbit Law's embryonic development.

The U.S. Commercial Space Launch Act of 1984 and 1988 not only established a safety regimen for commercial space activities, but also addressed issues of liability emerging from this increased private industry activity.[223] In order to cover all situations of potential liability by the U.S., these Acts established licensing requirements, which included insurance coverage to address instances of third party liability.[224] These provisions required the licensee to obtain sufficient coverage to indemnify the government in case there was an accident where the U.S. was held liable to third States for damage caused by the space activities of U.S. licensees.[225] Coverage amounts at that time were capped at $500,000,000, with any successful claims above that amount to be paid by the U.S. up to a ceiling of $1.5 billion per launch.[226] Any claims above that sum would presumably revert back to the licensee.[227] These statutory guidelines, as well as other risk-sharing efforts such as cross-waivers of liability, evolved out of the necessity of the participants in outer space activities to share some of the risks involved.[228] These de-

---

[221] Preliminary Report on International Liability for Injurious Consequences Arising out of Acts not Prohibited by International Law, U.N. Doc. A/CN.4/334/Add.2, paras. 52, 56, 60 (1980).

[222] *See* Liability Convention, *supra* note 130, at arts. II, III.

[223] Maniatis, *supra* note 198, at 390.

[224] *Id.* at 390-92.

[225] *Id.* at 391.

[226] *Id.*

[227] *Id.* at 392.

[228] Paul B. Larson, *Cross-Waivers of Liability*, *in* 35TH COLLOQ. L. OUTER SPACE 91, 95 (1992).

velopments in space law establish "a known regime of liability limitation to encourage space exploration and investment by reducing insurance costs and the potential for litigation."[229]

Continued progress modeled on this approach requiring national licensing and insurance coverage for private space entities looks to be a step in the right direction for Orbit Law – requiring each space actor to assume responsibility commensurate with their level of involvement in the space activities. Progression from this starting point is also in line with the current space law regime ultimately holding the State participant(s) responsible for these activities.

However, as more non-governmental entities commercially participate in and benefit from space activities, Orbit Law agrees with the position that it is mandatory for these enterprises to eventually accept and respond to their own international liability and relieve the "launching State" from the onus of this entire burden.[230] "How to split such responsibility and which aspects should remain with the relevant State in terms of supervision may be debatable, but at least the economic responsibility and potential liability for damages to third parties resulting from private launch activities should be imposed on the private entity."[231] This suggestion should come as no surprise, as the liability of entities providing capital in normal corporate structures is usually limited to the extent of their capital contribution,[232] while the Liability Convention also calls for the apportionment of damages between liable States.[233] It therefore stands to reason that in the eventual progression of Orbit Law, States would remain responsible for State action in outer space, while industry would be responsible for its own private actions. Where there is a consortium of State(s) and/or private parties sharing roles in the dispatch of space objects, even the existing

---

[229] *Id.* (citing 56 Fed. Reg. 48429, 48430 (Sept. 25, 1991) (codified at 14 C.F.R. pt. 1266).

[230] Rochus Moenter, *The International Space Station: Legal Framework and Current Status*, 64 J. AIR L & COM. 1033, 1051-52 (1999).

[231] *Id.* at 1052.

[232] Francis Lyall, *Privatization, Jurisprudence and Space, in* 42ND COLLOQ. L. OUTER SPACE 149, 150 (1999).

[233] Liability Convention, *supra* note 130, art. IV, para. 2.

Liability Convention could be used as a point-of-reference to apportion liability among *all* interested actors (eventually including State and non-State).[234] These notions pose a groundbreaking departure from the imposition of (only) State responsibility and liability in the Outer Space Treaty and Liability Convention, but are now called for given the fundamentally different landscape between the time of these treaties' inception and today's space activities.

When examining these proposals, one might question the necessity for reducing or removing sole-State responsibility from its present prominence within space law. As provided in the Outer Space Treaty and seen in the U.S. Commercial Space Launch Acts, the current method of holding the "launching State(s)" responsible for all space activities, and thus placing the burden on those States to ensure the accountability of its corporations, does not appear to be overly taxing on States and actually seems to support private space activities. However, as more and more private parties undertake flights into space, the ability of States to monitor all suborbital and orbital flights, and the effectiveness of State supervision over such multinational ventures, will be diminished. Some corporations might even resort to incorporating or launching only from certain States with lax supervisory standards or ambiguous domestic laws in an effort to avoid any blame for suborbital or orbital flight accidents (much like the comparable maritime problem of "flags of convenience"). Furthermore, many developing countries might not have a mature domestic space law program requiring private insurance or other reimbursement schemes for ill-fated corporate space activities, imposition of appropriate safety standards, or careful supervision of commercial launch activities. Yet under the current method of space law "justice," only that State (and possibly any joint launching State(s)) would be responsible for compensation if an orbital (and eventually suborbital) flight accident had launched from that State. The current method of holding State(s) absolutely liable under the Liability Convention for damage on Earth, or even fault-based liability

---

[234] *See id.* at arts. IV, V.

for space damage, does not properly apportion blame among *all* potentially responsible parties, and is not an equitable method for assigning fault and restitution.

One proposal for Orbit Law is a cohesive safety administration that will provide an excellent cornerstone to build a unified suborbital and orbital legal structure. Another method to address these concerns with State and private accountability would be to update the definition of "launching State" under the Outer Space Treaty and Liability Convention so as to hold private entities answerable for their space activities, and thereby require those States of incorporation to update their national laws to ensure shared responsibility. While modification of the term "launching State" might indeed be desirable, the preferred method for ensuring accountability would be through the establishment of a new international regime binding the liability of each space participant to their involvement in the space endeavor. Orbit Law should be the mechanism for such answers and clarifications.

Many of the concerns with the current space law regime and its methods of addressing liability also stem from the "victim orientation" of the existing space treaties.[235] This disposition is especially prevalent in the Liability Convention, where the effort to ensure compensation to victim States prevails, rather than emphasizing a certain, predictable, and equitable framework in which space business activity can be undertaken.[236] Dimitri Maniatis proposed one method of risk which is similar to that of Orbit Law:

> This fundamental flaw can be resolved in a manner that responds to the trends mentioned above: by abolishing the current system of State responsibility for private activities and, at the same time, unifying the private laws of States that apply to the situation of damage caused by space objects. . . . [By] harmonizing the applicable national laws, the redundancy and uncertainty of the current system would be avoided. . . . After all, this approach is not novel. It has been applied successfully to the neighboring field of air law where, both with respect to

---

[235] Maniatis, *supra* note 198, at 379.
[236] *Id.*

> liability for damage to persons and goods on aircraft or on the ground, private carriers are held directly liable according to a harmonized web of national laws.[237]

A similar assessment by Frans von der Dunk came to the same conclusions:

> When liability as a mechanism is transferred to the international inter-state level, it can take two fundamentally distinct forms. The first is a simple elevation of civil or private liability to the international level, or more exactly, adding transboundary aspects to the liability of (private) legal persons. The entity actually causing the damage is still held liable in those cases of transboundary damage. . . . These treaties essentially are treaties of private international law, obliging the state parties, where necessary, to harmonize their national legislation with respect to cases involving liability respectively to establish such legislation in line with the requirements provided for by the treaties. . . . Under international space law on the contrary international liability took on the second form: an elevation of the system of liability as a whole to the international level, with the subjects of international law – the States – themselves as the liable entities.[238]

Von der Dunk later proposed two potential options to solve these uncertainties and link international liability and national liability:

> Firstly, a generally accepted and very broad definition of liable state would be accepted. It should include in the term "state" those private entities with the nationality of that state, for purposes of launching, procuring launches and lending facilities for launches. Secondly, an amendment creating direct private liability under international space law would prevent national authorities from applying, consciously or unconsciously, their own, far from harmonized interpretations by means of national law. Solving this problem should be given high priority, before more and more states will find themselves confronted with the potential consequences of the ongoing privati-

---

[237] *Id.* at 399-400.

[238] Frans G. von der Dunk, *Commercial Space Activities: An Inventory of Liability – An Inventory of Problems*, 37TH COLLOQ. L. OUTER SPACE 161, 163-64 (1994).

> zation of space. They will then perceive a need to issue national regulation vis-à-vis private enterprise without any authoritative international guidance as to its scope and contents. The result may be not just gaps and overlaps, but "flags of convenience," "license shopping" and a growing disinterest in taking care of liability issues altogether.[239]

Although linking the nationality of private entities to that of the State for liability purposes is one solution proposed above, the question of liking nationality to spacecraft remains unresolved.

For whatever reasons, States have so far refrained from conferring nationality to spacecraft.[240] This article will not enter the debate over whether assignment of nationality to space objects (suborbital or orbital) would be another useful method for vetting liability. Rather, a summary of Orbit Law's position is simply that liability be apportioned between all parties (State and/or private) who maintain some interest in the space object in question. The current space law regime of sole State responsibility and liability does not seem equitable; unless the State is truly the sole actor in its space missions, inconsistent and uncertain methods of assigning private party accountability hamper both the private party's involvement and their cooperation with the parent State and other States.

But States need not be removed entirely from the Orbit Law equation. If the State does maintain a role in supervising private industry, such as safety oversight, manufacturing standards, personnel qualifications, licensing, etc., and some amount of State fault contributed to an accident, then the State might be enjoined with any involved private entities for international liability and responsibility. State jurisdiction over private entities, and State imposition of national laws to ensure private party responsibility, might also be a necessary hold-over from existing air law and space law methods of accountability for wrongs and accidents. For example, contemporary space law often results in the "launching State(s)" requiring its private

---

[239] Frans G. von der Dunk, *The 1972 Liability Convention – Enhancing Adherence and Effective Application*, 41st COLLOQ. L. OUTER SPACE 366, 372 (1998).

[240] Bin Cheng, *Nationality for Spacecraft?*, *in* STUDIES IN INTERNATIONAL SPACE LAW 475, 482 (Bin Cheng, ed., 1997) [hereinafter *Nationality for Spacecraft?*].

companies to reimburse third parties for any damage resulting from its space activities; there exists no international body with jurisdiction over private space activities. Perhaps a more effective approach would be to expand Orbit Law's scope of coverage to include jurisdiction over all suborbital and orbital flights, be they *public or private*.

As discussed in the previous Section B, some aspects of the application of air law to suborbital flights, and its eventual transition to Orbit Law, might also be considered for orbital flights. One aspect of this notion that could prove especially effective includes the Montreal Convention's establishment of a set amount of first-tier liability (e.g. 100,000 Special Drawing Rights (SDRs)),[241] and a first-tier determination of fault closely akin to a blending of the notions of strict liability and *res ipsa loquitur*. Furthermore, any imposition of damages in Orbit Law *above* the first tier would require substantiation just like the current air law regime.[242]

Although suborbital and orbital flight would both likely qualify as inherently dangerous activities and thereby a subcomponent of inherently dangerous space activities,[243] the Liability Convention's imposition of "absolute liability"[244] needs curtailment if Orbit Law is expected to flourish. Absolute liability is a term of art found in the Liability Convention, and while similar to strict liability, has fewer exceptions and stricter application than true strict liability.[245] Instead, some combination of strict liability and *res ipsa loquitur* for all suborbital and orbital flight liability determinations would likely meet the dual interests of victim protection and industry/insurance stability. Although the historical imposition of strict liability for inherently dangerous activities might be well-founded, one other pro-

---

[241] Special Drawing Rights are calculated by the International Monetary Fund based on the fluctuating value of the Euro, British Pound Sterling, Japanese Yen, and U.S. Dollar. *See* DEMPSEY & MILDE, *supra* note 185, at 2.

[242] *Id.* at 183.

[243] *See* CARL Q. CHRISTOL, THE MODERN INTERNATIONAL LAW OF OUTER SPACE 59 (New York : Pergamon Press, 1982).

[244] Liability Convention, *supra* note 130, at art. II.

[245] Ram S. Jakhu, Lecture at the Faculty of Law, McGill University: Space Law: General Principles (Nov. 13, 2006) (on file with author).

posal that Orbit Law might consider over time would be to eventually apply *fault*-based liability for *all* suborbital and orbital flights. This suggestion would closely resemble the second tier liability scheme of the Montreal Convention (albeit the Montreal Convention does have a basis of presumed negligence with a reversed burden of proof),[246] and already comport with the existing rule for all space-based accidents under Article III of the Liability Convention.[247] Determination of whether a true fault-based system (i.e. Liability Convention) or a presumptive negligence system (i.e. Montreal Convention) is more effective may be tested over time as Orbit Law transitions from air law for suborbital flights, and space law for orbital flights, to the ultimate Orbit Law gambit of liability.

Analysis of whether punitive damages for deliberate malfeasance should be authorized is another area for consideration as Orbit Law matures. Although insurance premiums would likely escalate if this proposal were approved, one must weigh whether such penalties would have the desired deterrent effect on those who might consider neglecting suborbital or orbital flight safety. And as previously mentioned, a closer examination of what additional damages might be included in this new compensation design (e.g. mental injuries, financial losses, pain and suffering, etc.) must also be performed. Again, a risk-benefit analysis by those eventually drafting an Orbit Law treaty must determine whether restitution for all possible losses outweighs the need for stable and affordable insurance and liability planning.

In summary, existing air law and space law seems to display a trend of greater protection for more terrestrial or near-space damages; air accidents are provided recovery under the Montreal Convention, while space objects causing damage on Earth or to aircraft in flight are provided recovery under the Liability Convention. Both systems appear to be designed as a method for victim-oriented restitution. But if air law currently follows a pattern of *res ipsa loquitur* and presumptive fault for its liability determinations, yet space launches impose a stricter

---

[246] DEMPSEY & MILDE, *supra* note 185, at 182.
[247] Liability Convention, *supra* note 130, at art. III.

standard of "absolute liability" under the Liability Convention, one must ask why there is such a difference, especially in light of the merging air and space capabilities of hybrid craft? Of greater concern is yet another standard for liability determinations when an object finally reaches space – Article III of the Liability Convention allows recovery under a fault/negligence-based system. Rather than having three separate designs for recovery (airspace under the Montreal Convention, near space under Article II of the Liability Convention, and outer space under Article III of the Liability Convention), why not apply some combination of strict liability and *res ipsa loquitur* for all suborbital and orbital flights? Or as another alternative, why not consider simple fault-based/negligence-based liability for all flights? Tiers of recovery might also be contemplated and modeled after the Montreal Convention, and perhaps even ceilings of liability as discussed in the U.S. Commercial Space Launch Act. Whether liability above certain set amounts would revert back to the State or remain with the private entity will likely be the subject of much deliberation and analysis.

Any of these considerations will require new legislation to be drafted as part of Orbit Law's eventual departure from pure air law and space law, but ineffective proposals could also be scheduled for eventual expiration as discussed in the Sunset Clause of Section E. Hopefully these thoughts will generate discussion and debate on the best methods of liability determination, which may eventually be applied to both suborbital and orbital flights. A discussion of Orbit Law's reflections on State sovereignty and overflight rights will be reserved for Section E as well.

E. Inter-Orbital Flights

Because there is not yet any data on legal issues facing interplanetary or interstellar missions, not too much can be said about the application of Orbit Law to inter-orbital flights. Nonetheless, the proposals (and flexibility) of Orbit Law should be relevant to these flights as well. The same legal provisions relevant to orbital flights (i.e. application of space law, and its eventual transition to Orbit Law) should be considered germane

to inter-orbital flights. This identical treatment represents a logical extension of existing space law to inter-orbital flight; as such travel becomes more technologically feasible, Orbit Law's growth can envelop any new nuances of inter-orbital flight into its corpus of suborbital, orbital, and inter-orbital laws.

F. Additional Provisions

i. The Solution to Sovereignty – The Open Skies Proposal

Given the numerous and liberal exceptions to the rule of State airspace exclusivity or ownership over its skies that have evolved over the years, the notion of State airspace sovereignty looks to be an outdated concept. It certainly appears to have outlived its usefulness and applicability in international law, with Orbit Law potentially offering the system to usher in a new era of Open Skies.

The extent of exclusive State sovereignty and any corresponding State action is still limited to that which is permitted under international law.[248] As one example of such limitations on State action, authorization for emergency landing by craft in distress represents a longstanding right in international law.[249] In the *Aerial Incident of 1955*, this case dictated that although aircraft are not specifically permitted a right of entry for distress under the Paris Convention, Article 22 did provide that "[a]ircraft of the contracting States shall be entitled to the same measures of assistance for landing, particularly in case of distress, as national aircraft. . .," while Article 25 of the Chicago Convention requires that "[E]ach contracting State undertakes to provide such measures of assistance to aircraft in distress in its territory. . . ."[250] Such a "right of entry" therefore means that States must not forcibly prevent a vessel in distress from land-

---

[248] *See* Palmas Island Case, 2 RIAA 821 (1928); *See also* Case of SS Lotus, (France vs. Turkey), PCIJ Ser., A. No. 10 (1927).

[249] Memorial of U.K. (Israel v. Bulgaria; U.S. v. Bulgaria; U.K. v. Bulgaria), 1959 I.C.J. pleadings (Aerial Incident of 27 Jul. 1955) 331, 358-9 (Memorial dated 28 Aug. 1958).

[250] *Id.*

ing.[251] Although these caveats do not rise to the level of aircraft having an unfettered "right" to enter a State's airspace, States do have an obligation to allow craft in distress to enter.

Further examples of diminished State sovereignty include limited incursions allowed under the Law of the Sea, where both State and merchant ships enjoy a right of innocent passage through a State's territorial seas.[252] The Law of the Sea also authorizes aircraft to navigate through international straights and archipelagic sea lanes within State territory.[253] Open skies are currently a *de facto* transit right throughout most of the world under the Chicago Convention and bilateral agreements, with most restrictions on airspace overflight focused on commercial activity. And although the breadth of State sovereignty is currently expansive, it is not exclusive – international law and the relevant space treaties make it clear that national sovereignty does *not* extend to outer space.[254]

International law has also not found violations of sovereignty to be a compensable event. Respect for territorial jurisdiction has never been an *erga omnes* obligation; States are only liable for violations of international obligations which injure another State.[255]

Space law emphasizes international cooperation rather than compensation for alleged territorial violations. For example, under the Liability Convention's Article I(a) use of the phrase "damage <u>means</u>" rather than "damage includes" indicates a complete definition rather than a partial sampling of compensation options. This definition of "damage" does not imply any cause of action for trespass *per se*[256] and was the result of contentious negotiations which declined broader theories of recovery or more expansive definitions of "damage."[257] The legis-

---

[251] *See* Bryan Schwartz & Mark L. Berlin, *After the Fall: An Analysis of Canadian Legal Claims for Damage Caused by Cosmos 954*, 27 MCGILL L.J. 676, 702 (1982).

[252] Convention on the Law of the Sea, art. 17, Dec. 10, 1982, 1833 U.N.T.S. 3.

[253] *See* Bin Cheng, *The Commercial Development of Space: the Need for New Treaties, in* STUDIES IN INTERNATIONAL SPACE LAW 648-49 (Bin Cheng, ed., 1997).

[254] *See* Bin Cheng, *From Air Law to Space Law, in* STUDIES IN INTERNATIONAL SPACE LAW 33 (Bin Cheng, ed., 1997).

[255] *See* East Timor (Australia v. Portugal), 1995 I.C.J. 90, 214 (Jun. 30).

[256] Schwartz & Berlin, *supra* note 251, at 707, 713.

[257] *Id.* at 720.

lative history of the Liability Convention reveals an intent to compensate victims of damage from space objects, not to save plaintiff States from intrusions into their territory.[258] On a similar vein, the Rescue and Return Agreement, and the Outer Space Treaty, emphasize tolerance and international cooperation to resolve instances of unintentional intrusions by space objects, rather than condemning them as violations of State sovereignty.[259] And the Liability Convention focuses on restoration of the victim to their previous status through compensation for physical, material injury; purely symbolic damage is nowhere contemplated as a theory of recovery.[260]

So what is the remedy for unauthorized overflight? Based on the existing air law and space law treaties and historical precedence, there does not appear to be any formal solution other than diplomatic rhetoric between the offending and offended States. Although ICAO has specifically stated that there is no right of innocent passage for spacecraft above State territory, there is no proposed outcome if such a flight occurs anyway.[261] Taking this outcome one step further, if one were to "lower the ceiling" of the longstanding principle that satellite orbits do not violate State-sovereign airspace, Orbit Law's Open Skies will facilitate greater freedom of air-space movement. For comparison, the United Nations Principles of Remote Sensing already reflects an Open Skies policy. Although the document is non-binding, its inception signals an imminent redefinition of traditional sovereign rights.[262]

Under current international law, in cases of unauthorized entry into the territory of another State (primarily through aircraft incursions), that aircraft-intruder's State of nationality may exercise protective competence through diplomatic intervention.[263] That State can also demand fair treatment of passengers and property, along with their safe return, and (when

---

[258] *Id.* at 713.
[259] *Id.*
[260] *See* Liability Convention, *supra* note 130, at arts. VIII, XII.
[261] Draft Brief for the ICAO Observer, *supra* note 77.
[262] *See* Susan M. Jackson, *Cultural Lag and the International Law of Remote Sensing*, 23 BROOKLYN J. INT'L L. 853,(1998).
[263] MCDOUGAL, ET AL., *supra* note 11, at 522.

warranted) compensation from abuse of authority.[264] More importantly, Article 3 *bis* of the Convention on International Civil Aviation (Chicago Convention) clearly prohibits use of force against civil aircraft for violations of airspace.[265] In fact, international law requires any military response (against aircraft, space assets, or any other potential target) to take into consideration the principles of the Law of Armed Conflict, which include the determination of military necessity, distinction of targeting, proportionality in response, and humanity to reduce and alleviate unnecessary suffering.[266] Although States might certainly share security concerns over unidentified assets entering their airspace, technically Article 51 of the U.N. Charter on its face does not appear to authorize "anticipatory self defense."[267] The plain reading of the text[268] requires that an armed attack first occur before defensive actions are authorized.[269] This requirement is clearly in conflict with many State's defensive policies, but rather than taking an aggressive posture against unauthorized incursions, Open Skies under Orbit Law might reduce these security concerns and enable a more reasonable response to unexpected or unidentified overflights.

Successful methods for identification of aircraft, through registration, nationality marks, route planning, and radio correspondence, have been in place for years:[270]

> For obvious reasons, techniques for the prompt and precise identification of spacecraft are of more urgent importance for both minimum and optimum order than was the case previously with respect to ships and aircraft. It is probable that states will make reciprocal demands for comprehensive and economic systems of identification of space vehicles by means of, for example, assignment of distinct radio signals to each

---

[264] *Id.*

[265] Convention on International Civil Aviation, art. 3 *bis*, Dec. 7, 1944, 61 Stat. 1180. [hereinafter Chicago Convention].

[266] *See* Michel Bourbonnière, *Law of Armed Conflict (LOAC) and the Neutralisation of Satellites or Ius In Bello Satellitis*, 9 J. CONFL. & SEC. L. 43 (2004).

[267] *See* U.N. Charter art. 51.

[268] *See* Vienna Convention on the Law of Treaties, art. 31(1), May 23, 1969, 1155 U.N.T.S. 331 [hereinafter Vienna Convention].

[269] U.N. Charter, *supra* note 267.

[270] MCDOUGAL, ET AL., *supra* note 11, at 523.

> spacecraft, disclosure of orbital and transit characteristics, display of external marks, and other appropriate methods that modern technology and human ingenuity may make available.[271]

In order to reduce State concerns over national security that Open Skies might bring, Orbit Law would propose utilization of technology to identify all suborbital and orbital vehicles during flight. Identification of all air and space vehicles would hopefully alleviate State security concerns and thereby authorize access to all States' airspace by such vehicles. Although suborbital craft will initially be governed by air law, they should enjoy Open Skies which mirrors that of space law and the current proposals for orbital flights; these freedoms could eventually be applied to aircraft as well.

Whether or not prior agreements or bilateral instruments would be required is an item for those drafters of the Orbit Law treaty to examine and negotiate, but true Open Skies should not include prior "permission" for overflight that today's bilateral negotiations require. In instances where a suborbital or orbital flight raises some State concern and the craft is not able to be identified or contacted, Orbit Law might authorize the State overflown to intercept, but certainly not engage the craft unless some hostile act was performed by the "intruder." Given today's technical advancements, any obstacle to this program's success is therefore not technological, but rather diplomatic – the difficulty in motivating States to embrace these new proposals.

Are Open Skies really such a controversial proposal for suborbital and orbital flights? The history of prior space object overflights highlighted in Chapter I suggests that it is already an accepted State practice. If these multiple instances of prior State overflights by objects going into orbit constitute the emergence of customary international law, "[T]he passage of only a short period of time is not necessarily, or of itself, a bar to the formation of a new rule of customary international law . . ."[272]

---

[271] *Id.* at 524.

[272] North Sea Continental Shelf (F.R.G. v. Den./F.R.G. v. Neth.), 1969 I.C.J. 3, 43, para. 74 (Feb. 20).

And as referenced in Chapter I, Open Skies comports with the *jus cogens* of freedom of exploration and use of outer space;[273] Orbit Law simply extends its scope of coverage slightly closer to Earth.

Stephen Gorove's article on *Aerospace Objects* provides an apt conclusion and a preliminary glimpse at the promise offered by the Open Skies proposal:

> Could a State lawfully deny another State's spacecraft the right of innocent passage at a height of 40-90 km in the space above its territory? Would this violate the fundamental freedom of exploration and use of outer space? Should the answer be influenced by an analogy to the law of the sea where, in the absence of mutual agreement or international convention, a land-locked State has no independent right for access to the sea and claim innocent passage through the territory of a coastal State notwithstanding the principle of the freedom of the seas? Should this be our policy choice for interpreting the freedom of exploration and use of outer space enshrined as a fundamental principle in the 1967 Outer Space Treaty? A courageous negative answer to this will be a challenge for air and space lawyers in the 21st century.[274]

Unlike landlocked States under the Law of the Sea, though, every State borders airspace, and thereby outer space. It is therefore in the interest of all States to embrace the notion of Open Skies in a unified effort to "slip the surly bonds of Earth" if we ever hope to "touch the face of God."[275]

---

[273] *See* Outer Space Treaty, *supra* note 9, at art. I.

[274] *See* Gorove, *supra* note 67, at 111-12.

[275] John Gillespie Magee, Jr., *High Flight*, *in* FAVORITE POEMS 203 (Helen Ferris Tibbets ed., 1957)

> Oh! I have slipped the surly bonds of Earth
> And danced the skies on laughter-silvered wings;
> Sunward I've climbed, and joined the tumbling mirth
> of sun-split clouds,—and done a hundred things
> You have not dreamed of—wheeled and soared and swung
> High in the sunlit silence. Hov'ring there,
> I've chased the shouting wind along, and flung
> My eager craft through footless halls of air….
>
> Up, up the long, delirious, burning blue
> I've topped the wind-swept heights with easy grace

ii. Sunset Clause Proposal

It seems fitting that an analysis of a new air and space regime includes a section on sunset clauses. However, contrary to this section's title, there is really nothing heliocentric to this proposal. Black's Law Dictionary defines a sunset clause as "[a] statute under which a governmental agency or program automatically terminates at the end of a fixed period unless it is formally renewed."[276] Because this article has repeatedly referenced the eventual transition from air law and space law principles to new Orbit Law principles, the drafters of such a convention might contemplate setting a date certain to retire those old standards. If suborbital flights will eventually merge with orbital flights under one cannon of Orbit Law, a timetable for such transition is advisable. Setting such deadlines will prompt those legislators of Orbit Law to continually review and revise this regime to preserve its best aspects, test those theories requiring further analysis, and jettison any tenants which are not conducive to the success of the program.

IV. CONCLUSION[277]

Has the time finally come to reevaluate the legal dicta of international air law and space law, or are these current systems and the rhetoric that has evolved little over the past five decades sufficient to cabotage the weighty cargo of the existing air and space treaties on their journey into the twenty-first century? Continued technological advancements and extended capabilities of hybrid flight vehicles lend support to the notion of change, rather than maintaining the *status quo*. In the early days of space flight, the functional—spatial demarcation of airspace and outer space was a logical bifurcation of solutions. But the blending of airspace and outer space through the advent of

---

Where never lark nor ever eagle flew—
And, while with silent lifting mind I've trod
The high untrespassed sanctity of space,
Put out my hand, and touched the face of God. *Id.*

[276] BLACK'S LAW DICTIONARY 1478 (8th ed. 1999).

[277] *Hybrid Hops*, *supra* note 1, at 806.

hybrid flight vehicles, and a recommendation to envelop *all* flights into one overarching legal system based on *orbital* status, seems to be the next logical step in the evolution of flight.

Orbit Law would initially apply existing principles of international air law to all suborbital flights, while governing all orbital and inter-orbital flights under current space law principles. Careful examination of liability systems which promote the growth and development of suborbital and orbital flights should be applied, along with the encouragement of Open Skies and eventual dissolution of sovereign boundaries for *all* such flights. Some blending of strict liability and *res ipsa loquitur* represents the most equitable method to hold public and private actors liable and responsible according to their degree of involvement in any flight accident. The separate legal structures applicable to suborbital and orbital/inter-orbital flights must be tested to determine the most successful and useful configurations, and should ultimately be united into a fine-tuned international treaty. By apportioning responsibility under one unified liability regime, and advancing Open Skies by utilizing technology to quickly identify all suborbital and orbital craft, the evolution of Orbit Law will advance State and corporate participation across all frontiers of flight.

Should States eventually embrace these suggestions, they will be able to select which solutions work best for suborbital, orbital, and inter-orbital flights. Inclusion of a Sunset Clause in Orbit Law will also give them the hindsight to retain, modify, or jettison any principles depending on their degree of success in the early years of application.

Quod Erat Demonstrandum

LEGALITY OF THE DEPLOYMENT OF ANTI-SATELLITE WEAPONS IN EARTH ORBIT: PRESENT AND FUTURE

Shang Kuan[*]

I. INTRODUCTION

We are now living in a vacuum of binding international law on the development and deployment of anti-satellite weapons. As the weaponization of outer space and proliferation of anti-satellite weapons intensifies, more and more scholars are beginning to question the legality of the development and deployment of anti-satellite weapons under the current framework of international law and are suggesting the possibility of outlawing such weapons in a future international treaty.

This paper, structured in three parts, is consequently written in response to these questions. The first part of this paper will briefly introduce the current framework of international laws regulating the development and deployment of anti-satellite weapons. As represented by Article 2(4) of the United Nations Charter,[1] Article 1(1)(a) of the Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and Under Water,[2] and the Preamble and Article I, II and IV of the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and

---

[*] Shang Kuan received a B.A. and LL.B. at China University of Political Science and Law (2010), and will enroll in the J.D. program of the University of Hong Kong in August 2010. Kuan was the recipient of the Award for the Best Memorials at the 2009 Manfred Lachs International Space Law Moot (Asia-Pacific Rounds). Kuan also wishes to thank Dean Prof. Zhang Living, Prof. Ling Yan and Prof. Li Juqian for their invaluable help in preparing this article.

[1] U.N. Charter art. 2, para 4.

[2] See Treaty Banning Nuclear Weapons Tests in the Atmosphere, in Outer Space and Under Water, art. 1(1), *opened for signature* Aug. 9, 1963, 14 U.S.T. 1313, 480 U.N.T.S. 43, [hereinafter Limited-Test-Ban Treaty].

Other Celestial Bodies,[3] international law has failed to respond to the legality of the development and deployment of anti-satellite weapons.

The second part of this paper is written to provide a detailed argument that the development and deployment of anti-satellite weapons do not contravene international law. The paper submits that they do not contravene the Outer Space Treaty *per se*, since the Treaty has only banned nuclear weapons and weapons of mass destruction to be placed in orbit; the "peaceful use" expression in the preamble of the Treaty is not legally binding,[4] and non-aggressive anti-satellite weapons are needed to be deployed in executing the right of self-defence. Furthermore, the development and deployment of anti-satellite weapons also do not contravene international customary law, since no State practice or *opinio juris* exists in forming an international customary law to ban the development and deployment of such weapons.

Consequently, the third part of this paper analyses the possibility of drafting a new treaty explicitly banning or restricting the usage of anti-satellite weapons. Although many nations[5] and scholars[6] suggest that a new treaty banning all

---

[3] Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, pmbl., arts. I, II, IV, *opened for signature* Jan. 27, 1967, 18 U.S.T. 2410, 610, U.N.T.S. 205 [hereinafter Outer Space Treaty].

[4] *See* Major Douglas S. Anderson, *A Military Look into Space: the Ultimate High Ground*, 1995 ARMY LAW. 19, 24 (1995); Marko G. Markoff, *Disarmament and "Peaceful Purposes" Provisions in the 1967 Outer Space Treaty*, 4 J. SPACE L. 3, 11 (1976); *see also* Nina Tannenwald, *Law Versus Power on the High Frontier: The Case for a Rule-Based Regime for Outer Space*, 29 YALE J. INT'L L. 363, 404 (2004).

[5] These nations include China, Russia, France and Canada. *See* Lori Scheetz, *Infusing Environmental Ethics into the Space Weapons Dialogue*, 19 GEOIELR 57, 65-66 (2006) (stating that "China and Russia have presented proposals [at the the U.N. Conference on Disarmament] to ban weapons based in space and the use of force directed at objects in space . . . . France and Canada support the notion that the space environment should be free from weapons."). *See also* Sean R. Mikula, *Blue Helmets in the Next Frontier: the Future is Now*, 29 GA. J. INT'L & COMP. L. 531, 549-50 (2001) (the Chinese Ambassador to the United Nations on Disarmament voiced his country's view that "[t]he prevention of an arms race and the prohibition of weapon systems in outer space will ... exempt outer space from wars ... [and will] be crucial for maintaining peace, security, and stability on the Earth." Russian President Vladimir Putin […] holds to the same position […].).

militarization of outer space should be signed, preferably based on the Antarctic Treaty model, there is still a long way to go in achieving such a treaty. With the major powers of the world reluctant to sign, the possibility of ratifying such a treaty is scarce.

As a final note, this paper concludes that the current vacuum of binding international law on the development and deployment of anti-satellite weapons will possibly continue to exist for a rather long time, and international criticism will serve as the most powerful controller to slow down the process of the proliferation of anti-satellite weapons. As technology develops and the proliferation of anti-satellite weapons accelerates, the international community might finally conclude a total ban treaty in the distant future.

II. THE CURRENT FRAMEWORK OF INTERNATIONAL LAW REGULATING THE DEVELOPMENT AND DEPLOYMENT OF ANTI-SATELLITE WEAPONS

A. Article 2(4) of the United Nations Charter

Article 2(4) of the U.N. Charter[7] provides a general rule governing the use of force among States, which reads, "[a]ll Members shall refrain in their international relations from the threat or use of force against the territorial integrity or political independence of any state, or in any other manner inconsistent with the Purposes of the United Nations."

Here, the application of Article 2(4), of the U.N. Charter, in outer space makes it unlawful for any State to interfere in a hostile manner with the space assets of another State.[8]

---

[6] *See generally* Frank M. Walsh, *Forging A Diplomatic Shield for American Satellites: the Case for Reevaluating the 2006 National Space Policy in Light of A Chinese Anti-Satellite System*, 72 J. AIR L. & COM. 759 (2007); Scheetz, *supra* note 5.

[7] U.N. Charter, art. 2 (4).

[8] *See* Christopher M. Petras, *The Use of Force in Response to Cyber-Attack on Commercial Space Systems -- Reexamining "Self-Defense" in Outer Space in Light of the Convergence of U.S. Military and Commercial Space Activities*, 67 J. AIR L. & COM. 1213, 1258 (2002); *see also* Ivan A. Vlasic, *Space Law and the Military Applications of Space Technology*, *in* PERSPECTIVES ON INTERNATIONAL LAW 385, 394 (Nandasiri Jasentuliyana ed., 1995).

B. Article 1(1)(a) of the Limited-Test-Ban Treaty

The Limited-Test-Ban Treaty[9] is usually considered the first legally binding document renouncing the military use of outer space,[10] as well as the first step towards the "denuclearization of outer space."[11] Article 1(1) of this Treaty reads:

> Each of the Parties to this Treaty undertakes to prohibit, to prevent, and not to carry out any nuclear weapon test explosion, or any other nuclear explosion, at any place under its jurisdiction or control:
> (a) in the atmosphere; beyond its limits, including outer space; or under water, including territorial waters or high seas [...]

Nevertheless, as the International Court of Justice's decision in the Nuclear Test Case[12] suggests, the treaty's prohibitions cannot "be regarded as declaratory of general international law."[13]

C. The Preamble and Article I, II and IV of the Outer Space Treaty

Signed in 1967, the Outer Space Treaty[14] is considered the first international agreement that deals exclusively with outer space. The Treaty has been described as the Magna Carta of international agreements pertaining to outer space.[15] Signed

---

[9] Limited-Test-Ban Treaty, *supra* note 2.

[10] See Glenn Harlan Reynolds, *The Moon Treaty: Prospects for the Future*, 52 SPACE POLICY 115 (1995); *see also* Petras, *supra* note 8.

[11] G.S. Raju, *Military Use of Outer Space: Towards Better Legal Controls*, *in* MAINTAINING OUTER SPACE FOR PEACEFUL PURPOSES 90, 92 (Nandasiri Jasentuliyana ed., 1984). *See also* Petras, *supra* note 8.

[12] Nuclear Test Case (Austl. v. Fr.), 1974 I.C.J. 253 (Dec. 20).

[13] *See* Bin Cheng, Lectures at the Institute of Public International Law and International Relations, University of Thessaloniki: Outer Space: The International Legal Framework--the International Legal Status of Outer Space, Space Objects, and Spacemen (Sept. 1979), *in* 10 THESAURUS ACROASIUM 41 (1981), *reprinted in* BIN CHENG, STUDIES IN INTERNATIONAL SPACE LAW 383, 408-09 (Clarendon Press 1997). *See also* Christopher M. Petras, *"Space Force Alpha" Military Use of the International Space Station and The Concept of "Peaceful Purposes"*, 53 A.F. L. REV. 135, 149, (2002).

[14] Outer Space Treaty, *supra* note 3.

[15] Ambassador Peter Jankowitsch of Austria, Chairman of the United Nations Committee on the Peaceful Uses of Outer Space (UN-COPUS), Opening remarks to the

and/or ratified by over one hundred nations,[16] the treaty "placed restrictions on military activities in space," and also "provided the principles on which subsequent outer space treaties were drafted."[17]

Within the preamble of the Outer Space Treaty are several phrases that indicate a desire that space activities be carried out peacefully.[18] For instance, it recognizes the "common interest of all mankind in the progress of the exploration and use of outer space for peaceful purposes," and that the use of outer space should be carried out "for the benefit of all peoples."[19]

In addition, the Outer Space Treaty states that the "exploration and use of outer space . . . 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."[20] Moreover, outer space "is not subject to national appropriation"[21] and "shall be used . . . for peaceful purposes."[22] Note that the Treaty is framed mainly in terms of exploration and use, not preservation of the space environment.[23]

The extent to which military use of outer space is restricted by the Outer Space Treaty, has been greatly debated. The main focus of this dispute, however, rests on the interpretation of the term "peaceful purposes," as provided in Article IV of the Outer Space Treaty. Some nations argue that the term should be

---

Committee on its Twenty-Fifth Anniversary, U.N. Coc. A/AC. 105/PV, 230, at 7, 8 (1982); *reprinted in* 10 J. SPACE L. 41, 41. *See also* Richard A. Morgan, *Military Use of Commercial Communication Satellites: A New Look at the Outer Space Treaty and "Peaceful Purposes"*, 60 J. AIR L. & COM. 237, 296 (1994).

[16] *See* Major John E. Parkerson, Jr., *International Legal Implications of the Strategic Defense Initiative*, 116 MIL. L. REV. 67 (1987). *See also* Anderson, *supra* note 4, at 24.

[17] *See* Anderson, *supra* note 4, at 24.

[18] *Id.* at 25.

[19] Outer Space Treaty, *supra* note 3, at preamble.

[20] Outer Space Treaty, *supra* note 3, at art. I.

[21] *Id.* at art. II.

[22] *Id.* at art. IV.

[23] See David Tan, *Towards a New Regime for the Protection of Outer Space as the "Province of All Mankind"*, 25 YALE J. INT'L L. 145, 165-66 (2000). *See also* Scheetz, *supra* note 5, at 59.

understood to mean "non-military," while others argue that it should mean "non-aggressive."[24]

III. STATUS QUO: THE DEVELOPMENT AND DEPLOYMENT OF ANTI-SATELLITE WEAPONS DO NOT CONTRAVENE INTERNATIONAL LAW

A. The Development and deployment of anti-satellite weapons do not contravene international treaties

i. The Outer Space Treaty and other international treaties have not explicitly banned the development and deployment of anti-satellite weapons

As discussed in the previous part of this paper, Article IV, of the Outer Space Treaty, does not represent a complete restriction on the placement of weapons in outer space.[25] Article IV prohibits only the placement of nuclear weapons and other weapons of mass destruction in outer space *sensu stricto* and is silent on the subject of conventional weapons.[26] Also, the development and deployment of anti-satellite weapons do not contravene other relevant international treaties. In other words, the current international law regime for outer space has failed to prohibit weaponization of space by failing to address conventional space weaponry.[27]

---

[24] Michael N. Schmitt, *Bellum Americanum: The U.S. View of Twenty-First Century War and Its Possible Implications for the Law of Armed Conflict*, 19 MICH. J. INT'L L. 1051, 1087 (1998). *See also* Petras, *supra* note 8, at 139.

[25] *See, e.g.,* Gyula Gal, *"Threat or Use of Force" -- Observations to Article 2 of the U.N. Charter and Article III of the Outer Space Treaty*, 17 J. SPACE L. 54, 55-57 (1989). *See also* Jackson Maogoto & Steven Freeland*, the Final Frontier: the Laws of armed Conflict and Space Warfare*, 23 CONN. J. INT'L L. 165, 180 (2000).

[26] Michel Bourbonnière, *Legality of the Deployment of Conventional Weapons in Earth Orbit: Balancing Space Law and the Law of Armed Conflict*, 18 EUR. J. INT'L L. 873, 888 (2007).

[27] *See* Scheetz, *supra* note 5, at 63.

ii. Developing and deploying anti-satellite weapons do not contravene the Outer Space Treaty as long as they are used non-aggressively

Currently, there are two competing interpretations of the "peaceful purpose" provision,[28] of the Outer Space Treaty, submitted by space law scholars: "non-military" and "non-aggressive."[29] However, although it may seem to still be a disputable issue within the international community, since some space law commentators and developing countries argue in favour of the "non-military" interpretation, the reality has, unfortunately, been different.[30] In fact, a consensus has already been established among spacefaring nations that the term "peaceful" should be interpreted as "non-aggressive,"[31] while no State has ever formally protested against this interpretation.[32]

Specifically, the United States has, from the very beginning of the space age up to the present day, maintained the official position that "peaceful" means "non-aggressive" and not "non-military,"[33] and has therefore determined that pursuing space weapons is not only permitted by the Outer Space Treaty, but is also consistent with the aims of the Treaty.[34] A position also

---

[28] Outer Space Treaty, *supra* note 3, at preamble.

[29] *See, e.g.*, Richard A. Morgan, *supra* note 15, at 240-241 and 304; BRUCE A. HURWITZ, THE LEGALITY OF SPACE MILITARIZATION 58, n.20 (1986); Eilene Galloway, *International Institutions to Ensure Peaceful Uses of Outer Space*, IX ANNALS AIR & SPACE L. 310 (1984).

[30] *See* Bin Cheng, *The 1967 Outer Space Treaty: Thirtieth Anniversary*, XXIII AIR & SPACE L. 156, 159 (1998). *See also* Maogoto & Freeland, *supra* note 25, at 179.

[31] *See* Morgan, *supra* note 15, at 303.

[32] *See* CHENG, STUDIES IN INTERNATIONAL SPACE LAW, *supra* note 13, 522(1997).

[33] *See* US Congress, Treaty on Outer Space: Hearings before the Senate Committee on Foreign Relations, 90th Cong. (1967), at 22, 59 (statement of Arthur J. Goldberg, US Ambassador to the UN); Bin Cheng, *Definitional Issues in Space Law: the "Peaceful Use" of Outer Space, including the Moon and other Celestial Bodies*, *reprinted in* Cheng, STUDIES IN INTERNATIONAL SPACE LAW, *supra* note 13, at, 513, 515; *See also* S.H. LAY AND H.J. TAUBENFELD, THE LAW RELATING TO THE ACTIVITIES OF MAN IN SPACE 97 (1970); and C.Q. CHRISTOL, THE MODERN INTERNATIONAL LAW OF OUTER SPACE 29-30 (1982). Petras, *supra* note 8, at 1254; Morgan, *supra* note 15, at 303-304, n.353-55.

[34] *See* White House Fact Sheet, National Space Policy (Sept. 1, 1996), *available at* http://www.fas.org/spp/military/docops/national/nstc-8.htm; Commission to Assess U.S. National Security Space Mgmt. and Org., Report of the Commission to Assess United States National Security Space Management and Organization (2001), 13-27, 27-36 *available at* http://www.fas.org/spp/military/commission/chapter2.pdf, http://www.fas.org/spp/military/commission/chapter3.pdf.

accepted by the Soviet Union.[35] This argument is reinforced by the actual state practices of the two superpowers, which quickly established that "peaceful" included passive military means.[36] In contrast, although much of the developing world objects to this interpretation,[37] and prefers to read "peaceful" as meaning "non-military,"[38] no State has ever formally protested the passive military use interpretation, as would be required to prevent a rule of customary international law from being established.[39]

In a nutshell, a consensus can be considered to be concluded in favour of the "non-aggressive" interpretation,[40] leading to the understanding that all military activities in outer space are permissible, unless specifically prohibited by treaty or customary international law.[41] Adopting this view, any non-aggressive device would therefore comply with the "peaceful purposes" provision of the Outer Space Treaty, even if the device is military in nature.[42]

iii. Anti-satellite weapons may need to be deployed in exercising the right of self-defence

The U.N. Charter has supremacy over all international treaties,[43] a concept also recognized in the Outer Space Treaty.[44] Article 51 of the Charter, recognizes that states have the right

---

[35] *See* Tannenwald, *supra* note 4, at 373.

[36] *See* STUDIES IN INTERNATIONAL SPACE LAW, *supra* note 13, at 515-16, 528-29; Ivan A. Vlasic, *The Legal Aspects of Peaceful and Non-Peaceful Uses of Outer Space*, *in* PEACEFUL AND NON-PEACEFUL USES OF OUTER SPACE 37, 44-45 (1991) [hereinafter PEACEFUL AND NON-PEACEFUL USES OF OUTER SPACE].

[37] *See* Tannenwald, *supra* note 4, at 373, n. 25.

[38] *See* Morgan, *supra* note 15, at 296.

[39] Tannenwald, *supra* note 4, at 373.

[40] *See* Morgan, *supra* note 15, at 303.

[41] PEACEFUL AND NON-PEACEFUL USES OF OUTER SPACE, *supra* note 36, at 37, 38, & 45.

[42] Cynthia B. Zhang, *Do as I Say, not as I Do -- is Star Wars Inevitable? Exploring the future of International Space Regime in the Context of the 2006 U.S. National Space Policy*, 34 RUTGERS COMPUTER & TECH. L.J. 422, 449 (2008).

[43] Article 103 of The U.N. Charter states: "In the event of a conflict between the obligations of the Members of the United Nations under the present Charter and their obligations under any other international agreement, their obligations under the present Charter shall prevail." U.N. Charter art. 64. *See also* Zhang, *supra* note 42, at 436.

[44] *See* Zhang, *supra* note 42, at 436.

of self-defence when facing "an armed attack,"[45] which is also applicable to the regulation of outer space.[46]

Article IV of the Outer Space Treaty prohibits States from stationing weapons of mass destruction or nuclear weapons in outer space; it does not, in any way, invalidate the inherent right of national self-defence pursuant to customary law and Article 51 of the U.N. Charter.[47] In other words, the "non-aggressive" device has left room to permit armed assets that are capable of self-defence. [48]

Since a State's inherent right to self-defence encompasses military support and application missions, whether terrestrial or space-based,[49] deploying non-aggressive anti-satellite weapons in outer space would therefore not violate the Outer Space Treaty.

iv. The Preamble of the Outer Space Treaty is not legally binding

Apart from the previous arguments listed above, it is also worthy to note that even if the "non-military" interpretation of the "peaceful use" expression in the preamble of the Outer Space Treaty is adopted, the development and deployment of anti-satellite weapons do not contravene international law, since a preamble of a treaty is not legally binding.[50] Therefore, the phrase of "peaceful use" can only be used as persuasive evidence of the drafters' intent.[51]

---

[45] U.N. Charter art. 51.

[46] *See* Tannenwald, *supra* note 4, at 397.

[47] *See* CHRISTOL, supra note 33, at 37.

[48] *See* Zhang, *supra* note 42, at 449.

[49] *Id*. at 449.

[50] *See* Anderson, *supra* note 4, at 24; Markoff, *supra* note 4, at 11; Tannenwald, *supra* note 4, at 404.

[51] See Markoff, *supra* note 4, at 11.

v. The Outer Space Treaty, outdated as it may be, does not need an interpretation "in the light of its object and purpose"

Some scholars acknowledge[52] the fact that conventional space weapons are not explicitly banned by the text of the Outer Space treaty, yet they argue[53] that the text of the treaty has became vague[54] as technology advances; thus, the treaty needs to be interpreted "in the light of its object and purpose,"[55] as stipulated under the Vienna Convention of Law of Treaties.[56] Nevertheless, this argument cannot stand since the interpretation of a treaty should always be initially centred on the actual text of the agreement, with an emphasis on the analysis of the words used,[57] closely followed with the subsequent "object and purpose" approach in the interpretation process.[58] A typical argument of these scholars[59] might look like the following:[60]

---

[52] *See, e.g.,* Bourbonnière, *supra* note 26, at 881; Kimberly M. Schlie, *Developing and Deploying Laser Weaponery in Space: Is it Legal?*, 4 DEPAUL INT'L L.J. 17, 157 (2000); Alex B. Englehart, *Common Ground in the Sky: Extending the 1967 Outer Space Treaty to Reconcile U.S. and Chinese Security Interests*, 17 PAC. RIM L. & POL'Y J. 133, 142 (2008).

[53] Adam G. Quinn, *The New Age of Space Law: the Outer Space Treaty and the Weaponization of Space*, 17 MINN. J. INT'L L. 475, 487, 491 ("[t]he Outer Space Treaty is inadequate to govern space [… and] is irrelevant to modern space policies.").

[54] *Id*. at 496 (arguing that without proper interpretation, "the [Outer Space] Treaty itself may actually be invalid under the Vienna Convention on the Law of Treaties. . . [due to a] fundamental change in circumstances.").

[55] Article 31.1 of The Vienna Convention on the Law of Treaties states: "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." Vienna Convention on the Law of Treaties, art. 31.1, May 23, 1969, 1155 U.N.T.S. 331 [hereinafter Vienna Convention].

[56] Vienna Convention, *supra* note 55, at art. 31.

[57] Gerald Fitzmaurice, *The Law and Procedure of the International Court of Justice 1951-54: General Principles and Sources of International Law*, XXXV B.Y.I.L. 204-07 (1959).

[58] ULF LINDERFALK, ON THE INTERPRETATION OF TREATIES: THE MODERN INTERNATIONAL LAW AS EXPRESSED IN THE 1969 VIENNA CONVENTION ON THE LAW OF TREATIES, 202-3 (Springer, 2007).

[59] *See, e.g*., Quinn, *supra* note 53, 496; Bourbonnière, *supra* note 26, at 888-9; Lieutenant Colonel John C. Kunich, USAF, *Planetary Defense: the Legality of Global Survival*, 41 A.F. L. REV. 119, 134-135 (1997); Morgan, *supra* note 15, at 311-312.

[60] *See generally* Quinn, *supra* note 53; Bourbonnière, *supra* note 26; Kunich, *supra* note 59; Morgan, *supra* note 15; Englehart, *supra* note 52.

a. The Vienna Convention provides that a treaty shall be interpreted in the light of its object and purpose

The Scholars who advocate[61] that the Outer Space Treaty should be interpreted first point to Article 31.1 of the Vienna Convention, which provides 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."[62] Pursuant to this provision, these scholars argue[63] that the "object and purpose" of a treaty is the most important background against which the meaning of any particular treaty provision should be measured.[64] Thus, where a treaty's text is vague and ambiguous, it needs to be interpreted so as to safeguard its object and purpose.

b. The Outer Space Treaty is outdated, and the text of the Treaty becomes vague as technology advances

These scholars[65] would then point to the preamble of the Outer Space Treaty, where the drafters' purpose is indicated: "[The State Parties of this treaty] [r]ecognizing the common interest of all mankind in the progress of the exploration and use of outer space for peaceful purposes…"[66]

They argue that the goals set forth in the preamble to the treaty remain equally valid today.[67] Nonetheless, technology has changed to such an extent that the text of the treaty is no longer capable of fulfilling those goals,[68] as demonstrated by a broad consensus throughout the international community, there are "some deficiencies in the existing outer space architecture which

---

[61] *Id.*

[62] Vienna Convention, *supra* note 55, at art. 31.

[63] *See* Kunich, *supra* note 59, at 134-138.

[64] *See* MALCOLM NATHAN SHAW, INTERNATIONAL LAW, 839 (2006).

[65] *See generally* Quinn, *supra* note 53; Englehart, *supra* note 52.

[66] Outer Space Treaty, *supra* note 3, preamble.

[67] *See* Englehart, *supra* note 52, at 143. *See also* Press Release, The White House, President Bush Announces New Vision for Space Exploration Program (Jan. 14, 2004) http://georgewbush-whitehouse.archives.gov/news/releases/2004/01/20040114-3.htm.

[68] Englehart, *supra* note 52, at 142.

could be strengthened through . . . improving or enhancing the implementation and universalisation of existing agreements."[69]

Furthermore, these scholars argue that the actual meaning of the text of the Outer Space Treaty has increasingly become vague as technology advances.[70] They argue that in 1967, when the Outer Space Treaty was signed, the contracting States had sufficient reason to believe that by banning nuclear weapons and WMDs they were actually banning all space weapons from being placed in outer space.[71] Back in 1967, the stationing of nuclear weapons in orbit was the only significant military threat that most contracting States could envision in space.[72] There was real fear and concern that nuclear weapons would soon be stationed in space,[73] and thus a ban would be best for both superpowers, at that time, and for humanity at large.[74] Moreover, the idea of conventional weaponry in orbit was science fiction at the time, and thus did not merit serious attention in the treaty.[75] Nevertheless, these weapons are being actively pursued currently,[76] and have posed threats which are at least as serious today as the stationing of nuclear weapons in space was in 1967.

---

[69] *See* Letter Dated 14 August 2008 from the President of the Conference on disarmament on behalf of the 2008 presidents addressed to the secretary-General of the Conference Transmitting the reports of the seven coordinators submitted to the president of the conferences on the work done during the 2998 session on agency items 1 to 7, U.N. Doc. CD/1846, 15 Aug. 2008.

[70] *See, e.g.*, Englehart, *supra* note 52, at 145; Quinn, *supra* note 53, at 477-478.

[71] *See* Englehart, *supra* note 52, at 145; Quinn, *supra* note 53, at 496.

[72] Englehart, *supra* note 52, at 144.

[73] The U.S. Department of State, Narrative of Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, http://www.state.gov/t/isn/5181.htm#narrative (last visited Jan. 16, 2010).

[74] *Id.*

[75] Englehart, *supra* note 52, at 144.

[76] *See* Andrew T. Park, *Incremental Steps for Achieving Space Security: The Need for a New Way of Thinking to Enhance the Legal Regime for Space*, 28 HOUS. J. INT'L L. 871, 881 (2006); Englehart, *supra* note 52.

c. Interpreting the Outer Space Treaty is therefore needed to safeguard its object and purpose correctly understood by the international community

Finally, scholars advocating for an interpretation of the Outer Space Treaty have reached the conclusion that interpreting the treaty according to its object and purpose[77] is the only way to fulfil the spirit of the treaty in the 21st century. Additionally, they point out that the International Court of Justice pays attention to the advancement of technology when interpreting a treaty, by taking the state of present-day scientific knowledge into account. For instance, the International Court of Justice stated in the *Case concerning Kasikili/Sedudu Island*[78] that: "[i]n order to illuminate the meaning of words agreed upon in 1890, there is nothing that prevents the Court from taking into account the present-day state of scientific knowledge."[79] Consequently, the international community also needs to consider and balance the present-day state of scientific knowledge with that existing in 1967.

Pursuant to the arguments above, these scholars conclude[80] that the Outer Space Treaty should be interpreted in accordance with its object and purpose, with all anti-satellite weapons banned from being deployed in outer space.

Nevertheless, this author submits that the "object and purpose" interpretation should not be employed until textual interpretation fails. When an advocate uses the object and purpose of a treaty in accordance with the provisions of the Vienna Convention, Article 31, the object and purpose is not considered independently of other means of interpretation.[81] The object and purpose is always used in relation to conventional language ("the ordinary meaning"); it is always a second step in the interpretation process.[82]

---

[77] *See* Englehart, *supra* note 52, at 143.

[78] Case concerning Kasikili / Sedudu Island (Botswana v. Namibia), 1999 I.C.J. 19, at para. 20 (December 13) (Judgment).

[79] SHAW, *supra* note 64, at 40.

[80] *See, e.g.*, Englehart, *supra* note 52, Quinn, *supra* note 53.

[81] *See* LINDERFALK, supra note 58.

[82] *Id.*

vi. The "non-military v. non-aggressive" debate and the making of future customary law

Detached and apathetic to the "non-military v. non-aggressive debate," many scholars tend to adopt a pragmatic view of the current situation,[83] as they argue that the debate is a "redundant argument"[84] and rather meaningless. They submit that since outer space has been, and continues to be, used for an expanding array of military activities,[85] it is likely that space will increasingly be utilized to further the military and strategic aims of specific countries, particularly as military and space technology continues to evolve and develop.[86] Consequently, a fully developed rule in customary international law may emerge that legalizes the development and deployment of anti-satellite weapons, superseding all "non-military" arguments, unless concrete steps are taken to stop this trend.

B. The development and deployment of anti-satellite weapons do not contravene international customary law

Under the current international framework, the development and deployment of anti-satellite weapons contravene not only the international treaties, but also customary international law. Custom comprises two elements: the usage or practice of customary international law (State practice), and *opinio juris sive necessitatis*, the belief that the usage is a legal right (*opinio juris*).[87] In this case, however, no State practice or *opinio juris* exists in forming an international customary law banning the development and deployment of anti-satellite weapons.

---

[83] *See* Maogoto & Freeland, *supra* note 25, at 181.
[84] *Id*.
[85] *See* Cheng, *supra* note 30, at 159.
[86] Maogoto & Freeland, *supra* note 25.
[87] Continental Shelf (Libya v. Malta), 1985 I.C.J. 13, 20 (June 3).

i. No State practice exists to form an international customary law banning anti-satellite weapons

a. Space-faring nations have not stopped developing anti-satellite weapons

Although the space-faring nations stopped testing anti-satellite weapons in 1985,[88] they never stopped developing these weapons.[89] In fact, the development of anti-satellite weapons is actively pursued by these nations. For instance, the U.S. government has declared: "[p]urposeful interference with U.S. space systems will be viewed as an infringement on our sovereign rights. The U.S. may take all appropriate self-defence measures, including, . . . the use of force, to respond to such an infringement on U.S. rights."[90] Several U.S. government publications have similarly called space a "vital national interest," a traditional governmental term of art for objectives of such importance that armed force would be used to protect them.[91] "Space was also of growing importance to the U.S. military, as evidenced by the 1982 creation of a separate Space Command within the U.S. Air Force."[92] Moreover, in 2006 the

---

[88] *See, e.g.,* Walsh, *supra* note 6, at 760, n.3; Lori Damrosch, *The Future of International Law*, 101 AM. SOC'Y INT'L L. PROC. 233, 235 (2007) (stating that "the Soviet Union ended its [anti-satellite weapon] testing in 1982, and the last U.S. test was in 1985."); Michael W. Taylor, *Trashing the Solar System One Planet at a Time: Earth's Orbital Debris Problem*, 20 GEO. INT'L ENVTL. L. REV. 1, 11. (2007).

[89] *See* Englehart, *supra* note 52, at 133.

[90] U.S. Dep't of Defense, *"U.S. Department of Defense, Dir. 3100.10" Space Policy*, *in* DEPARTMENT OF DEFENSE DICTIONARY OF MILITARY AND ASSOCIATED TERMS 253 (1999).

[91] John M. Logsdon, George Washington University's Space Policy Institute, Reflections On Space As A Vital National Interest, 2 (2003) (citing The White House, A National Security Strategy for a New Century (1999) and U.S. DOD, Quadrennial Defense Review Report (2001)) 45, *available at* http://www.gwu.edu/%7Espi/assets/docs/space_as_a_national_interest.pdf.

[92] Major Elizabeth Seebode Waldrop, *Integration of Military and Civilian Space Assets: Legal and National Security Implications*, 55 A.F. L. REV. 157, 160 (2004). A unified Command, the United States Space Command (USSPACECOM), was created in 1985, including three service component commands-the Air Force Space Command (created in 1982), the Naval Space Command (created in 1983), and the Army Space Command (created in 1988). *See* COLIN S. GRAY, AMERICAN MILITARY SPACE POLICY: INFORMATION SYSTEMS, WEAPON SYSTEMS & ARMS CONTROL 115 (1982); Anderson, *supra* note 4, at 20; Burrus M. Carnahan, *The Legality of A High-Technology Missile Defense System: The ABM and Outer Space Treaties*, 78 AM. J. INT'L L. 418, 422, n 43; Lieutenant General Thomas S. Moorman, Jr., United States Air Force, *Space, a New*

U.S. government announced a new National Space Policy (2006 Space Policy).[93] It is estimated that the United States also invested approximately $1 billion in developing anti-satellite weapons, in that year.[94] In addition, Russia sees "space warfare as a distinct possibility in the future."[95]

Similarly, China has also expressed its determination in developing military satellites. In 2003, a Chinese military official commented on China's army already integrating the concept of space force strength,[96] indicating that Chinese space programs are significantly driven by military and security considerations,[97] and "the Chinese space program has always been under the command of senior officers of the People's Liberation Army."[98] China's Central Committee has given "its highest priority to the development" of anti-satellite weapons since 1998;[99] this nation has invested between $1.4 and $2.2 billion on its space program over the past decade.[100]

Strategic Frontier, AIRPOWER J., 14, 18 (Spring 1992); Mikula, *supra* note 5, at 554 (noting that "the Army, Navy, and Air Force. . . . fall[s] under the overall control of the United States Space Command.").

[93] U.S. Office of Science & Technology Council, United States National Space Policy 1 (2006), www.fas.org/irp/offdocs/nspd/space.pdf [hereinafter "2006 Space Policy"].

[94] *See* David A. Koplow, *ASAT-Isfaction: Customary International Law and the Regulation of Anti-Satellite Weapons*, 30 Mich. J Int'l L 1187, 1194 (2009); *see also* National Public Radio (NPR), *Does China Test Signal Weapons Race?*, *Talk of the Nation: Science*, Jan. 26, 2007, http://www.npr.org/templates/transcript/transcript.php?storyId =7039546 (noting that Ms. Victoria Samson, a research analyst at the Center for Defense Information, stated that "[w]e looked at the budget request from last year, and there could be $1 billion for programs that could have that kind of [anti-satellite] space weapons capability.").

[95] *See* Maogoto & Freeland, *supra* note 25, at 169; *see also* Michael R. Gordon & David S. Cloud, *U.S. Knew of China's Missile Test, but Kept Silent*, N.Y. TIMES, Apr. 23, 2007, at A1; Peter Spiegel, *U.S. Gauges the Threat to Satellites*, L.A. TIMES, Apr. 22, 2007, at A1.

[96] Leonard David, Pentagon Report: China's Space Warfare Tactics Aimed at U.S. Supremacy, Space (2003) http://www.space.com/news/china_dod_030801.html.

[97] *See* James Perry, *Operation Allied Force: The View from Beijing*, 14(2) AEROSPACE POWER J. 79, 81-82 (Summer 2000); *see also* Maogoto & Freeland, *supra* note 25, at 169.

[98] Maogoto & Freeland, *supra* note 25, at 186; *See* China in Space, China's Spacecraft, SPACE TODAY, http:// www.spacetoday.org/China/ChinaSatellites.html (last visited Jan. 16, 2010); *See* Gabriele Garibaldi, The Chinese Threat to American Leadership, http://www.asianresearch.org/articles/2435.html (last visited June 14, 2010).

[99] Walsh, *supra* note 6, at 767; *See* Paul Beaver, *China Develops Anti-satellite Laser System*, JANE'S DEF. WKLY., Dec. 2, 1998, at 18; Paul Richter, *China May Seek Satellite*

b. Space-faring nations have recently carried out new tests of anti-satellite weapons in outer space

In recent years, space-faring nations have restarted testing anti-satellite weapons, after such tests ceased in 1985. On January 11, 2007, China shot down one of its satellites using a ground-based ballistic missile known as an anti-satellite weapon.[101] On February 20, 2008, America destroyed a defunct spy satellite using a warship-based missile.[102]

ii. No opinio juris exists in forming an international customary law banning anti-satellite weapons

a. Space superpowers have stopped testing anti-satellite weapons for various reasons other than fearing a contravention of international law

The space powers have stopped testing anti-satellite weapons since 1985 for several decades.[103] Also, during the late 1980s, the United States and the former Soviet Union negotiated to end the space arms race by freezing tests of anti-satellite weapons.[104]

Laser, Pentagon Warns, L.A. TIMES, Nov. 28, 1998 http://articles.latimes.com/1998/nov/28/news/mn-48519.

[100] *See* Marcia S. Smith, Cong. Research Serv., Doc. No. RS21641, China's Space Program: An Overview 4 (2005); Walsh, *supra* note 6, at 768.

[101] Tim Reid, *"Star Wars" Missile Test Heralds New Arms Race in Space*, LONDON TIMES, Jan. 19, 2007, *available at* http://www.timesonline.co.uk/tol/news/world/asia/article1294519.ece; Zhang, *supra* note 42, at 427.

[102] *See* Koplow, *supra* note 94, at 1210; Catherine Elsworth & Richard Spencer, *Protests after US shoots down rogue spy satellite*, THE DAILY TELEGRAPH, Feb. 21, 2008, http://www.telegraph.co.uk/news/worldnews/1579552/Protests-as-US-shoot-down-rogue-spy-satellite.html; Ewen MacAskill, *US plans missile launch to destroy rogue spy satellite*, THE GUARDIAN, Feb. 15, 2008, http://www.guardian.co.uk/world/2008/feb/15/usa1.

[103] *See, e.g.*, Walsh, *supra* note 6, at 760, n.3; Damrosch, *supra* note 88, at 235; Taylor, *supra* note 88, at 11 unrelared. *See also* Mark Kaufman & Dafna Linzer, *China Criticized for Anti-Satellite Missile Test*, WASH. POST, Jan.19, 2007, at A1, *available at* http://www.washingtonpost.com/wpdyn/content/article/2007/01/18/AR2007011801029.html.

[104] *See* Koplow, *supra* note 94, at 1219. *See also* Harold Jackson, *Reagan now ready to end space arms race: US set to offer a freeze on tests of anti-satellite weapons*, THE GUARDIAN, Sep. 22, 1984.

Scholars[105] advocating that the development or deployment of anti-satellite weapons contravenes international law, argue that the arms race ended, and negotiations[106] began, in the 1980s. At such time, the space powers began to realize that such tests were in contravention of international law, and that anti-satellite weapons tests could produce thousands of pieces of space debris, making it much riskier to put either commercial or military satellites into low-Earth orbits.[107] For example, the Soviet representative to the United Nations Committee on the Peaceful Uses of Outer Space, unofficially acknowledged that the space debris problem affecting the "space environment must be dealt with immediately, rather than leaving it until late in the day as had happened with the Earth's environment."[108] Similarly, former U.S. Vice President Al Gore indicated that the problems of orbital debris and radioactive pollution from space-based nuclear reactors merit international concern.[109]

However, the previous argument can hardly stand, since environmental concerns have never been a major reason for the space powers to stop the arms race. In fact, the negotiations were started for "practical purposes" rather than fearing a contravention of international law as a result of environmental problems. The United States, for instance, stopped testing anti-satellite weapons in the 1980s when it experienced "technical problems" which "forced a delay in the testing of its anti-satellite weapons."[110] Moreover, it is also significant to note that while the space superpowers stopped testing anti-satellite weapons from 1985 to 2007, at the same time they were investing heavily in developing these weapons, as discussed above.

---

[105] *See, e.g*. Koplow, *supra* note 94.

[106] *See* Englehart, *supra* note 52, at 141.

[107] *See* David Tan, *supra* note 23, at 165; Scheetz, *supra* note 5, at 59.

[108] Press Release, U.N., Outer Space Committee Considers Agenda of Legal Sub-Committee (1986) OS/1259 3; H.A. Baker, *Liability for Damage Caused in Outer Space by Space Refuse*, 12 ANNALS cited in David Tan, *Towards a New Regime for the Protection of the Outer Space as "Province of All Mankind"*, 25 YALE J. INT'L L. 145, 153 (2000); AIR & SPACE L. 183 (l988).

[109] *See* Albert Gore, Jr., *Outer Space, the Global Environment, and International Law: Into the Next Century*, 57 TENN. L. REV. 329, 334 (1990).

[110] *Id.*

b. No State has expressed the view that developing and deploying anti-satellite weapons would contravene international law

As anti-satellite weapons remain one of the main aspirations that the space powers pursue in their space policies, no State has ever expressed the view that developing and deploying anti-satellite weapons would contravene international law.

Some scholars[111] point to China's 2007 anti-satellite weapon test,[112] and argue that since the international community responded negatively against the test, it could be considered that such weapons would contravene international law. Specifically, they argue that shortly after the test, China was criticized by the United States[113] and Japan.[114] The U.S. expressed its belief that China's development and testing of such weapons is inconsistent with the spirit of cooperation,[115] and labeled the event "regrettable," "very troubling,"[116] "destabilizing,"[117] as well as complained that it was "inconsistent with the spirit of cooperation that both countries aspire to in the civil space area."[118] Japan cast doubt over China by stating: "if

---

[111] *See, e.g.,* Koplow, *supra* note 94, at 1215-1264.

[112] On January 11, 2007, China shot down one of its satellites using a ground-based ballistic missile known as an anti-satellite weapon. *See* Tim Reid, *supra* note 101.

[113] *See, e.g.*, *U.S. Criticizes Chinese Anti-Satellite Weapons Test*, THE ASSOC. PRESS (2007).

[114] *See Chinese Foreign Ministry spokesman denies knowledge of anti-satellite weapons test*, THE ASSOC. PRESS, Jan. 20, 2007.

[115] Richard Spencer, *Chinese Missile Destroys Satellite in Space*, THE TELEGRAPH, Jan. 19, 2007, *available at* http://www.telegraph.co.uk/news/worldnews/1539948/Chinese-missile-destroys-satellite-in-space.html.

[116] Christina Rocca, Ambassador, U.S. Permanent Representative to the United Nations, Prevention of an Arms Race in Outer Space, Statement to the Conference on Disarmament (Feb. 13, 2007), http:// www.usmission.ch/Press2007/0213PAROS.html (last visited June 30, 2009) (expressing the U.S. government's view that China's 2007 ASAT test was "regrettable"); *see also* Marc Kaufman & Dafna Linzer, China Criticized for Anti-Satellite Missile Test, Wash. Post, Jan. 19, 2007, at A1 (quoting U.S. administration official saying: "It's unfortunate that China is going down this path .... This sort of thing is such a throwback to the Cold War.").Theresa Hitchens, *U.S.-Sino Relations in Space: From "War of Words" to Cold War in Space?* 5 CHINA SECURITY 12, 25 (Winter 2007). *See also* Koplow, *supra* note 94, at 1237.

[117] Wade Boese, *Chinese Satellite Destruction Stirs Debate*, ARMS CONTROL TODAY, Mar. 2007, at 27, 28. *See also* Koplow, *supra* note 94, at 1238.

[118] Space Security 2008, *supra* note 2, at 55 (quoting a U.S. official calling the Chinese test "inconsistent with the spirit of cooperation that both countries aspire to in the

we could call this a peaceful use" on the legitimacy of the test.[119] The European Union, United Kingdom, Australia, Canada, India, South Korea, and Taiwan also joined in protesting over the test.[120] Even China itself promised after the test that it will conduct no more anti-satellite tests,[121] and reiterated that it was against the militarization of space.[122]

The flaw of the above argument, again, is that these criticisms, harsh they might be, were made mainly out of political concerns rather than based on international legal beliefs. Above all, among these criticisms, no State has ever expressed the position that developing and deploying anti-satellite weapons contravene international law.[123] In contrast, several nations, Britain for instance, expressly declared that they do not believe China's test has contravened international law.[124] The U.S. reacted strongly against the Chinese test, but it did not label the test "illegal" or "inconsistent with" any particular legal obligations.[125] In fact, the U.S. position is contradictory. As delivered in the 2006 Space Policy,[126] the U.S. states that it "will oppose the development of new legal regimes or other restrictions that seek to prohibit or limit U.S. access to or use of space."[127]

---

civil space area"); *see also* Richard Weitz, *U.S. Allies Criticize China's Anti-Satellite Weapon Test; Media Notes Concerns About U.S. Space Policies*, 13 WMD INSIGHTS 2, 3 (2007) (quoting NASA spokesperson Jason Sharp as saying: "We believe China's development and testing of such weapons is inconsistent with the constructive relationship that our presidents have outlined, including on civil space cooperation").

[119] Chisaki Watanabe, *Allies protest China's Anti-Satellite Test as Militarization of Space*, THE ASSOCIATED PRESS, Jan. 19, 2007 (quoting Japanese Foreign Minister Taro Aso).

[120] *See* Koplow, *supra* note 94, at 1239.

[121] *See China has no plans for more anti-satellite test, Japan's former defense chief says*, THE ASSOCIATED PRESS, Feb. 12, 2007.

[122] Chisaki, *supra* note 119.

[123] *See* Koplow, *supra* note 94, at 1237 (stating that the international community "criticize each other's ASAT experiments [... as] unwise, unwelcome, adverse for international peace and security -- but not illegal.").

[124] *Id.* at 1240 (noting that "Tom Kelly, the spokesperson for Britain's Prime Minister Tony Blair, stated that: 'We are concerned about the impact of debris in space and we expressed that concern. We don't believe that this does contravene international law.'"); *See also* Chisaki, *supra* note 119.

[125] *See* Koplow, *supra* note 94, at 1238.

[126] See 2006 Space Policy, *supra* note 93.

[127] *Id.*

IV. A LONG WAY TO GO FOR THE FUTURE TOTAL-BAN TREATY

A. Some nations and scholars suggest that a new treaty governing the use of outer space should be signed based on the Antarctic Treaty model

As discussed above, military and civilian uses of outer space have overlapped from the outset, blurring the line between fortress and sanctuary.[128] Consequently, space has, arguably, already been militarized.[129] As the militarization of space intensifies, scholars and government officials have begun to evaluate the possibility of having the space powers sit down and negotiate a stricter treaty, banning the development and deployment of all anti-satellite weapons.[130] Specifically, Russia and China have pressed the international community for such a treaty,[131] and China's recent weapon test has been interpreted as an attempt to redefine the "rules of the game" to bring the United States to the negotiating table.[132]

The ideal model for the new treaty, favored by most nations[133] and scholars,[134] is the Antarctic Treaty. Taking the Ant-

---

[128] DETLEV WOLTER, COMMON SECURITY IN OUTER SPACE AND INTERNATIONAL LAW 31 (2006).

[129] *See* MICHAEL E. O'HANLON, NEITHER STAR WARS NOR SANCTUARY: CONSTRAINING THE MILITARY USES OF SPACE 8 (2004).

[130] *See* Gordon, *supra* note 95; Joseph Kahn, *China confirms anti-satellite test*, NEW YORK TIMES, Jan. 23, 2007, *available at* http://www.nytimes.com/2007/01/23/world/asia/23cnd-china.html (noting that "China's intentions in conducting this test may have been more diplomatic in nature, designed to pressure the United States to negotiate a treaty to ban weapons in space," and "Russia and China have pressed for the international treaty that would limit the use of space for military purposes.").

[131] Jacob M. Harper, *Technology, Politics, and the New Space Race: the Legality and Desirability of Bush's National Space Policy Under the Public and Customary International Laws of Space*, 8 CHI. J. INT'L L. 681, 682 (2008). *See* Scheetz, *supra* note 5, at 66; Tannenwald, *supra* note 4, at 377; Englehart, *supra* note 52, at 133.

[132] *See, e.g.,* Kahn, *supra* note 130 (reporting that "Xu Guangyu, a former Chinese army officer and an official at the government-run China Arms Control and Disarmament Association, said the anti-satellite test amounted to an attempt to redefine the 'rules of the game' and bring the United States to the negotiating table."); Harper, *supra* note 131, at 682.

[133] *See* Mikula, *supra* note 5 (noting that "Russia and China […] claim to desire complete demilitarization."); Zhang, *supra* note 42, at 435 (noting that "Eisenhower advocated that the basic tenants of the Antarctic Treaty should also apply to outer space."); Tannenwald, *supra* note 4, at 413.

arctic analogy[135] for outer space, supporters of this notion suggest that the new treaty should be made parallel to the Antarctic Treaty,[136] which has prevented the militarization of Antarctica by banning all military activities there,[137] as provided by Article I of the Antarctic Treaty:[138]

> Antarctica shall be used for peaceful purposes only. There shall be prohibited, inter alia, any measures of a military nature, such as the establishment of military bases and fortifications, the carrying out of military maneuvers, as well as the testing of any type of weapons.

Similar considerations suggest that outer space should be demilitarized like the Moon and other celestial bodies,[139] as provided by Article 3 of the Agreement on the Activities of States on the Moon and Other Celestial Bodies,[140] and that "peaceful purposes" mean no militarization of any sort:

> 1. The moon shall be used by all States Parties exclusively for peaceful purposes.
>
> 2. Any threat or use of force or any other hostile act or threat of hostile act on the moon is prohibited. . . .
>
> 3. States Parties shall not place in orbit around or other trajectory to or around the moon objects carrying nuclear weapons or any other kinds of weapons of mass destruction or place or use such weapons on or in the moon.

---

[134] *See generally* Zhang, *supra* note 42; Tan, *supra* note 23; Major Robert A. Ramey, *Armed Conflict on The Final Frontier: The Law of War in Space*, 48 A.F. L. REV. 1 (2000).

[135] *See* Tannenwald, *supra* note 4, at 373 (arguing that outer space, like Antarctica, is among the last unclaimed territories).

[136] *See* Quinn, *supra* note 53, at 483.

[137] See Tannenwald, *supra* note 4, at 374.

[138] Antarctic Treaty, Dec. 1, 1959, 12 U.S.T. 794, 402 U.N.T.S. 71; *see also* Tannenwald, *supra* note 4, at 413.

[139] *See* M.J. Peterson, *The Use of Analogies in Developing Outer Space Law*, 51 INT'L ORG. 245, 257-60 (1997).

[140] Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, *opened for signature* Dec. 18, 1979, 1363 U.N.T.S. 21 at arts. 3.1-3.3 [hereinafter Moon Treaty].

> 4. The establishment of military bases, installations and fortifications, the testing of any type of weapons and the conduct of military manoeuvres on the moon shall be forbidden. . . .

B. With the major powers of the world reluctant to sign, the possibility of the signature of a Total-ban Treaty is scarce

Amid suggestions for the adoption of a stricter treaty, this author is of the view that the possibility for a accepting a hardline treaty banning all anti-satellite weapons in the near future is scarce. The main obstacle, as many scholars[141] have pointed out, is the United States' uncompromising position[142] in which it refuses to talk, and instead seeks to preserve "freedom of action" in space.[143]

Another obstacle, albeit one less obvious, is that China and Russia are also reluctant to completely ban space weapons. This sentiment is reflected in the treaty proposal titled, "Treaty on Prevention of the Placement of Weapons in Outer Space and of the Threat or Use of Force against Outer Space Objects," submitted by the two nations to the Conference on Disarmament on 2008.[144] As pointed out by the United States, the draft has not banned the research, development, production or storage of anti-satellite weapons, nor has it banned the test

---

[141] *See* Zhang, *supra* note 42, at 428; Walsh, *supra* note 6, at 795; Park, *supra* note 76, at 899.

[142] *See* Scheetz, *supra* note 5, at 66 (noting that "the United States has […] a general unwillingness to agree to a weapons-free space environment."). *See generally* Englehart, *supra* note 52.

[143] *See* Kahn, *supra* note 130 (reporting that "President Bush authorized a new space policy that seeks to preserve 'freedom of action' in space, and he said that the United States reserves the right to use force against countries that seek to disrupt American satellites.").

[144] *See* Letter from the Permanent Representative of the Russian Federation and the Permanent Representative of China to the Conference on Disarmament (Feb. 12, 2008), Addressed to the Secretary-General of the Conference Transmitting the Russian and Chinese Texts of the Draft "Treaty on Prevention of the Placement of Weapons In Outer Space and of the Threat or Use of Force Against Outer Space Objects (PPWT)" Introduced By the Russian Federation and China, Conference on Disarmament, CD/1839 (2008); Letter from the Permanent Representative of China to the Conference on Disarmament (Feb. 12 2008), Addressed to the Secretary-General of the Conference Transmitting A Message from the Minister For Foreign Affairs of China to the Conference on Disarmament, Conference on Disarmament, CD/1836 (2008).

or development of ground-based anti-satellite weapons.[145] Therefore, "[s]ince the draft Treaty only bans the placement of weapons in space . . . a Party could build a breakout capability [of anti-satellite weapons]."[146]

The United States, while finding the Chinese-Russian submission "even more unacceptable" than their previous positions,[147] restated the view that it has consistently stated for nearly three decades: it is not possible to develop an effectively verifiable agreement for the banning of either space-based weapons or terrestrial-based anti-satellite systems.[148]

Therefore, with the major powers of the world all reluctant to fully ban the use of anti-satellite weapons, the probability of obtaining full international acceptance of a future total-ban treaty is slight.

V. CONCLUSION: IS THE PROLIFERATION OF SPACE WEAPONS INEVITABLE?

The current vacuum of binding international law on the development and deployment of anti-satellite weapons will likely continue to exist for a long time. International criticism, political as it may be, will serve as the most powerful force to keep the space powers restrained in their ambitions to develop such weapons, and in turn, slow down the process of anti-satellite weapons, just as the international community accomplished in 2007. Nevertheless, as technology develops, fears will arise that world peace will be greatly threatened if the "States of concern" acquire anti-satellite weapons in the future. If so, then perhaps the international community will finally call again for acquiescence to a total-ban treaty.

---

[145] *See* Letter from the Permanent Representative of the United States of America Addressed to the Secretary-General of the Conference (Aug. 19, 2008) Transmitting Comments on the Draft Treaty on Prevention of the Placement of Weapons In Outer Space and of the Threat or Use of Force Against Outer Space Objects (PPWT) As Contained In Document CD/1839 of 29 February 2008, Conference on Disarmament, CD/1847 (2008).

[146] *Id.* at para. 25.

[147] *Id.* at para. 23.

[148] *Id.* at para. 24.

INSURING HUMAN SPACE FLIGHT: AN UNDERWRITER'S DILEMMA

Paul Ordyna[*]

I. INTRODUCTION

In this last decade, a number of events have significantly altered the way the world perceives risk. Acts of terrorism, natural disasters, and economic turmoil have fundamentally altered public awareness of the inherent risks that permeate human activity. Nowhere has this awareness had such an impact as it has had in the insurance industry. Many of the greatest losses the industry has ever experienced have occurred in the past ten years, including the catastrophic losses sustained in the United States from the September 11, 2001, terrorist attacks. Losses sustained by insurers from these attacks alone amounted to more than one and a half times the next largest catastrophic loss in insurance history.[1] As a result, insurers and underwriters have become extremely sensitive to assessing risk and pricing insurance to adequately cover these risks.

Despite the heightened level of sensitivity among insurance underwriters, many industries still rely on insurance to manage risk, thus affording opportunity for growth.[2] Insurance acts as a risk-shifting device.[3] Essentially, risk is passed from a risk adverse party to a risk-neutral party for a fee.[4] The difficulty lies in fully understanding and assessing the risk. Although both parties present information concerning the risk, a level of un-

---

[*] Paul is a third year law student at the University of Mississippi. His education includes a B.S. in Accounting from Brigham Young University and M.S. in Accounting from the University of Mississippi. He has over five years experience in accounting and finance with industry leaders such as PricewaterhouseCoopers L.L.P and Comcast Cable Communications.

[1] R. Glenn Hubbard et al., *The Economic Effects of Federal Participation in Terrorism Risk,* 8(2) RISK MGMT. & INS. REV. 177 (2005).

[2] Damian Ward & Ralf Zurbruegg, *Does Insurance Promote Economic Growth? Evidence from OECD Countries,* 67(4) J. RISK & INS. 489 (2000).

[3] KENNETH S. ABRAHAM, INSURANCE LAW AND REGULATION 3 (4th ed. 2005).

[4] *Id.*

certainty remains in every insurance contract.[5] Surprisingly, one would think that a phrase like "Anything is possible," should scare insurers, but in actuality, a limited amount of uncertainty provides an opportunity to increase profits. These limits derive from the fact that insurance companies are not risk-neutral.[6] Like most businesses, insurers act in an environment full of risks, where cost and information constraints limit the amount of exposure an insurer can take. These constraints influence insurers in situations where imperfect or no information exists, or where it costs too much to ascertain and manage the risk.[7] Logically, insurers will not insure a risk of loss that may be immeasurable. Put more simply, insurers will not insure a risk of loss that does not result in a profit. Importantly, commercial human space flight is one industry that must rely on insurance to grow. However, cost and informational constraints inhibit the industry from taking full advantage of insurance benefits.[8] This paper will address insurability issues with respect to commercial human space flight, and provide recommendations to improve the likelihood of insurability from an underwriter's point of view.

II. THE PROSPECTS OF MORAL HAZARD, ADVERSE SELECTION, AND THE CATASTROPHIC LOSS

The principle question that an underwriter wishes to answer with respect to commercial human space flight is, whether flights can be insurable where the insurer can still create a profit? Generally, insurers will try to avoid three adverse prospects when insuring commercial human space flight in order to create a profit. They are moral hazard, adverse selection, and catastrophic loss. First, insurers wish to avoid moral hazard. Moral hazard refers to an insured party's propensity to act with

---

[5] *Id*. at 6.
[6] *Id*. at 3.
[7] *Id*. at 4.
[8] *See generally* John R. Olds et al., *Space Tourism: Making it Work for Fun and Profit*, *in* 51ST INTERNATIONAL ASTRONAUTICAL CONGRESS (Rio de Janeiro, Brazil, Oct. 2-6, 2000), http://smartech.gatech.edu/dspace/bitstream/1853/8405/1/IAA-00-IAA.1.3.05.pdf.

less care to avoid an insured loss than would be exercised if the loss were not insured.[9] Moral hazard also includes taking additional risks after acquiring insurance with the underlying belief that the insurance will cover the loss.[10] Moral hazard could be a significant issue in the commercial human space flight industry because of misinformation. As operators apply for insurance, insurance underwriters will require the operator to disclose information that materially influences the risk of loss. Often developing industries, like commercial human space flight, may not fully understand the factors that materially influence the risk of loss because those factors may be unknown or unclear. Operators may provide their "best guesses" or partial explanations to an underwriter, but ultimately the underwriter is still misinformed. After the operator acquires insurance, the operator may learn through experience that the information previously conveyed to the underwriter understates the risk. If the operator continues to offer space flights without notifying the underwriter about this new information, then moral hazard has occurred. Meaning, the operator may act with less care knowing that the insurer will still cover a loss if it should occur. This propensity may be particularly strong in the commercial human space flight industry because insurance is a significant cost in conducting the activity.[11] Moreover, an operator may believe that an admission of any adverse information could tip the scale to a higher premium, or worse, uninsurability.

Underwriters may combat moral hazard in a number of ways. Typically, with an unfamiliar industry, such as commercial human space flight, underwriters may look to an operator's propensity and approach towards risk-taking in other activities.[12] If an underwriter determines that an operator has had a

---

[9] ABRAHAM, *supra* note 3, at 7.

[10] Sumon C. Mazumdar, *Regulatory Monitoring, Closure Costs and Bank Moral Hazard Behavior*, 12 J. REG. ECON. 267, 270 (1997).

[11] Pierre Miquet, *Private Manned Access to Space: Space Insurance Questions, but also a Broader View on Insurance Matters,* in PROCEEDINGS OF THE IAA 1ST SYMPOSIUM ON PRIVATE HUMAN ACCESS TO SPACE CD-ROM (May 30, 2008) (on file with author). Insurance cost for space projects amount to 10-15% of the whole project.

[12] Jaap H. Abbring et al., *Moral Hazard and Dynamic Insurance Data*, 1(4) J. EUR. ECON. ASS'N. 767, 770 (2003).

previous problem with moral hazard that may indicate a similar incident in the future. Arguably, some people see human space flight as a tourist activity reserved for risk-taking adventurers.[13] While this may raise a red flag to an underwriter, stereotypes have little influence if the operator has avoided moral hazard and managed risk well in the past.

Second, insurers try to limit adverse selection as a part of underwriting. Naturally, a party having a higher risk of loss is more likely to obtain insurance coverage than a party with a lower risk of loss. The party with the higher risk may have a greater incentive to misinform an insurer to obtain insurance, thus resulting in adverse selection.[14] In commercial human space flight, adverse selection could occur when an operator either knows or suspects information that will influence an underwriter's risk assessment of the operator's activity. The operator could subsequently withhold, underestimate, or even lie about that information, to either obtain insurance, or to obtain insurance at a lower cost. Moreover, operators still have many questions that remain unanswered with regard to the operational risk involved in commercial human space flight. Operators hold a unique position as the principle provider of risk information for commercial human space flight. Even though information provided by a single source raises questions of quality and may be difficult to verify, underwriters receive the best available information to assess risk from operators. More importantly, operators are willing to work with insurers by taking steps to become more informed and to minimize risks.[15]

However, underwriters must reasonably address adverse selection to make an accurate risk assessment. Invariably, the answers to the questions surrounding risk change with each

---

[13] Dominic DePasqulae, et al., *The Emerging Orbital Space Tourism Industry: New Insight into Demand an Prospects for Success*, American Institute of Aeronautics and Astronautics (Sept. 2006), *available at* http://www.sei.aero/eng/papers/uploads/archive/AIAA-2006-7478.pdf (last visited Feb. 11th, 2009).

[14] ABRAHAM, *supra* note 3, at 6.

[15] Denis Bensoussan - Hiscox, *Space Tourism Risks: An Insurance Perspective* (paper presented at the IAA 1st Symposium on Private Human Access to Space, Arcachon, France, May 30, 2008) (highlighting a risk management strategy that operators will have to explain to the underwriter what they are doing to justify their technical choices) (on file with author).

new development and test flight. Operators can help underwriters prevent adverse selection by sharing information on the associated risks and developing methods to address these risks.[16] For example, the National Aeronautics and Space Administration (NASA), along with the Commercial Spaceflight Federation and the Universities Space Research Association have created the Commercial Suborbital Research Program.[17] This program was designed to provide valuable research on ways to reduce risk in commercial human spaceflight.[18] Thus, a concerted effort to understand information concerning safety, regulation, informed consent, vehicle design and delivery, consumer demand, as well as other factors, will help operators and underwriters address adverse selection appropriately.

Finally, the insurer will try to avoid a catastrophic loss. A catastrophic loss has the potential to force the insurer into a situation where the insurer is unable to pay all claims levied against it, thus forcing the insurer out of business.[19] Scenarios that could make an insurer insolvent include, substantial loss of life and limb, extensive property damage, immeasurable third-party liability, and other domestic and international tort liability. Significantly, the risk for catastrophic loss is pervasive throughout commercial human space flight activities. For example, one could conceive a collision of a space flight with an orbiting space hotel, or a launch explosion taking the lives of the crew, space flight participants, and innocent third parties, as catastrophic events.[20] Conceivably, insurers could lose billions

---

[16] Press Release, X Prize, Space Entrepreneurs Resolve to Create Industry Group to Promote Safety Standards and growth of the Personal Spaceflight Industry (Feb. 8, 2005) http://www.xprize.org/foundation/press-release/space-entrepreneurs-resolve-to-create-industry-group-to-promote-safety-stan (cited as an example of commercial human space flight operators working together to develop safety systems).

[17] Commercial Suborbital Research Program, *Commercial Suborbital Research Program: Overview*, http://sites.google.com/site/commercialsuborbitalflight (last visited Jan. 16, 2010).

[18] *Id.*

[19] Dwight M. Jaffee & Thomas Russell, *Catastrophe Insurance, Capital Markets, and Uninsurable Risks*, 64(2) J. RISK & INS. 205, 208 (1997).

[20] Micheal C. Mineiro, *Assessing the Risks: Tort Liability and Risk Management in the Event of a Commercial Human Space Flight Vehicle Accident*, 74 J. AIR L. & COM 371, 391 (2009) (citing the destruction of a space hotel as a potential catastrophic loss).

of dollars as the result of a single incident, especially where many lives are lost and property damage is extensive.[21]

Traditionally, underwriters have dealt with moral hazard, adverse selection, and catastrophic losses by 'risk-pooling' and relying on the law of numbers.[22] 'Risk pooling' involves combing individuals with similar characteristics into a single pool, whose individual insurance costs are combined and then divided to calculate premiums.[23] Essentially, pooling risks together allows the costs of risky to be subsidized by the less risky.[24] Even though the individuals in a pool seem to carry the same risk because of supposedly similar characteristics, actual conduct reveals that some individuals may be more risky, or less risky, than others in the pool. Where risks are uncorrelated and independent insurers can pool and allocate these risks, thus making the sum of the individual risks less risky as a whole.[25] Consider car insurance, some car operators provide perfect and truthful information to their insurers, others do not. The underwriter evaluates this information then organizes each insurance contract into pools by various degrees of risk. Although some contracts in a pool may not belong to that pool because they are actually more or less risky, the other contracts balance out the difference. Thus, the insurer has a greater ability to cover losses from the riskiest car operators and a greater ability to predict losses in larger pools. Unlike automobiles, only a handful of commercial human space flight vehicles and operators exist. Apart from the handful of operators scattered around the world, only 20 commercial space launch licenses are currently active and issued by the U.S. Office of Space Transportation (FAA/AST).[26] Additionally, each commercial human space flight

---

[21] *Id.*

[22] ABRAHAM, *supra* note 3, at 3.

[23] Cori Uccello & David Shea Jr., *Wading Through Risk Pools: Practical implications for Health Insurance* (Captiol Hill briefing, Washington D.C., United States of America, May 20, 2008) *available at* http://www.actuary.org/briefings/pool08.asp (last visited Mar. 9, 2009).

[24] *Id.* at 2.

[25] ABRAHAM, *supra* note 3, at 4.

[26] Federal Aviation Administration, Commercial Space Data - Active Licenses, http://www.faa.gov/about/office_org/headquarters_offices/ast/launch_data/current_licenses/ (last visited Jan. 16, 2010).

vehicle possesses unique characteristics that make analogous comparison impossible, and pooling and the use of the law of numbers ineffective.

Consequently, insurers have used other techniques to mitigate the effects of moral hazard and adverse selection. For instance, limiting warranties and voiding policies due to misrepresentations are used as defenses in both property and life insurance claims.[27] Typically, their effectiveness comes to light in insurance litigation.[28] While, their effectiveness with respect to insuring commercial human space flight is yet unknown, at this point, only one fatal accident has occurred in the commercial human space flight industry with the potential to merit litigation. In 2007, three Scaled Composites employees were killed while testing a rocket engine.[29] According to the FAA, this accident was not a launch related accident, but an industrial accident.[30] As such, no issue with respect to insuring the space flight was raised. Only when space flight insurability becomes an issue in litigation will warranty and misrepresentation defenses enlighten underwriters as to their effectiveness in mitigating risks that involve imperfect information.

III. GOVERNMENTAL EFFORTS

Despite the difficulties of dealing with uncertainty and misinformation in the commercial human space flight industry, many governments have taken steps to improve the likeliness of obtaining lower cost insurance. The most notable being the principles established in the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and other Celestial Bodies (Outer Space Treaty). Now ratified by 98 countries, and signed by 27 others, the Outer Space Treaty outlines the responsibilities of State

---

[27] ABRAHAM, *supra* note 3, at 7.

[28] *Id.*

[29] Leonard David, *Explosion Kills Three at Mojave Air and Space Port*, SPACE NEWS, Aug. 9, 2007, http://www.space.com/news/070727_scaled_explosion_update.html.

[30] Brian Berger, *FAA Defers to State Authority in Mojave Mishap Inquiry*, SPACE NEWS, Aug. 14, 2007, http://www.spacenews.com/archive/archive07/scaledfolo_0806.html.

Parties for their outer space activities.[31] While the Outer Space Treaty does not directly address insurance issues, the treaty does establish a liability regime for governmental and non-governmental parties associated with a particular State. As such, the Outer Space Treaty requires that States regularly regulate and monitor all space activities under their jurisdiction to avoid international liability.

Thus, the Outer Space Treaty is the foundation for existing national laws that address the licensure and safety of commercial human space flight. For example, in the United Kingdom, the 1986 Outer Space Act establishes standards for licensing and safety.[32] Sweden, Norway, and Belgium also have laws that govern certain space activities.[33] In 2004, the United States enacted the Commercial Space Launch Amendments Act (hereinafter 2004 Launch Act).[34] Unlike the space laws in other countries, the U.S. legislation provides operators the most advantageous environment to foster commercial human space flight. In general, the 2004 Launch Act aims to protect the commercial human space flight operator as well as the public.[35] It grants authority to the Federal Aviation Administration (FAA) to issue licenses and experimental permits to commercial human space flight operators.[36] Through its Office of Commercial Space Transportation (AST), the FAA fosters progress in commercial human space flight by facilitating the expansion of space trans-

---

[31] Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, *opened for signature* Jan. 27, 1967, 18 U.S.T. 2410, 610 U.N.T.S. 205 [hereinafter Outer Space Treaty].

[32] Axelle Cartier & Christopher Stott, *The UK Outer Space Act (1986) and its Application to the Potential Licensing of Commercial Manned Spaceflight,* (paper presented at 1st IAA Symposium on Private Human Access to Space, Archachon, France, May 30, 2008) (on file with author).

[33] Julie Abou Yehia & Kai-Uwe Schrogl, *European Regulation for Private Human Spaceflight in the Context of Space Traffic Management,* European Space Policy Institute, (paper presented at 1st IAA Symposium on Private Human Access to Space, Arcachon, France, May 30, 2008) (on file with author).

[34] Commercial Space Launch Amendments Act, H.R. 5382, Pub. L. No. 108-489, 108th Cong. (2d Sess. 2004) (hereinafter 2004 Space Act).

[35] Timothy R. Hughes & Esta Rosenberg, *Space Travel Law (and Politics): The evolution of the Commercial Space Launch Amendments Act of 2004*, 31 J. SPACE L. 1, 35 (2005).

[36] *Id*. at 43.

portation infrastructure.[37] The AST issues FAA licenses, tracks space launch data, and works with industry to develop safety programs.

Aside from the regulatory benefits provided by the FAA, the 2004 Space Act also contains a unique indemnification provision that substantially influences insurance underwriting.[38] According to the legislation, operators that obtain a license and operate in the United States must demonstrate financial responsibility by obtaining a specified amount of liability insurance.[39] Analogous to underwriting, the FAA performs a maximum probable loss (MPL) risk analysis.[40] Based on that risk analysis, the operator must obtain insurance for the lower of the computed MPL or $500 million.[41] The United States government will then indemnify the operator for liability losses in excess of the required amount up to $2 billion.[42] Liability in excess of $2 billion must be borne by the operator.[43] Unfortunately, this indemnification regime only applies to operator loss and third party claims, not to space flight participants.[44] By participating in commercial human space flight, space flight participants will be assuming their own risk and will have to sign personal liability waivers after receiving written disclosure and giving informed consent.[45] Essentially, space flight participants will have to obtain individual insurance if they wish to insure their flight. Unfortunately, individual insurance may be difficult to obtain and may be very expensive for the space flight participant. Considering that only a few hundred people have flown to space, eight-

---

[37] Federal Aviation Administration, About the Office, http://www.faa.gov/about/office_org/headquarters_offices/ast/about/ (last visited Jan. 16, 2010).

[38] Hughes & Rosenberg, *supra* note 35, at 56.

[39] *Id.*

[40] The MPL Calculation varies by launch vehicle type authorized to a launch site under FAA license at the FAA/AST. Federal Aviation Administration, Office of Commercial Space Transportation, http://www.faa.gov/about/office_org/headquarters_offices/ast/ (last visited Jan. 16, 2010).

[41] Hughes & Rosenberg, *supra* note 35, at 57.

[42] *Id.*

[43] *Id.*

[44] *Id.*

[45] Tracy Knutson, *What is "Informed Consent" for Space-Flight Participants in the Soon-to-launch Space Tourism Industry?*, 33 J. SPACE L. 105, 106 (2007).

een of which have lost their lives, the data and mortality rates do not support the insurability of space flight participants.[46]

Aside from the benefits of the indemnification regime, the MPL risk analysis could provide valuable information to an underwriter. Although an underwriter's methodology may vary greatly from that of the MPL analysis, the MPL analysis should give an underwriter a basic understanding of the risks involved in commercial human space flight. Also, since the FAA requires coverage for the lesser of the MPL analysis amount or $500 million, the MPL analysis could serve as a risk comparability tool among operators in the industry. More importantly, the MPL analysis highlights the FAA's focus on public safety by requiring riskier operators to obtain additional insurance coverage.[47] Some operators, however, have questioned the FAA's current safety focus claiming that the risk analysis focuses too much on the safety of the public versus the safety of the space flight participants.[48] Understandably, the FAA's focus on the safety of the public must support the current indemnification regime in the 2004 Launch Act. In contrast, other industry experts argue that the safety of space flight participants will influence the safety of the third party public.[49] The likelihood of an accident involving the death of a space flight participant directly effects damage to third parties due to the likelihood of collateral damage.[50] Unintentionally, operators may forget that the overall purpose of a government is to protect and promote the public health and safety of its citizens. The protection of a few at expense of the majority conflicts with this purpose.

IV. SAFETY REMAINS THE FOCUS

Notwithstanding these arguments, a focus on safety is paramount to an underwriter. An underwriter's focus on safety

---

[46] *Id.* at 115 (*citing* Jeffery F. Bell, *Rocket Plane Roulette,* SPACE DAILY, Mar. 7, 2007, http://www.spacedaily.com/reports/Rocket_Plane_Roulette_999.html (discussing the flight history of experimental rocket plans)).

[47] Hughes & Rosenberg, *supra* note 35, at 57.

[48] Melanie Walker, *Suborbital Tourism Flights: An Overview of Some Regulatory Issues at the Interface of Air and Space Law*, 33 J. SPACE L. 375, 379 (2007).

[49] *Id.*

[50] *Id.*

does not emphasize to whom the benefit will be given, but to what extent does the emphasis on safety cover the risk of loss. Even though the MPL analysis does address certain safety issues, it is unlikely that the analysis provides enough safety information for an underwriter to adequately ascertain the risk of loss. Logically, spacecraft operators will have to close the information gap. The challenge facing the industry concerns setting standards that each operator can achieve, but also satisfy an underwriter's need for adequate information. For instance, Scaled Composites LLC founder, Burt Rutan, suggested an alternative solution to this challenge that would create a hybrid arrangement between the commercial human space flight industry and the FAA.[51] Collectively, the commercial human space flight industry and the FAA could define and implement safety standards through self-governing policy and FAA regulation.

Currently, the commercial human space flight industry has established the Commercial Spaceflight Federation (CSF) to promote and pursue higher standards of safety within the industry.[52] However, previous self-policing industry standards have achieved mixed results. For example, the ISO 9000 management standards created by the International Organization for Standardization to address enhanced quality management.[53] Presently, the aerospace industry successfully uses AS9100 standards, a supplement to ISO 9000, to enhance quality in aerospace design and manufacturing.[54] Conversely, the American accounting profession has had difficulty maintaining independence standards between auditors and their clients. In 2001, the Enron scandal exposed the failings of the American Insti-

---

[51] Reason Foundation, Annual Privatization Report 2005 - Space Travel, http://reason.org/news/show/126612.html (last visited Jan. 16, 2010) (interview by Ted Balaker with Burt Rutan, Space Entrepreneuer, Scaled Composites).

[52] Press Release, Commercial Spaceflight Federation, Newly Renamed Commercial Spaceflight Federation Launches New Website (June 15, 2009), http://www. commercialspaceflight.org/pressreleases/CSF%20Press%20Release%2020New%20Name%20and %20Website%20-%20Jun%202009.pdf (prior to May 2009, the Commercial Spaceflight Federation was known as the Personal Spaceflight Federation).

[53] International Organization for Standardization, ISO 9000 and ISO 14000, http:// www.iso.org/iso/iso_catalogue/management_standards/iso_9000_iso_14000.htm (last visited Jan. 16, 2010).

[54] Katrina C. Arabe, *Aerospace Industry Readies for the AS9100*, THOMASNET NEWS, Oct. 5, 2001, http://news.thomasnet.com/IMT/archives/2001/10/aerospace_indus.html.

tute of Certified Public Accountants (AICPA) as a regulating industry authority.[55] As a result of the AICPA's inadequate efforts to address client-auditor relations, the Securities and Exchange Commission (SEC) stripped the AICPA of its self-standardized policing and auditing power.[56] Despite the mixed successes, the commercial human space flight industry can use the CSF to either police safety standards that exceed the FAA mandated level, or better yet, work with the FAA to improve safety standards. [57]

Moreover, the continued development of safety standards between governments and operators sends a positive signal to underwriters that operators are combating moral hazard. Because of the developing character of the industry, operators realize that safety functions as a vital part of each space flight. Accidents would be destructive to the industry by reducing consumer confidence and opening the door to potential liability.[58] Unfortunately, an over emphasis on safety may also be cost-prohibitive to many operators.[59] Like all businesses starting out, a time arrives when an operator needs to generate profits. However, the emphasis on the bottom line may give rise to actions that push safety aside, increasing the likelihood of moral hazard for the insurer. Notwithstanding, opportunities exist where operators can more effectively utilize working capital without sacrificing safety.

Principally, operators can focus on safety development in areas of high risk through the use of simple control procedures. Operators that focus on immediate considerations such as reliability of reusable launch vehicles, the training and skill of flight and ground crews, and the adequacy of launch and landing sites, should address the majority of risk in the space flight activity.[60]

---

[55] Sue Ravenscroft & Paul F. Williams, *Rules, Rogues and Risk Assessors: Academic Responses to Enron and Other Accounting Scandals,* 14-2 EUR. ACCT. REV. 363, 364 (2005).

[56] *Id.* at 369.

[57] Walker, *supra* note 48, at 401.

[58] *Id.*

[59] *Id*. at 402.

[60] Richard W. Scott, *Policy/Legal Framework for Space Tourism Regulation*, 28(1) J. SPACE L. 1, 7 (2000).

An example of a cost effective approach using simple control procedures in particular areas is financial auditing. Part of an auditor's responsibilities include understanding and providing an opinion on the risk of material misstatement in a company's internal control.[61] According to the Public Company Accounting Oversight Board (PCAOB), internal controls "must be in place to see that records accurately and fairly reflect transactions" of the company.[62] When a weakness in internal control exists the risk for material misstatement increases.[63] However, material misstatement can be hidden in one the of millions of transactions a company processes each year. Consequently, in order to manage auditing costs, the PCAOB recommends that auditors focus risk assessment on internal controls that have the greatest impact on material misstatement, as well as accounts where material misstatements are more likely to occur.[64] Using a risk based approach, an auditor can address the majority of risk by testing only a few areas of internal control.

Applying this example to commercial human space flight, an area of very high risk is likely the launch and landing of the vehicle. Here, the commercial human space flight industry can take a lesson from the airline industry. For instance, after the 9/11 attacks, underwriters became more aware of the risks in aviation.[65] As premiums increased, the airline industry appreciated the importance of identifying and remedying risky areas to control aviation insurance costs.[66] Furthermore, empirical evidence shows that of the total number of commercial jet accidents, 57% occurred during take-off and landing. Specifically,

---

[61] PCAOB *Briefing Paper*, *Board Considers Adopting Standard for Audits of Internal Control Over Financial Reporting* (Mar. 9, 2004) http://www.pcaobus.org/rules/docket_008/2004-03-09_briefing_paper.pdf.

[62] *Id.* at 2.

[63] Public Company Accounting Oversight Board, Auditing Standard No. 5, 401 ¶ 11, *available at* http://www.pcaobus.org/Rules/Rules_of_the_Board/Auditing_Standard_5.pdf (last visited Jan. 16, 2010).

[64] *Id.*

[65] Yi-Hsin Lin et al., *Determinants of Aviation Insurance and Risk Management Strategy*, *in* PROCEEDINGS OF THE 13TH ASIA PACIFIC MANAGEMENT CONFERENCE 1289 (Melbourne, Australia, 2007) (citing a 2003 Boeing study of commercial jet aircraft accidents) *available at* http://www.infotech.monash.edu.au/research/centres/cdsesr/apmc/papers-pdf/t127.pdf .

[66] *Id.*

12% of commercial accidents occurred at takeoff, and 45% occurred at landing.[67] As a result, the trend has shifted in assessing aviation insurance from the total volume of passenger miles flown as an insurance basis, to the number of passengers flown and the number of departures.[68] Thus, recent developments in aviation insurance have encouraged airlines to address the majority of risk by focusing on take-offs and landings in an effort to improve safety. Appropriately, in 2008 the airline industry had one of the safest years on record.[69]

Likewise, the commercial human space flight industry may also reduce risk of loss by focusing on the launch and the landing of the space vehicle. Not only do the launch and landing present a significant risk to the public, but also could present substantial stress to the vehicle itself.[70] This is such a significant concern that the FAA issued a guide to operators that focuses on the reliability of reusable launch and reentry vehicles.[71] In addition, the FAA report to the U.S. Congress on the analysis of human space flight safety, suggests that lessons can be learned from the *Challenge*r launch and *Columbia* reentry to avoid future public safety hazards in commercial human space flight.[72]

V. REDUCING THE COST OF INSURANCE: AN OPERATOR'S EFFORT

As part of focusing on areas of risk, operators should realize that an underwriter's assessment of risk would likely involve an expected value analysis to compute a premium. Generally, an

---

[67] *Id.* at 1292.

[68] *Id.*

[69] Press Release, ASCEND, Passenger safer in the skies as airline fatalities drop 25 per cent in 2008 (Jan. 7, 2009) http://www.ascendworldwide.com/story.aspx?story=299.

[70] Tommaso Sgobba, *An International Civil Aviation Organization for Outer Space, in* SECURITY IN SPACE: THE NEXT GENERATION-CONFERENCE REPORT 110 (United Nations Institute for Disarmament Research (UNIDIR), Mar. 31 - Apr.1, 2008) *available at* http://www.unidir.org/pdf/articles/pdf-art2819.pdf.

[71] Federal Aviation Administration, *Guide to Reusable Launch and Reentry Vehicle Reliability Analysis* (April 2005), *available at* http://www.faa.gov/about/office_org/headquarters_offices/ast/licenses_permits/media/FAA_AST_Guide_to_Reliability_Analysis_v1.pdf.

[72] The Aerospace Corporation, *Analysis of Human Space Flight Safety – Report to Congress* (Nov. 11, 2008), *available at* http://www.faa.gov/about/office_org/headquarters_offices/ast/media/Human%20Spaceflight%20Safety%20Report_11Nov08.pdf.

underwriter will convert the likelihood of an accident occurring, at some point in the space flight, into a percentage. The underwriter will also assess the amount of property damage from that event. The likelihood that something may occur, and the amount of loss, are computed to arrive at an expected value.[73] For example, let's assume that an underwriter assesses that there is a 10% likelihood that a $100,000 loss could happen at a particular point in the space flight. Also, assume that at another point in the space flight a 1% chance of a $1,000,000 loss could occur. An operator may think to focus safety procedures on the greater loss, but to an underwriter the expected value (.01 X $1,000,000 = $10,000 = .1 X $100,000) of each event is the same. Therefore, an insurer would likely assess a similar premium for both events. Thus, a simple expected value analysis of different phases of the launch can help operators understand where to focus their safety efforts. As operators address risks at areas of higher expected value, costs of insurance will decrease.

An operator may also strategically locate a spaceport to reduce insurance costs. For example, while constructing a spaceport closer to sea level may provide access to a greater number of people, a spaceport located at higher altitude may be less risky and save on fuel costs to enter and return from a suborbital trajectory.[74] On the other hand, a launch from high altitude may be riskier because of cooler temperatures and the presence of other physical elements, such as snow or ice. Another influential factor for underwriters would be a decision to locate a spaceport near a highly populated area versus a more rural location.[75] Logically, the risk of loss to third parties should be less in a rural setting compared to that of an urban setting.

In addition, another important consideration relating to third party loss would be the use of a range safety officer in commercial human space flight. Traditionally, range safety procedures concentrate on protecting the public throughout the

---

[73] ABRAHAM, *supra* note 3, at 3.
[74] Scott, *supra* note 60, at 8.
[75] *Id.*

launch and flight.[76] Part of these procedures involves the range safety officer's ability to terminate a vehicle during launch or flight if it poses a serious risk to the public.[77] Currently, range safety procedures do not differentiate between manned and unmanned flights.[78] For example, a range safety officer monitors each flight of NASA's *Space Shuttles*.[79] In fact, after the explosion of *Challenger* in 1986, a range safety officer detonated the solid rocket motors as they veered towards land.[80] The officer determined that the motors posed a serious threat to the general public.[81] Obviously, underwriters will pay close attention to an operator's emphasis on range safety. The part a range safety officer plays in the overall range safety strategy remains to be seen. The ability to detonate the insured's property adds a new dimension to underwriting commercial human space flight.

Furthermore, the design of the space vehicle, and method of delivery, are also significant factors in risk analysis for insurability.[82] Typically, rockets contain explosive propellants that can cause extensive and deadly damage. Alternatively, some vehicles are launched from airplanes as opposed to being launched from the ground.[83] Notably, the risk of loss varies with an air launch versus a ground launch. Although making comparisons among vehicle design, vehicle delivery, and range safety can be difficult, an expected value analysis can translate risks into comparable monetary amounts. This tool allows the operator to weigh the benefits and detriments of a particular

---

[76] National Aeronautics and Space Administration, NASA Range Safety Program - Overview, *available at* http://kscsma.ksc.nasa.gov/Range_Safety/Overview.htm (last visited October 19, 2009).

[77] National Aeronautics and Space Administration, NASA Range Safety Glossary of Terms, Range Safety Officer (RSO), http://kscsma.ksc.nasa.gov/Range_Safety/Definitions_6.htm (last visited Jan. 16, 2010).

[78] *Analysis of Human Space Flight Safety – Report to Congress*, *supra* note 72, at 19.

[79] National Aeronautics and Space Administration, Report of the Presidential Commission on the Space Shuttle Challenger Accident, 184 (commonly called the Rogers Commission Report) June 1986 and Implementations of Recommendations, June 1987, *available at* http://history.nasa.gov/rogersrep/v1ch9.htm (last visited Oct. 21, 2009).

[80] *Id.* at 185.

[81] *Id.*

[82] Lloyd's, *Lloyd's insurers look to the challenge of aviation's final frontier*, LLOYD'S, Dec. 27, 2007, http://www.lloyds.com/News_Centre/Features_from_Lloyds/Lloyds_insurers_look_to_the_challenge_of_aviations_final_frontier_27122007.htm.

[83] *Id.*

operational strategy and make changes where necessary to improve safety and perhaps profitability.

VI. UNDERWRITER CONCERNS

Despite the many methods an operator can apply to improve the insurability of space flight, there is an overriding concern that troubles the underwriter: imperfect information continues to inhibit the industry from literally getting off the ground. Consider the question of whether consumer demand will be sufficiently consistent to support commercial human space flight? Business risk and going concern questions still plague the commercial human space flight industry.[84] These questions relate to operators actively engaging in business with the expectation of indefinite continuance.[85] Operators, however, maintain that consumer demand will be strong enough to support the continued activity of commercial human space flight.[86] Others have offered evidence to the contrary. One study, conducted by the Futron Corporation, targeted 450 households with a net worth of $1 million or a household income of $250,000.[87] The Futron Study considered these respondents to be the potential customers of the commercial human space flight industry. The respondents were informed of the benefits and detriments of human space flight, and then were questioned regarding their level of interest in the activity.[88] Only 20% of the respondents showed interest in commercial human space flight after being informed about the dangers, and only 16% indicated they would be willing to pay $250,000 for a space flight.[89] This information not only suggests that income and informed consent may be barriers for some consumers, but it may also suggest a weakness in demand.

---

[84] Roger D. Launius & Dennis R. Jenkins, *Is it Finally Time For Space Tourism?*, 4 ASTROPOLITICS 253, 254 (2006).

[85] BLACK'S LAW DICTIONARY (8th ed. 2004).

[86] DePasqulae et al., *supra* note 13, at 3.

[87] Futron, *Space Tourism Market Study* (Oct. 2002), *available at* http://www.futron.com/pdf/resource_center/white_papers/SpaceTourismMarketStudy.pdf.

[88] *Id.* at 48.

[89] *Id.*

Aside from consumer demand, the absence of historical and comparable information remains a weighty concern for underwriters. In an attempt to improve the quantity and quality of information, industry leaders have promised to work to inform insurers.[90] This could include relaying information obtained from trials and testing. However, the inability to ascertain every loss scenario in the real world through testing makes trial data preliminary at best. Only through actual operating experience will the underwriter become informed enough to make an accurate assessment.

A more recent concern for both the underwriter and the insurer has developed in the past year. Accessibility to capital financing has influenced the risk portfolios of insurers, banks, and businesses. Exacerbated by the worthlessness of mortgage-backed securities, the world capital markets are functioning in extreme volatility and uncertainty.[91] As a result, banks and insurers continue to tighten cash flow until a solution is presented that removes these abnormally risky securities, or until the markets stabilize.[92] Essentially, banks and insurers feel that extending or insuring credit is currently too risky. This severely affects the commercial human space flight industry, because commercial human space flight is inherently risky. Additionally, insurers have shown a disinterest in adding risk to their risk laden portfolios. Therefore, operators will either have to pay more for insurance or be uninsurable.

Notwithstanding the current world economic environment, the commercial space flight industry has received help to weather this tough financial environment. Recently, NASA announced plans to invest $50 million in orbital commercial hu-

---

[90] Press Release, Commercial Spaceflight Federation Press Release, *Personal Spaceflight Federation Announces* Future Plans (August 26, 2006) *available at* http://www.commercialspaceflight.org/press_releases.shtml (last visited Oct. 21, 2009).

[91] Serena Ng & Liam Pleven, *An AIG Unit's Quest to Juice Profit – Securities – Lending Business Made Risky Bets; They Backfired on Insurer*, WALL ST. J., Feb. 5, 2009, at C1.

[92] Peter Porrino & Robert Stein, *Ernst & Young on Reflections on Current Market Conditions for the Insurance Industry*, 2008 EMERGING ISSUES 3108 (Dec. 2, 2008).

man space flight.[93] NASA believes that investing in commercial human space flight will "foster entrepreneurial activity leading to job growth" and "reduce the gap in U.S. human space flight capability."[94] This investment not only shows NASA support for commercial human space flight, but the possibility that the commercial human space flight industry will provide cargo and crew for the international space station.[95] Additionally, SpaceX recently acquired a maximum investment of $60 million from Draper Fisher Jovelson Venture Capitalists.[96] Such investments demonstrate that the industry may be financially less risky than the current economic environment indicates. In the meantime, operators should continue to conduct test flights and develop safety procedures to reduce the risk of an accident.

Information obtained from these developments help underwriters to classify the type of insurance that is appropriate for the operator. The arguments vary among underwriters as to the type of insurance best suited for commercial human space flight. Some insurers refer to the structure of the space vehicle and argue that aviation insurers should insure the industry, while others argue that space insurers are better suited to insure the activity.[97] However, simply deciding whether the vehicle is like an airplane, or more like a rocket, does not automatically categorize which insurers should insure the activity. Methods of delivery, the payload, and other technical criteria will determine who will insure the commercial human space flight. Undoubtedly, both aviation and space insurers will demand a focus on safety to deter liability.[98] The underwriter will likely look to an operator's process management to see how the operator has built safety and emergency contingencies into the system. In

---

[93] John Gedmark, *NASA Announces Plan to invest in Commercial Crew Concepts*, COMMERCIAL SPACEFLIGHT FEDERATION NEWS (Aug. 4, 2009), http://www.commercialspaceflight.org/?p=458.

[94] *Id.*

[95] John Gedmark, *Growing Investment Moves Industry Forward, Enables New Scientific Capabilities*, COMMERCIAL SPACEFLIGHT FEDERATION NEWS (Aug. 7, 2009) *available at* http://www.commercialspaceflight.org/?p=468.

[96] *Id.*

[97] Bensoussan – Hiscox, *supra* note 15, at 4.

[98] Lloyd's, *supra* note 82 (highlighting that principle concern for underwriters will likely be avoidance of personal accident liability as an example).

addition, underwriters look to the experience and training of ground and flight personnel, including the operator's plan for continued training.[99]

Moreover, an emphasis on redundancy and backup systems in high-risk areas is very important. The operator's plans for the aging and frequency of use of the spacecraft will factor into the risk assessment.[100] Flight environmental control procedures, including the role of the space flight participant, inform the underwriter what will happen during flight. Emergency systems explain the capability of the operator to handle potential accidents that could occur during flight. These emergency systems could be as basic as handing out parachutes, or as complex as utilizing an ejection capsule.[101]

In addition, sound process management decreases the likelihood of an accident and potential liability. Although process management helps an underwriter gain an understanding of certain risks, other risks are still unknown. For example, what happens if an accident occurs resulting in a space flight participant fatality? Will the waiver of liability based on the law of informed consent be an adequate defense?[102] Successful informed consent defenses rely on a standard of care that includes a premise that the individual is adequately informed of the material risks.[103] Insurers and operators can only hope that they have informed the space flight participants adequately to allow them to understand the inherent risks and make a reasonable prudent decision.[104] Even though some inherent risks may be unknown, or difficult to define, the standard of care depends on whether the space flight participant can make an informed decision from the information provided.[105] The strength of informed consent policies and disclosures is an important consideration in any risk assessment. Process management and informed consent are only a couple of the risks that the underwriter will con-

---

[99] *Analysis of Human Space Flight Safety – Report to Congress*, *supra* note 72, at 5.
[100] *Id.* at 62.
[101] Bensoussan – Hiscox, *supra* note 15, at 7.
[102] Knutson, *supra* note 45, at 106.
[103] *Id.* at 111.
[104] *Id.* at 118.
[105] *Id.* at 119.

sider. Other material risks worth consideration include risks of terrorism; business and market stability; and the soundness of political climates. Carefully identifying and addressing many of these risks allows the underwriter to form a better risk assessment of commercial human space flight.

VII. CONCLUSION

In conclusion, the dilemma an underwriter faces with respect to insuring commercial human space flight lies in the quantity of imperfect information and uncertainty. The industry is so new that insurers and underwriters know little about the potential risks and liabilities associated with the activity. Underwriters can rely on experience and make comparisons to other industries, but ultimately they have to rely on information provided by the operator. A one-sided source of information places the insurer at an extreme disadvantage when contracting for coverage. As such, the prospects for moral hazard and adverse selection abound in insuring the commercial human space flight industry. Due to the overwhelming informational constraints, the current state of the financial industry and inherent riskiness of space travel, the initial commercial human space flights will likely carry high insurance costs until insurers can obtain sufficient information to accurately assess an acceptable risk. In the meantime, operators, governments, and insurers should continue to develop safety standards, processes, and relationships to assure the success of the industry.

USE OF OUTER SPACE FOR PEACEFUL PURPOSES: NON-MILITARIZATION, NON-AGGRESSION AND PREVENTION OF WEAPONIZATION

Jinyuan Su[*]

I. INTRODUCTION

The "use [of outer space] for peaceful purposes" is one of the guiding principles for the global commons, which includes Antarctica, outer space, and the high seas. However, this principle is currently being challenged or even derogated in one way or another. This is particularly true in the context of outer space, which since the inception of human exploration has been one of the major issues for political contention. States, while agreeing to use outer space for peaceful purposes in principle, interpret its use in divergent manners, particularly with regard to non-militarization and non-aggression. As the "militarization-aggression" debate continues fruitlessly, the issue of space weaponization has become one of the top agendas in various international fora.

The use of outer space for peaceful purposes is governed by a body of U.N.-based multilateral treaties and bilateral treaties between the two adversaries of the Cold War—the former Soviet Union and United States.[1] Apart from the outer space treaty system, there are arms control and disarmament agreements relating to outer space. Among these agreements, for the purpose of preserving the peaceful use of outer space, the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celes-

[*] PhD candidate, The Silk Road Institute of International Law, Xi'an Jiaotong University, China; Visiting fellow, the Lauterpacht Centre for International Law, University of Cambridge, UK.

[1] After the dissolution of USSR, Russia succeeded to its membership in international organizations, including a permanent membership in the Security Council, and rights and obligations under the international treaties in which USSR was a party.

tial Bodies (Outer Space Treaty) remains the cornerstone treaty. Article IV of the Outer Space Treaty is the central provision in this connection, stating:

> States Parties to the Treaty undertake not to place in orbit around the Earth any objects carrying nuclear weapons or any other kinds of weapons of mass destruction, install such weapons on celestial bodies, or station such weapons in outer space in any other manner.
>
> The Moon and other celestial bodies shall be used by all States Parties to the Treaty exclusively for peaceful purposes. The establishment of military bases, installations and fortifications, the testing of any type of weapons and the conduct of military manoeuvres on celestial bodies shall be forbidden. The use of military personnel for scientific research or for any other peaceful purposes shall not be prohibited. The use of any equipment or facility necessary for peaceful exploration of the Moon and other celestial bodies shall also not be prohibited.[2]

State governments and scholars have construed from this article, and sometimes in conjunction with other articles, two interpretations of the peaceful principle, namely non-militarization *vis-à-vis* non-aggression, which are different but not antonymous terms.

Before commencing with the peaceful principle it would be helpful to make some preliminary terminological clarifications, between outer space, outer void space, and celestial bodies. In the United Nations, prior to 1963, outer space had always been referred to as separate from celestial bodies, meaning solely the void space between celestial bodies. No wonder the term "outer space and celestial bodies" appeared in the document texts on several occasions.[3] Then as the discussions proceeded, the ter-

---

[2] Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, art. IV, *opened for signature* Jan. 27, 1967, 18 U.S.T. 2410, 610 U.N.T.S. 205 [hereinafter Outer Space Treaty].

[3] Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space, G.A. Res. 1962 (XVIII), U.N. GAOR, 18th Sess., 1280th plen. mtg., U.N. Doc. A/RES/1962(XVIII) (Dec. 13, 1963); International Co-operation in the Peaceful Uses of Outer Space, G.A. Res. 1721 (XVI), U.N. GAOR, 1085th plen. Mtg., U.N. Doc. A/RES/1961(XVI) (Dec. 20, 1961).

minology "outer space" underwent semantic change, embracing both the innumerable celestial bodies and the immense void space in between. They are defined by Professor Bin Cheng as "celestial bodies" and "outer void space" respectively.[4] While, the international treaties do not adopt those definitions, they are very helpful to the present analysis.

II. NON-MILITARIZATION

The militarization of outer space is defined as "the use of assets based in space to enhance the military effectiveness of conventional forces or the use of space assets for military purposes."[5] It is inferred that non-militarization would mean the prohibition of using space-based facilities for any military purpose. This prohibition does not include development and testing not conducted in outer space. In fact, this strict interpretation of the peaceful principle is commonly agreed upon in some other international treaties, such as the treaties on Spitzbergen of 9 February 1920, and on the Aland Islands of 20 October 1921, the Statute of IAEA, and the Antarctic Treaty of 1959.

Here our task is to see whether this strict interpretation should be applied to the use of outer space for peaceful purposes. In this connection, Article IV, paragraph 2 of Outer Space Treaty, reserves celestial bodies "exclusively for peaceful purposes" by explicitly prohibiting "the establishment of military bases, installations and fortifications, the testing of any type of weapons and the conduct of military manoeuvres" but not "the use of military personnel for scientific research or for any other peaceful purposes" or "the use of any equipment or facility necessary for peaceful exploration." A comparison could be made between this provision and Article I of the Antarctic Treaty, which is prevalently regarded as an example of non-

---

[4] "Properly speaking, only celestial bodies have been reserved for use exclusively for peaceful (non-military) purposes, but not outer void space", Bin Cheng, *International Law Across the Spectrum of Conflict: Essays in Honour of Professor L.C. Green on the Occasion of his Eightieth Birthday*, *in* INTERNATIONAL WAR STUDIES 83-84 (Michael N. Schmitt ed., Naval War College 2000) [hereinafter *International Law Across the Spectrum of Conflict*].

[5] MATTHEW MOWTHORPE, THE MILITARIZATION AND WEAPONIZATION OF SPACE 3 (Lexington Books 2004).

militarization in the strictest sense. While the military related uses explicitly not prohibited by the two provisions are basically the same, the explicitly prohibited military activities by the Antarctic Treaty could be broader than those by the Outer Space Treaty. The Antarctic Treaty seems to indicate that the above enunciated prohibitions are not exhaustive of all military uses. Article I, paragraph 1 of the Antarctic Treaty interprets them as part of a "measure of a military nature" because of the use of "such as"; and this is in turn understood as part of the prohibition because of the term "*inter alia.*" Therefore, even for celestial bodies, non-militarization in the strictest sense is not fully proscribed. As to outer void space, it is more apparent that military activities are not prohibited as Article IV paragraph 2, only applies to celestial bodies, and paragraph 1 only bans weapons of mass destruction. Therefore, in conclusion, the non-militarization interpretation could only be applicable to celestial bodies at best, but not to outer void space. This interpretation is faithful to the text, but its correctness needs to be proved in relation to the context, State practice, the preparatory work and circumstance of the conclusion.

According to the 1969 Vienna Convention on the Law of Treaties, "[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."[6] The context includes, *inter alia*, the text, preamble and annexes.[7] The agreement's object and purpose are usually stated in the Preamble.

First, whether military activities in outer space are consistent with the spirit of the Preamble, such as "the benefit of all peoples," "international cooperation," and "friendly relations," to a large extent depends on what kind of military activities is under discussion. Since we are rebutting the non-militarization interpretation, the question we should ask is whether all military activities in outer space go against the spirit of the treaty. The reality is that during the past few decades, military satel-

---

[6] Vienna Convention on the Law of Treaties, art. 31(1), May 23, 1969, 1155 U.N.T.S. 331.

[7] *Id.* at art. 31(2).

lites have reduced the risk of conflict by promoting transparency, verifying arms control compliance, and avoiding surprise attacks. Obviously, it could also be argued that military enhancement has been one of the prime motives for States to reach out into space, which in turn promotes civilian technological development.

Second, one may question in the alternative whether military activities in outer space are contrary to other provisions of the treaty, such as "for the benefit and in the interests of all countries" in Article I(1), and "cooperation and mutual assistance" in Article IX. These written principles, although broad, entail contractual obligations with binding force on States Parties rather than merely reflecting a statement of goals and good will. Whether military activities are contrary to "the benefit and in the interests of all countries" is a question answered. As to international cooperation, although States are obliged to facilitate cooperation, how they implement cooperative measures in practice is subject to agreement. This is specifically addressed by the U.N. General Assembly declaration that "States are free to determine all aspects of their participation in international cooperation in the exploration and use of outer space on an equitable and mutually acceptable basis."[8] Therefore, whether States give up military activities to make way for international cooperation is also subject to States' discretion.

In interpreting a treaty, apart from the context, subsequent State practice in application shall also be taken into account.[9] Ultimately, non-militarization was too strict an approach for States to follow. In fact, outer space has been militarized since the earliest communication satellites were launched. Military uses of outer space have also been accelerated in terms of both participating countries and technologies used. To date, they are mainly passive uses such as reconnaissance, surveillance, early warning, communication, and global positioning, which can

---

[8] 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, G.A. Res. 51/122, U.N. GAOR, 51 plen. mtg., Sess., 83d plen. mtg., U.N. Doc. A/Res/51/122 (Dec. 13, 1996), at Annex, ¶ 2.

[9] Vienna Convention on the Law of Treaties, *supra* note 6, at art. 31(3)(b).

multiply the strength of conventional military forces. Although particular activities conducted from outer space, like espionage, are disliked by many States, they seldom result in official protests. Neither has any country accused any State(s) of violating the Outer Space Treaty by conducting passive military uses of outer space. The passive use of outer space is thereby agreed to be one of the peaceful uses protected by Outer Space Treaty. Today, military satellites are protected by multilateral treaties, such as the International Telecommunication Convention, and other bilateral treaties, for instance between Russia and the United States.

In order to confirm this interpretation, or where one thinks the foregoing interpretation leads to a manifestly absurd or unreasonable result, recourse may be had to the preparatory work of the treaty and the circumstances of its conclusion.[10] The peaceful principle for outer space was borrowed from the Antarctic Treaty, which adopts a stringent approach. It is evident that a similar approach was intended initially, with "peaceful" antonymous to "military." One can even discern the United States support from its early official documents. For instance, in a memorandum submitted on 12 January 1957, to the First Committee of the General Assembly, the U.S. proposed that "the first step toward the objective of assuring that future developments in outer space would be devoted exclusively to peaceful and scientific purposes would be to bring the testing of such objects under international inspection and participation."[11] In January 1958, President Dwight D. Eisenhower proposed to the U.S.S.R. that they should agree to use outer space "only for peaceful purposes," and not for the "testing of missiles designed for military purposes."[12] But this approach was soon discarded for the sophism of non-aggression in 1959, when the great value of reconnaissance satellites was recognized, and the U.S.S.R. took the lead in space exploration. The U.S.S.R., on the other

---

[10] *Id.* at art. 32.

[11] US Senate Comm. On Aeronautical & Space Sciences, *Documents on International Aspects of the Exploration and Use of Outer Space*, 1954-1962, 88th Cong., 1st Sess., 38 (1963).

[12] *Id.* at 52.

hand, stuck to the non-militarization school of thought for a longer duration; but it was simply lip service, because its satellites had been carrying out military functions in the guise of conducting "scientific research."[13] In 1985 the Soviet Union acknowledged to the United States and public that it had military satellites in orbit.[14] In the end, the same gestures found in the Antarctic Treaty did not appear in Outer Space Treaty. Therefore, the drafters of the Outer Space Treaty did not reach the equivalent degree of consensus on preserving outer space as a military-free zone like their counterparts did with regard to Antarctica.

Thus far, I have been rebutting the non-militarization interpretation of the peaceful principle. On account of the contribution of passive military uses of outer space to international peace and security, and the interconnection between military activities in outer space and those on earth, demilitarization of outer space is unlikely. To some extent, I partially agree with the U.S. view that "[t]he question of military activities in space cannot be divorced from the question of military activities on earth" and "[t]o banish these activities in both environments we must continue our efforts for general and complete disarmament with adequate safeguards."[15] However, this by no mean reflects on my support of the lawfulness of all military activities in outer space. Military uses of outer space can be placing reconnaissance satellites into orbit, installing military space stations, conducting military exercises and maneuvers, stationing weapons, etc. Some activities are under the explicit prohibition or permission of international treaties, some are justified through State practice accompanied by State acquiescence, while others are still not governed. Their legality merits case-by-case study, rather than simply being concluded in favor of the non-militarization doctrine.

---

[13] Bin Cheng, *The Commercial Development of Space: the Need for New Treaties*, 19 J. SPACE L. 17, 27 (1991).

[14] NICHOLAS L. JOHNSON, THE SOVIET YEAR IN SPACE 1990, 81 (Colorado Springs, Colo., Teledyne Brown Engineering 1991).

[15] First Committee on the United Nations, U.N. Doc. A/C.1/PV.1289, 13 (Mar. 12, 1962).

III. NON-AGGRESSION

Proponents of the non-aggression interpretation of the peaceful principle, in particular the United States, suggest that the military use of outer space, as long as it is in compliance with Article 2(4) of the U.N. Charter and other international obligations, is compatible with international law. For instance, U.S. Senator Albert Gore addressed the First Committee of the U.N. on 3 December 1962, stating:

> It is the view of the United States that outer space should be used only for peaceful—that is, non-aggressive and beneficial—purposes. The question of military activities in space cannot be divorced from the question of military activities on earth. To banish these activities in both environments we must continue our efforts for general and complete disarmament with adequate safeguards. Until this is achieved, the test of any space activities must not be whether it is military or non-military, but whether or not it is consistent with the United Nations Charter and other obligations of law.[16]

The United States has adhered to this view consistently since 1959, in the context of outer space and other arenas. For example, the U.S. delegation expressed their view at the Law of the Sea Conference, declaring that:

> The United States had consistently held that the conduct of military activities for peaceful purposes was in full accord with the Charter of the United Nations and with the principles of international law. Any specific limitation on military activities would require the negotiation of detailed arms control agreement. The Conference was not charged with such a purpose and was not prepared for such negotiation. Any attempt to turn the Conference's attention to such a complex task could quickly bring to an end current efforts to negotiate a law of the sea convention.[17]

---

[16] *Id.*

[17] Third United Nations Conference on the Law of the Sea 1973-1982, 67th plen. mtg., U.N. Doc. A/CONF.62/SR.67 (Dec. 10, 1982), at ¶ 81.

The non-aggression doctrine has brought up several questions, including: (1) whether the non-aggression principle is applicable to outer space; (2) whether permissible use of force may be conducted in outer space; and (3) whether all non-aggressive uses of outer space are compatible with the peaceful principle.

As to the first question, non-aggression is one of the general principles of international law that regulates inter-State relations universally, without regard to geographical seating. International law, as Professor Lowder writes, has adhered to no intrinsic geographical limits since its creation.[18] Thus, the extension of human activities into new spatial areas may require special rules to cope with the particularities of these areas. However, this does not affect the application of fundamental inter-State norms. Outer space, despite the sparseness of human activities to date in that region, is not an area void of law. In fact, Article III of the Outer Space Treaty provides:

> States Parties to the Treaty shall carry on activities in the exploration and use of outer space, including the Moon and other celestial bodies, in accordance with international law, including the Charter of the United Nations, in the interest of maintaining international peace and security and promoting international cooperation and understanding.[19]

This provision has more of a declaratory value. The non-aggressive use of outer space places a limitation on the behavioral, rather than technological, aspect of State actions in outer space. States must not use force or threaten to use force from outer space, just as they may not do from the high seas. States' assets in outer space, as is the case in other common areas, are not subject to another's attack if used in accordance with international law.

As to the second question, there are two permissible uses of force under international law, specifically, the use of force under the authorization of the U.N. Security Council, in accordance with Article 42 of the UN Charter, and self-defense in accor-

---

[18] Stacey L. Lowder, *A State's International Legal Role: From The Earth To The Moon*, 7 TULSA J. COMP. & INT'L L. 253, 256 (1999).

[19] Outer Space Treaty, *supra* note 2, at art. III.

dance with Article 51 and customary international law. The use of force under the authorization of the Security Council aims to restore international peace and security.[20] This use of force is compatible with the wording of "in the interest of maintaining international peace and security" stipulated in Article III of the Outer Space Treaty. Therefore, it is indeed compatible with the peaceful principle, although the means employed may not be peaceful. For example, this is what happened in the first Gulf War, a military conflict initiated by a coalition force from 34 nations, with U.N. authorization, and a mission to expel invading Iraqi forces from Kuwait. The coalition's reliance on space technology greatly enhanced the strength of the conventional military forces, and earned the name "the first space war." The *jus ad bellum* of the First Gulf War, and the *jus in bello* of the strategic utilization of outer space technologies are seldom questioned. The Iraq War initiated in 2003 by a multinational force led by the United States and the United Kingdom has been more heavily reliant on space assets.[21] While the legality of waging the war itself is widely disputed, there is little discussion with regard to the space reliance. The use of outer space to assist conventional wars on earth such as through intelligence, communication, and global positioning measures, has been accepted as legal. These measures have actually furthered the purpose of humanitarian law by promoting precision and reducing casualties. But it is important to note that it does not justify the war itself, and what has been accepted is limited to what has been employed so far.

As for the use of outer space for self-defense, traditional international law would give an affirmative answer, as in the case of the high seas. Moreover, States' "inherent right of individual or collective self-defence" is recognized and preserved by the UN Charter.[22] It fits well into the realm of use of outer space "in accordance with international law, including the Charter of the United Nations," as in Article III of the Outer Space Treaty. In

---

[20] U.N. Charter art. 2.

[21] Everett C. Dolman, *U.S. Military Transformation and Weapons in Space* (2006) 26(1) SAIS REV. 163, 165.

[22] U.N. Charter art. 51.

fact, the Legal Sub-Committee of COPUOS has explicitly rejected the idea "that the right of self-defence [is] not applicable in regards to outer space."[23] Although international treaties may impose limitations on means available in outer space for self-defense (for instance, Article IV of the Outer Space Treaty bans the use of certain weapons), they don't restrict the right to self-defense itself. So, a question arises as to whether a State Party to the Outer Space Treaty could legally degrade the de-weaponization clauses by, for example, placing weapons of mass destruction in orbit or stationing other weapons on celestial bodies, for the purpose of self-defense. The legality of using nuclear weapons for self-defense is an unsettled question, as the ICJ said in its *Nuclear Weapons* Advisory Opinion in 1996:

> [T]he threat or use of nuclear weapons would generally be contrary to the rules of international law… and in particular the principles and rules of humanitarian law… However, in view of the current state of international law, and of the elements at its disposal, the Court cannot conclude definitively whether the threat or use of nuclear weapons would be lawful or unlawful in an extreme circumstance of self-defense, in which the very survival of a State would be at stake…[24]

Whether the Court is declaring a *non liquet* situation or proposing a necessity test is disputed. Either way, the Court does imply that in very extreme cases nuclear self-defense could be lawful. Nevertheless, use of weapons from outer space may breach a State's obligation under the treaty vis-à-vis all other States Parties. The defending State's wrongful actions and obligations, vis-à-vis the attacking State, could be precluded by Article 21 of the ILC Draft Article on State Responsibility, which provides "[t]he wrongfulness of an act of a State is precluded if the act constitutes a lawful measure of self-defence taken in

---

[23] BRUCE A. HURWITZ, THE LEGALITY OF SPACE MILITARIZATION 72 (Elsevier Science Pub. Co., 1986).

[24] Legality of the Threat or Use of Nuclear Weapons (Adv. Op.), 1996 I.C.J. 226, ¶ 105 (July 8).

conformity with the Charter of the United Nations."[25] Nonetheless, the breach of a State's obligation vis-à-vis other States Parties cannot be precluded. Yet, under this circumstance, the invocation of other States Parties with regard to the wrongful act is unlikely.

Notwithstanding, that outer space shall not be used for aggression and may be used for self-defense, we now turn to the question of whether all non-aggressive uses of outer space are in conformity with the peaceful principle. Proponents make their argument based on two rationales: (1) the non-aggressive use of outer space has already been accepted by States; and (2) under international law, what is not specifically prohibited, is allowed.

The United States maintains the view that "no State has ever *formally* protested the U.S. interpretation of the phrase 'peaceful uses' in the context of outer space activities," by citing the enormous amount of military activities of both the U.S. and U.S.S.R. in outer space.[26] As to non-aggressive uses of outer space, there are certainly many. For example, launching communication satellites, deploying weapons, testing weapons, shooting down one's own satellites etc. It is true that some uses, such as operating reconnaissance satellites, have already been accepted by States and, therefore, are lawful under international law. But the mere absence of protests concerning some uses does not legitimatize others, which have yet to be conducted. Thus, the absence of formal protests against a State's space activity, before it is conducted, does not mean acquiescence of the operation either. In this connection, Professor Bin Cheng rightly opines:

> … one can definitely not speak of any subsequent practice acquiescing in the United States' interpretation of the term "peaceful" based on the absence of any protest insofar as Article IV(2) is concerned, since States are certainly not required

---

[25] Draft Articles on Responsibilities of States for International Wrongful Acts 2001, art. 21, a*vailable at* http://untreaty.un.org/ilc/texts/instruments/english/commentaries/9_6_2001.pdf.

[26] Ivan Vlasic, *The Legal Aspects of Peaceful and Non-Peaceful Uses of Outer Space*, *in* BHUPENDRA JASANI (ED.), PEACEFUL AND NON-PEACEFUL USES OF SPACE 44-45 (Taylor & Francis 1991).

> to monitor and correct other States' mistakes in their understanding of the law or legal malapropisms, as long as they do not put their misinterpretation into practice.[27]

It is also noteworthy that some uses of outer space, which have been planned but not yet implemented, have already drawn protests from States. Therefore, non-aggression is a necessary, rather than sufficient, condition for the peaceful principle. Furthermore, another argument could be made as to the judgment of the Permanent Court of International Justice (PCIJ) in the *Lotus Case*: if an act is not specifically prohibited, it is permitted under international law. This is the major legal barrier to the prevention of space weaponization.

IV. PREVENTION OF WEAPONIZATION

Weaponization of outer space is defined as "weapons based in space or weapons based on the ground with their intended targets being located in space."[28] Technically, ground-based weapons targeting space objects are not placed in outer space; hence, they are not considered as part of the weaponization of outer space. Nevertheless, a discussion here is of crucial relevance in the present context.

Although weaponization of outer space hasn't happened yet, the possibilities are intense. The United States, since President Ronald Reagan's announcement of the Strategic Defense Initiative (SDI) in the early 1980s, has been the country most likely to put it into practice. Although the plan was temporarily discarded in the early 1990s, the United States Space Command Vision for 2020, published in 1997, delineated a plan for U.S. dominance of the Earth from space. Entering the 21st century, the United States was enthusiastic about establishing "space superiority" and initiated a missile defense system plan in 2001. In June 2002, the United States withdrew from the Treaty on the Limitation of Anti-Ballistic Missile Systems (ABM Treaty), which expressly prohibits the development, testing, and de-

---

[27] *International Law Across the Spectrum of Conflict*, *supra* note 4, at 98.
[28] MOWTHORPE, *supra* note 5, at 3.

ployment of sea-based, air-based, space-based, and mobile land-based ABM systems.[29] The 2006 U.S. National Space Policy adopts a hard line saying that US will, among other things, ". . . take those actions necessary to protect its space capabilities; respond to interference; and deny, if necessary, adversaries the use of space capabilities hostile to US national interests."[30]

After the U.S. withdrew from the ABM Treaty, the Outer Space Treaty remains the only international convention limiting space weaponization. The Outer Space Treaty, in Article IV paragraph 1, prohibits weapons of mass destruction in outer void space as well as on celestial bodies; whereas, paragraph 2 strictly bans all types of weapons from celestial bodies. However, it is widely acknowledged that two loopholes exist in this Article: (1) conventional weapons are not banned in outer void space, including the orbit around the Earth and (2) ballistic missiles which temporarily transit through outer space are not prohibited. The first point is relevant for our purpose here. The United States maintains the view that placing weapons like kinetic-kill-vehicles and laser satellites in orbit is not contrary to Article IV. This is true, because when read "in accordance with the ordinary meaning," Article IV indeed does not contain an explicit prohibition. And this double standard applied to outer void space on the one hand and celestial bodies on the other hand could be confirmed by the preparatory work of the Treaty. In fact, during the treaty negotiations India did propose to extend the application field of "exclusively for peaceful purposes," as in paragraph 2, to all outer space areas. In 1962, the Indian delegation to the United Nations Committee on the Peaceful Use of Outer Space stated "[m]y delegation cannot contemplate any prospect other than that outer space should be a kind of warless world, where all military concepts of this earth should be totally inapplicable."[31]

---

[29] Treaty on the Limitation of Anti-Ballistic Missile Systems, art. V, May 26, 1972, U.S.-U.S.S.R., 23 U.S.T. 3435, 944 U.N.T.S. 13 [hereinafter ABM Treaty].

[30] U.S. National Space Policy (Unclassified) (Aug. 31, 2006), 2, *available at* http://www.nss.org/resources/library/spacepolicy/2006NationalSpacePolicy.htm.

[31] U.N. Doc. A/AC.105/PV.3 (Mar. 20, 1962), 63.

This proposal was rejected because it denotes total demilitarization of outer space, including the prohibition of military communication satellites. This was not acceptable to either the United States or the Soviet Union. The U.S., as aforementioned, links the disarmament in outer space to that on earth. Consequently, at the beginning of negotiations the United States proposed a treaty limited to celestial bodies, and "only after the negotiations had started that it agreed to extend the scope of the Treaty to include also the outer void space.[32] However, the Legal Sub-Committee of COPUOS was never authorized to conclude any decisions pertaining to general disarmament.[33] Hence, it could only be concluded that the double standards in Article IV were deliberately adopted. For instance, the Outer Space Treaty does not prohibit conventional weapons in outer void space. However, neither can we infer from this lack of prohibition that the Treaty permits it implicitly. Because there was simply no international consensus for permission, the drafters could not have explicitly permitted it like they did concerning the use of military personnel in scientific research.[34] In fact, the Outer Space Treaty was drafted at a time when the drafters were primarily concerned with the placement of nuclear weapons in outer space. Thus, conventional weapons in outer void space were not foreseen, and therefore not prohibited.

Because space weaponization has not been implemented in practice, there is no customary international law in place to which to refer. Nonetheless, the predominant political will of the international community is much more likely to prohibit, rather than to permit, the weaponization of outer space. The issue of space weaponization is most hotly debated between three major space-faring States, namely the U.S., Russia, and China. Among them, one is keen on, but has not yet realized space weaponization. Russia and China, the two countries believed to have the capacity to weaponize outer space following the U.S., are actively advocating the preservation of a weapon-free outer space.

---

[32] *International Law Across the Spectrum of Conflict*, *supra* note 4, at 95.

[33] Marko G. Markoff, *Disarmament and 'Peaceful Purposes' Provisions in the 1967 Outer Space Treaty*, 4 J. SPACE L. 3, 10 (1976).

[34] Outer Space Treaty, *supra* note 2, at art. IV, ¶ 2.

The recent efforts by Russia and China at the Conference on Disarmament on adopting a treaty on preventing space weaponization are appreciated by a larger number of States.[35] In the Legal Subcommittee of COPUOS, the delegates of a large number of nations do not favor the extension of the arms race into outer space either, leaving the U.S. to stand alone on the opposite side. For example, in 2006, the U.N. General Assembly Resolution on "Transparency and confidence-building in outer space activities" was adopted by 167 yes votes, with only the United States voting against and Israel abstaining.[36] In 2004, the PAROS resolution reserving outer space for peaceful purposes was adopted by 178 countries voting in favor, and Israel, Haiti, Palau and the U.S. abstaining.[37] Of course, the U.S., as a space superpower, well deserves the status of "specially affected" State and its acts do carry substantial weight in international law.[38]

Consequently, the above analysis could conclude that placing conventional weapons in outer void space is neither permitted nor prohibited by international law, but the prevalent international political will is on the side of prohibition. The question before us is whether this lacunae could be filled by the *Lotus Case* principle that "[r]estrictions upon the independence of States cannot . . . be presumed,"[39] which could be rephrased as, "in international law what is not specifically prohibited is permitted." Proponents of this approach make two assumptions, which must not be overlooked: (1) the completeness of international law and (2) the *Lotus* principle as the closing rule for its lacunaes.

---

[35] Compilation of Comments and Suggestions to the CD Working Paper on PAROS(CD/1679), CD/1818 (on file with author).

[36] Transparency and Confidence-Building Measures in Outer Space Activities, G.A. Res. 61/75, U.N. GAOR, 61st Sess., 67th plen. mtg., U.N. Doc. A/RES/61/75 (Dec. 18, 2006); Press Release, General Assembly, General Assembly Adopts 55 Texts Recommended by First Committee on a Wide Range of Disarmament, Security Matters, U.N. Doc. GA/10310 (Mar. 12, 2004).

[37] Press Release, General Assembly, Arms Trade Treaty, 'Nuclear-Weapon-Free World', Outer Space Arms Race Among Issues, As General Assembly Adopts 54 First Committee Texts, U.N. Doc. GA/10547 (Dec. 6, 2006).

[38] North Sea Continental Shelf Cases 1969 I.C.J. Reports 3, 42, ¶ 73.

[39] Case of the S.S. "Lotus" (Fr. v. Turk., 1927 P.C.I.J. (Ser. A) No. 10, at 18.

Occurring in both municipal and international law, lacunaes develop where legal rules and principles are unclear or insufficient in relation to a concrete case, or where the law is silent on a certain matter, thus creating a material gap.[40] As Sir Hersh Lauterpacht noted,

> "in the international sphere the 'gaps' . . . are more ostensible and more frequent. . . . Even when the law is clear and generally accepted it occasionally exhibits what some consider to be lacuna . . . inasmuch as it represents a rule which . . . may be deemed to be morally questionable, or which has become politically reprehensible and obsolete on account of changed conditions, or which leaves outside its orbit a situation clearly and urgently calling for regulation."

The system of international law is an incomplete one only if the material gaps, in Judge Higgins' words, "are not remediable either by a liberal interpretation of the judicial function or by reference to Article 38(1)(c) [of the Statute of the International Court of Justice] on the 'general principles of law recognised by civilized nations'."[41] Whether international law is complete or not has been subject to longstanding debates since initiated by Lauterpacht and Stone over fifty years ago, and need not be resolved for our present purpose. Suffice it to point out that the question of completeness of international law is skipped by proponents who take the *Lotus* principle as a *panacea*.

Today, the *Lotus* principle has become so widely upheld in academic and political circles that it is regarded as a "ground rule" for the former, and a "golden rule" for the latter. In fact, the PCIJ upheld Turkey's way of thinking as a starting point, allowing Turkey's jurisdiction whenever such jurisdiction does not come into conflict with a principle of international law, but very unlikely declared as a closing principle. That the principle justifies all that is not prohibited, even those acts not governed

---

[40] Sir Hersh Lauterpacht, *Some Observations on the Prohibition of 'Non Liquet' and the Completeness of the Law*, *in* Elihu Lauterpacht (ed.), International Law: Being the Collected Papers of Hersch Lauterpacht, Vol. 2, Part I, (Cambridge University Press, 1975) 213, at 220-21.

[41] R. Higgins, *Policy Considerations and the International Judicial Process* 17 INT'L & COMP. L.Q. 58, 67 (1968).

by existing norms, is an exaggeration accelerated by subsequent discussions. In the *Lotus Case* itself, at least three judges explicitly disagreed, and to different extents, with the above dictum.[42] Somewhat ironically, the Justices' disagreement played an important role in contributing to the ensuing debates, by setting the issue as an important agenda. Subsequently, the Court, unlike in the academic and political arenas, has been very cautious in referring to the *Lotus* principle by avoiding it as much as possible. For instance, in the *Arrest Warrant* case it ruled against Belgium without dealing specifically with the Belgium citation to the *Lotus Case*,[43] and in the *Nuclear Weapons* advisory opinion the Court avoided clarification by saying that it was "without particular significance for the disposition of the issues before the Court," because "the nuclear-weapon States appearing before it either accepted, or did not dispute, that their independence to act was indeed restricted by the principles and rules of international law . . ."[44] In a survey conducted on the application of the *Lotus* principle in the Court, Hugh Handeyside concludes that the Court has viewed the principle at best as inapposite, and at worst as an inaccurate statement, of the principles of international law.[45]

The *Lotus Case* was adjudicated early in 1927, since then significant changes have occurred. Significantly, it has not been this principle that has guided the development of inter-State relations; otherwise, the world we are living in today could be one where Antarctica is divided up and nuclear weapons continue to be tested in the air and the on the high seas. As Judges Higgins, Kooijmans, and Buergenthal noted in their joint separate opinion to the *Arrest Warrant Case*, "[The *Lotus* principle] represents the high water mark of laissez-faire in international

---

[42] *Case of the S.S. "Lotus"*, *supra* note 39, at 34 (Loder M., dissenting), 43 (Weiss M., dissenting), & 52 (Lord Finlay, dissenting).

[43] Case Concerning the Arrest Warrant of 11 April 2000 (Congo v. Belg.), 2002 I.C.J. 1 (Feb. 14).

[44] Legality of the Threat or Use of Nuclear Weapons, 1996 I.C.J. 1, 239.

[45] Hugh Handeyside, *The Lotus Principle in ICJ Jurisprudence: Was the Ship Ever Afloat?*, 29 MICH. J. INT'L L. 71, 72-73 (2007).

relations, and an era that has been significantly overtaken by other tendencies."[46]

Today States are unprecedentedly interrelated not only in the sense that they are more inter-dependent on each other in economics or other fields, but also because the global issues challenging cooperation among States are more demanding than ever before. The weaponization of outer space reaches far beyond the business interests of a sole country. With little doubt, one State's weaponization of outer space would cause a chain reaction by inviting others to follow suit and ignite an arms race. This in turn will break the current global strategic balance and stability under the philosophy of mutually assured destruction (MAD). Meanwhile, it would encourage the increase in nuclear stockpiles and the development of anti-satellite weapons (ASATs). None of these subsequent actions, under the *Lotus* principle, are prohibited by international law. The rise of inter-State conflicts would replace issues on the international agenda concerning the common benefits of all mankind, such as climate change, poverty and disease. This scenario would be contrary to the current underlying theme of international law. The *Lotus* principle may not be completely outdated. But at least for space weaponization, it is not, and should not be, applicable.

V. CONCLUSION

In international law it frequently happens that when the use of something is not yet feasible, it is much easier to regulate it in a somewhat ideal, if not Utopian, way. But when exploitation or other uses become feasible, State interests start to penetrate and encroach upon the former ideal spirit. This is exactly what happened in the context of outer space. The non-military initiative proved too impractical to sustain. Fortunately, the space race brought the world more benefit than harm. To some extent, it fixed the troubles on earth. But beneficial outcomes are very unlikely to be with us if weapons are placed in the space.

---

[46] The Arrest Warrant Case (Dem. Rep. Congo v. Belg.), 2002 I.C.J. 3, 78 (Feb. 14) (joint separate opinion of Judges Higgins, Kooijmans, and Buergenthal).

The non-militarization interpretation has become completely outdated. Consequently, efforts to prevent space weaponization by the doctrine are fruitless. On the other hand, non-aggression cannot provide justification for space weaponization either. If we simply test "peaceful" by the minimum standard of inter-State norms, for what do we need a peaceful principle? Moreover, the lack of a specific prohibition does not mean space weaponization is permitted under international law. Relying on the *Lotus* principle would undermine the international legal framework and instigate a laissez-faire attitude in the international community. In essence, all hopes for prevention of space weaponization are pinned on the space-faring States and international political will.

There are two ways to prohibit an issue that should not happen from happening: first, reach an international consensus on prohibition before it happens or, second, reach a consensus after human beings learn a serious lesson. Of course, no one would practice the second alternative with space weaponization.

ENLIGHTENED STATE-INTEREST—A LEGAL FRAMEWORK FOR PROTECTING THE "COMMON INTEREST OF ALL MANKIND" FROM HARDINIAN TRAGEDY

Nicholas D. Welly[*]

INTRODUCTION

"Que le utility del chose excusera le noisomeness del stink?"[1]

The ability to use and explore outer space is internationally recognized as the "common interest of all mankind,"[2] but given

---

[*] J.D., Certificate in Remote Sensing, Air & Space Law, The University of Mississippi School of Law (2010); M.S., Webster University (2005); B.A., Ohio Wesleyan University (2000). Law Clerk, the Honorable Daniel P. Jordan, U.S. District Court, Southern District of Mississippi. Mr. Welly was listed in the 2010 class of Who's Who Among Students in American Colleges and Universities. He is a Major in the NYANG and has served in a variety of air and space operations assignments. The opinions expressed in this paper are those of the author and do not reflect the official position of the United States government. The author would like to thank the faculty and staff of the National Center for Remote Sensing, Air, and Space Law, especially Professor Joanne Irene Gabrynowicz, whose generosity and support made this article possible. Finally, the author would like to thank his wife, Emily Welly, for her love and patience during the previous three years.

[1] Roughly translated, "Does the usefulness of the thing excuse the foulness of the pollution?" *See* R.H. Coase, *The Problem of Social Cost*, 3 J.L. & ECON. 1, 19-20 & n.16 (1960) (citing W.L. PROSSER, THE LAW OF TORTS 398-99 (2d ed. 1955)).

[2] Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies preamble, Jan. 27, 1967, 18 U.S.T. 2410, 610 U.N.T.S. 205 (Oct. 10, 1967) [hereinafter Outer Space Treaty]. While the language "common interest of all mankind" is similar to the phrase "the province of all mankind," *see id.* art. I, and the phrase "common heritage of all mankind," *see* U.N. Convention on the Law of the Sea art. 136, *opened for signature* Dec. 10, 1982, 1833 U.N.T.S. 397; Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, art. 11, *opened for signature* Dec. 18,1979, 1363 U.N.T.S. 3, these terms have fundamentally different meanings. Extensive scholarship addresses the semantic and definitional differences between these provisions. *See, e.g.*, Stephen Gorove, *The Concept of "Common Heritage of Mankind": A Political, Moral or Legal Innovation?*, 9 SAN DIEGO L. REV. 390 (1971); Dr. Ernst Fasan, *The Meaning of the Term "Mankind" in Space Legal Language*, 2 J. SPACE L. 125 (1974); Adrian Bueckling, *The Strategy of Semantics and the "Mankind Provisions" of the Space Treaty*, 7 J. SPACE L. 15 (1979); B. Maiorski, *A Few Reflections on the Meaning and the Interrelation of "Province of All Mankind" and "Common Heritage of Mankind" Notions*, *in* 29TH PROC.

the vast expanse of outer space, early advances in national space programs rarely considered human made debris a threat to future space activities. Indeed, for nearly fifty years, State-sponsored space operations were conducted almost without incident.[3] Then in 1996, the first unintended collision between cataloged space objects occurred when a fragment from an exploded *Ariane* upper stage impacted the operational *Cerise* satellite.[4] This incident sent a shockwave through the global space community.[5] Yet even before this incident, the topic of debris mitigation had been the subject of international discussion. The National Aeronautics and Space Administration (NASA) began exchanging information regarding space debris with the European Space Agency (ESA) as early as 1987, and in April 1993, the American, European, Japanese, and Russian space agencies established "an informal multi-lateral Inter Agency Space De-

---

COLLOQ. L. OUTER SPACE 58 (1986); Lynn M. Fountain, Comment, *Creating Momentum in Space: Ending the paralysis Produced by the "Common Heritage of Mankind" Doctrine*, 35 CONN. L. REV. 1753 (2003). This paper neither accepts or rejects the contentions by these and other authors, and does not seek to further the debate regarding the "mankind" provisions. Rather, it presumes the near-Earth space environment is a global commons, and attempts to provide an normative analysis of the legal regimes which apply to it.

[3] Early space-based experiments did involve anti-satellite weapons testing, however such tests did not result in negative mission impact to another nation's space assets. For a detailed account of the competing anti-satellite weapons programs of the United States and the Soviet Union, see David W. Ziegler, *Safe Heavens: Military Strategy and Space Sanctuary Thought*, *in* BEYOND THE PATHS OF HEAVEN: THE EMERGENCE OF SPACE POWER THOUGHT 185 (Bruce M. DeBlois ed., 1999). Furthermore, though several satellites were forced to perform collision avoidance maneuvers to avoid large debris, post-maneuver analysis showed the predicted collisions would likely not have occurred. *See* U.N. Comm. on Peaceful Uses of Outer Space, Sci. & Tech. Subcomm., *Technical Report on Space Debris* 15, U.N. Doc. A/AC.105/720 (1999) [hereinafter COPUOS Technical Report on Space Debris].

[4] COPUOS Technical Report on Space Debris, *supra* note 3, at 15-16.

[5] *See, e.g.*, Marietta Benko & Kai-Uwe Schrogl, *Space Debris in the UN: Aspects of Law and Policy*, PROC. OF THE SECOND EUR. CONF. ON SPACE DEBRIS 749, Mar. 17-19, 1997, *available at* http://adsabs.harvard.edu/full/1997ESASP.393..749B ("the urgency of the matter [of space debris] has become clear through the first recorded collision of space debris . . . with an active satellite"); *also* Timothy P. Payne, *First Confirmed Natural Collision Between Two Cataloged Satellites*, PROC. OF THE SECOND EUR. CONF. ON SPACE DEBRIS, *supra* at 597, *available at* http://adsabs.harvard.edu/full/1997ESASP.393..597P; F. Alby et al., *Collision of Cerise with Space Debris*, PROC. OF THE SECOND EUR. CONF. ON SPACE DEBRIS, *supra* at 589, *available at* http://adsabs.harvard.edu/full/1997ESASP.393..589A.

bris Coordination Committee" (IADC).[6] Soon after, the U.N. General Assembly recognized "that space debris is an issue of concern to all nations," and endorsed the Committee on the Peaceful Uses of Outer Space (COPUOS) recommendation to add the matter of space debris to the agenda of the Scientific and Technical Subcommittee (STSC).[7] Subsequent reports by the U.S. National Research Council in 1995[8] and UNCOPUOS in 1999[9] brought the issue to the forefront of international debate, leading the IADC to introduce a new action item at its October 1999 meeting—"to develop a set of consensus space debris mitigation guidelines."[10] In 2002, the STSC invited the IADC "to present its proposals on debris mitigation," based on consensus among the IADC members, "to the fortieth session of the Subcommittee," held in Vienna in February of 2003.[11] On November 29, 2002, the IADC submitted the guidelines to STSC, which eventually adopted the guidelines in 2007.[12] COPUOS subsequently adopted the guidelines,[13] and they were finally adopted by the entire General Assembly in resolution 62/217 on February 1, 2008.[14] The result was "a set of [seven] high-level, qualitative guidelines"[15] which, although not legally binding, enjoy "wide[] acceptance among the global space community,"[16] since

---

[6] OFFICE OF SCI. & TECH. POL'Y, EXECUTIVE OFFICE OF THE PRESIDENT, INTERAGENCY REPORT ON ORBITAL DEBRIS 43 (1995).

[7] G.A. Res. 48/39, ¶8, U.N. Doc. A/Res/48/39 (Feb. 10, 1994).

[8] NATIONAL RESEARCH COUNCIL, ORBITAL DEBRIS: A TECHNICAL ASSESSMENT (1995).

[9] COPUOS Technical Report on Space Debris, *supra* note 3.

[10] N.L. Johnson, *Developments in Space Debris Mitigation Policy and Practice*, 221 J. AEROSPACE ENG'G 907, 907 (2007).

[11] *See* U.N. Comm. on Peaceful Uses of Outer Space, *Report of the Scientific and Technical Subcommittee on its Thirty-Eighth Session*, U.N. Doc. A/AC.105/761 (Mar. 2, 2001); *see also* Theresa Hitchens, *Space Debris: Next Steps*, *in* SAFEGUARDING SPACE FOR ALL: SECURITY AND PEACEFUL USES—CONFERENCE REPORT, Mar. 25-26, 2004, United Nations Institute for Disarmament Research (UNIDIR) 62, 64 (2005), *available at* http://www.unidir.org/pdf/articles/pdf-art2378.pdf.

[12] U.N. Comm. on Peaceful Uses of Outer Space, *Report of the Scientific and Technical Subcommittee on Forty-Fourth Session*, U.N. Doc. A/AC.105/890, ¶ 99 (Mar. 6, 2007).

[13] U.N. Gen. Assembly, *Report on the Committee on the Peaceful Uses of Outer Space*, ¶ 117, U.N. Doc. A/62/20 (July 26, 2007).

[14] G. A. Res. 62/217, ¶ 26, U.N. Doc. A/RES/62/217 (1 Feb., 2008).

[15] *Report of the Scientific and Technical Subcommittee on Forty-Fourth Session*, *supra* note 12, at 42-43.

[16] *Id.* at 43.

they are explicitly based upon the recommendations and best practices of the several space-faring States who make up the IADC.[17]

Consistent with these recommendations,[18] several major space-faring States have promulgated their own domestic requirements for mitigating space debris.[19] Yet, despite the concerted efforts of the international bodies responsible for promulgating such guidelines, recent events have spurred several commentators to call for more formal, legally binding rules in outer space.[20] In light of the obvious goal of these proposals—maximizing the utility of the near-Earth space environment—it stands to reason that a normative analysis should reveal whether the current system of non-binding standards is truly insufficient to protect the global common interests in outer space. Though the Outer Space Treaty ensures a right to use and explore outer space to all of humankind, a space debris mitigation treaty would necessarily limit those rights. Such

---

[17] *See id.* at 42.

[18] *See id.* at 43 ("Member States and international organizations should voluntarily take measures, through national mechanisms or through their own applicable mechanisms, to ensure that these guidelines are implemented, to the greatest extent feasible, through space debris mitigation practices and procedures.").

[19] For an overview of State debris mitigation approaches, see *infra* Part IV.A.

[20] *See* Colin Clark, *Augustine Likes Space Debris Treaty*, DODBUZZ, Jan. 26, 2010, http://www.dodbuzz.com/2010/01/26/augustine-likes-space-debris-treaty/; Stephen Gorove, *Contamination and the Outer Space Treaty*, 14 PROC. COLLOQ. L. OUTER SPACE 63 (1971) (describing the inherent ambiguity in the provisions of Article IX and calling for "the formulation of an international code of conduct regarding pollution and contamination from outer space"); *US General Says Space Needs Traffic Rules*, REDORBIT, May 14, 2010, http://www.redorbit.com/news/space/1865454/us_general_says_space_needs_traffic_rules/index.html; *Official: Space Faring Nations Must Work Together to Mitigate Debris*, INSIDE THE AIR FORCE, June 12, 2009, *available at* 2009 WL 11279373; Amy Butler, *Satellite Collision Prompts More Oversight of Space Traffic From the Pentagon*, AVIATION WK. & SPACE TECH., Apr. 6, 2009, at 27-28; Thierry Senechal, *Orbital Debris: Drafting, Negotiating, Implementing a Convention*, May 11, 2007, at 13, *available at* http://web.mit.edu/stgs/pdfs (last visited May 14, 2010) (describing space debris as a "global challenge . . . that cannot be resolved among a few countries," and advocating that "a global convention on space debris is a requirement for preserving the space environment for future generations"); Robert C. Bird, *Procedural Challenges to Environmental Regulation of Space Debris*, 40 AM. BUS. L.J. 635 (2003); Ezra J. Reinstein, *Owning Outer Space*, 20 NW. J. INT'L L. & BUS. 59, 62-65 (1999) (calling for a comprehensive private property regime in outer space).

limitations are not inherently bad;[21] however, limitations on States' rights in outer space should strive to be "efficient,"[22] that is, to optimize the utility of the near-Earth space environment to current and future space-faring nations in a manner consistent with the aspirations of the Outer Space Treaty. This paper does not present a legal solution for managing space resources. Rather, it presents a normative analysis of the current system of non-binding debris mitigation guidelines utilizing the tools of law and economics. It presumes the goals of the foundational space treaties should be promoted in international transactions, and it concludes that States exercising enlightened self-interest can more efficiently protect interests common to space-faring and nonspace-faring States than a new prescriptive regime. Ultimately, this article seeks to further the debate regarding what "ought to be" the state of the law governing State practice in debris-creating activities during the use and exploration of outer space.

I. OUTER SPACE—THE "PROVINCE OF ALL MANKIND" AS A GLOBAL COMMONS

A. The Commons

Occasionally, scholars have pointed to the prohibition on State appropriation in the Outer Space Treaty to suggest the space belongs to no one.[23] Yet quite the contrary is true—space belongs to everyone. Indeed, outer space has been recognized as

---

[21] Indeed, the Outer Space Treaty itself places some limitations on the freedoms enjoyed by humans in outer space. *See, e.g.*, Outer Space Treaty, *supra* note 2, at art. II (no right to national appropriation in outer space); *id.* at art. III (activities in outer space are subject to international law); *id.* at art. IV (prohibition against nuclear weapons and other weapons of mass destruction in Earth orbit); *id.* at art. IX (obligation to exercise due regard for the space activities of others; obligation to avoid harmful contamination of outer space; and obligation to avoid harmful interference with the space activities of others).

[22] *See* THOMAS J. MICELLI, THE ECONOMIC APPROACH TO LAW 3 (2004) ("In a world of scarcity it is 'immoral' to waste resources, and the law should therefore be structured to minimize such waste, at least to the extent that it does not conflict with other goals.") (citing RICHARD POSNER, ECONOMIC ANALYSIS OF LAW 30 (5th ed. 1998)).

[23] For a brief discussion of the evolution of this debate, see EVERETT C. DOLMAN, ASTROPOLITIK: CLASSICAL GEOPOLITICS IN THE SPACE AGE 97 (2002).

a *res communis*[24]—a resource "legally incapable of *exclusive* ownership."[25] While the right to exclude plays an important role in modern western private property regimes,[26] such a right finds very limited application in the modern international law of outer space.[27] For example, under the Outer Space Treaty, the use and exploration of outer space "shall be the *province* of all mankind."[28] Thus by its terms the treaty defines outer space using property language,[29] and bestows the several rights in that property upon mankind. However, as distinguished from individual rights in private property, the rights of humankind "relate to the collective entity" and are exercised by States.[30] Notably, the Outer Space Treaty secures the right to use and explore outer space to "all human beings wherever they may be found," and is thus not limited to those represented by space-faring States.[31] Consequently, outer space, like the high seas

---

[24] *See, e.g.*, J.E.S. FAWCETT, OUTER SPACE: NEW CHALLENGES TO LAW AND POLICY 5 (1984); CARL Q. CHRISTOL, THE MODERN INTERNATIONAL LAW OF OUTER SPACE 318 (1982); Aldo Amando Cocca, *The Advances in International Law Through the Law of Outer Space*, 9 J. SPACE L. 13, 14 (1981); Robert D. Crane.

[25] Daniel R. Coquillett, *Mosses From An Old Manse: Another Look At Some Historic Property Cases About The Environment*, 64 CORNELL L. REV. 761, 800 (1979) (emphasis added).

[26] For example, in the seminal case *Kaiser Aetna v. United States*, 444 U.S. 164 (1979), United States Supreme Court then Justice Rhenquist described the right to exclude as "one of the most essential," noting that it was "universally held to be a fundamental element of the property right." *Id.* at 176, 179–80.

[27] *See* Outer Space Treaty, *supra* note 2, at art. II. *But see id.* at art. IX (right to be free from harmful interference implies a minimal right to exclude); *id.* at art. VIII (retention of jurisdiction and control implies right to exclude from space objects, though not from any particular realm of outer space); Agreement Among the Government of Canada, Governments of Member States of the European Space Agency, the Government of Japan, the Government of the Russian Federation, and the Government of the United States of America Concerning Cooperation on the Civil International Space Station art. 9, Jan. 29, 1998, T.I.A.S. 12927 [hereinafter ISS IGA] (right to exclude from national modules in context of ISS).

[28] Outer Space Treaty, *supra* note 2, art. I (emphasis added).

[29] *See* BLACK'S LAW DICTIONARY 1345 (9th ed. 2009) (defining "province" as "[a]n administrative district into which a country has been divided").

[30] *See The Concept of "Common Heritage of Mankind"*, *supra* note 2, at 393 (defining "mankind" as used in the several international documents and U.N. resolutions, including the Outer Space Treaty).

[31] *Id.*

and the atmosphere, is a global commons.[32] This communal concept is recognized in the Article I of the treaty, which declares, "[t]he exploration and use of outer space . . . shall be carried out for the benefit and in the interests of all countries."[33] Yet, as with resources like the sea and the atmosphere, the near-Earth outer space environment has historically been seen as so plentiful or so unbounded that the social and economic costs of establishing a resource management system were unjustified.[34] In fact, the near-Earth space environment was, at the time the Outer Space Treaty was drafted, a virtual *vacuum domicilium*.[35] This perspective, along with the "politically tense environment" of the Cold War, ensured the Outer Space Treaty and its progeny evolved as instruments for preventing the major world powers from "gaining irreversible advantage" over one another "by militarizing outer space,"[36] but prevented the treaties from becoming effective guides for managing the resources of the near-Earth space environment. The result was a generally unregulated environment wherein States freely created orbital debris, either ignorant of or despite the external costs of doing so.[37]

B. Economics and Externalities in Outer Space

The discipline of law and economics is an invaluable tool for evaluating legal regimes. Because economics is fundamentally

---

[32] A "common" is generally defined as some area "set aside for the general public's use," BLACK'S LAW DICTIONARY, *supra* note 29, at 311, and "belong[s] equally to more than one," 2 OXFORD ENGLISH DICTIONARY 565 (2d ed. 1989).

[33] Outer Space Treaty, *supra* note 2, at art. I.

[34] *See, e.g.*, Lawrence D. Roberts, *Addressing the Problems of Orbital Space Debris: Combining International Regulatory and Liability Regimes*, 15 B.C. INT'L & COMP. L. REV. 51, 52 (1992) ("The Outer Space Agreements embodied the state of environmental law when they were drafted, but have failed to incorporate later developments."). *Cf.* 2 HUGO GROTIUS, DE JURE BELLI AC PACIS 190 (Kelsey trans. 1925) (describing the air and oceans as too plentiful and unbounded to reduce to private property).

[35] "Empty domain." *See* Kathryn Milun, *Open Access Commons: An Open-ended Question for Democracy*, ONTHECOMMONS, Mar. 1, 2007, http://onthecommons.org/content.php?id=1035.

[36] Reinstein, *supra* note 20, at 62.

[37] *Cf.* ARISTOTLE, THE POLITICS AND THE CONSTITUTION OF ATHENS 33 (Stephen Everson ed., Benjamin Jowett trans., 1996) ("[T]hat which is common to the greatest number has the least care bestowed upon it. Everyone thinks chiefly of his own, hardly at all of the common interest.").

positivistic[38]—it tells us what "is"—it provides the starting point for a normative analysis of the law—determining what "should be."[39] Economists commonly refer to models developed through game theory, "which provides a general theory of strategic interaction between economic agents."[40] Though several games exist, in each, economists assume that individual actors "seek to further their self-defined interests through the most efficacious means available."[41] While often applied to common law analyses, economic game theory "easily lends itself to treaty-based or institutional responses to international issues involving cooperation or conflict."[42] Indeed, authors Jeffrey Donoff and Joel Trachtman recognize that "transactions in international relations are analogous to transactions in private markets."[43] Space is just one of a number of markets of international relations;[44] it is a place where the national activities of States have given life to "a structure that affects and constrains all of them."[45] Historically, States pursued national activities in outer space for power and for international prestige.[46] In true market fashion, those

---

[38] Jeffrey L. Dunoff & Joel P. Trachtman, *The Law and Economics of International Law*, 24 YALE J. INT'L L. 1, 9-11 (1999). *See also*, JOEL P. TRACHTMAN, THE ECONOMIC STRUCTURE OF INTERNATIONAL LAW 7 (2008).

[39] *See* Daniel A. Farber, *Positive Theory as a Normative Critique*, 65 S. CAL. L. REV. 1565 (1995).

[40] THOMAS J. MICELI, THE ECONOMIC APPROACH TO LAW 27 (2004).

[41] Dunoff & Trachtman, *supra* note 38, at 13 (recognizing that "[l]ike economic markets, the international system is formed by the interactions of self-regarding units — largely, but not exclusively, states" who trade "components of power" in the form of "jurisdiction to prescribe, jurisdiction to adjudicate and jurisdiction to enforce"). *See also* Elinor Ostrom, *Collective Action and the Evolution of Social Norms*, 14 J. ECON. PERSPECTIVES 137, 139 (2000) ("A wide range of economic experiments have found that the rational egoist assumption works well in predicting the outcome in auctions and competitive market situations.") (citation omitted).

[42] Dunoff & Trachtman, *supra* note 38, at 11.

[43] *Id.* at 9.

[44] *See id.* at 13 (describing "markets" in international relations as "the place where states interact to cooperate on particular issues").

[45] KENNETH N. WALTZ, THEORY OF INTERNATIONAL POLITICS 90 (1979) (describing markets as arising out of individual actions).

[46] *See* ISSUES AND OPPORTUNITIES REGARDING THE U.S. SPACE PROGRAM 15 & n.6, *available at* http://www.nap.edu/openbook.php?record_id=10899&page=R1 ("Dramatic achievements in space, therefore, symbolize the technological power and organizing capacity of a nation. Major successes . . . lend national prestige even though the scientific, commercial, or military value of the undertaking may by ordinary standards be marginal or economically unjustified. This nation needs to make a decision to pursue

States who valued the power or prestige of robust national space programs pursued such programs despite their almost illimitable costs—even to the point of financial ruin.[47] But generally the price of national activities in outer space has included costs not borne entirely by the State sponsoring the activity, notwithstanding these high price tags. For example, the reentry of the Soviet spacecraft *Cosmos 954* in Canada's Northwest Territories in 1978 sparked an international search and recovery effort, motivated in part by the anticipated environmental hazard from the spacecraft's nuclear propulsion system, at a cost of more than C$14 million.[48] Under the regime of the Liability Convention, one could reasonably have expected the Canadian government to present a claim to the Soviet Union, and for the Soviet Union to either honor that claim, or to submit the issue to a claims commission.[49] However, the parties settled the matter before invoking the provisions of the treaty, with Canada accepting a mere $3 million in reparations.[50] Thus, the actual cost to the Soviet Union of *Cosmos 954*'s oceanic surveillance mission did not reflect the total cost of the activity.[51] The difference—an

---

space projects aimed at enhancing national prestige.") (quoting then Secretary of Defense Robert McNamara and NASA Administrator James Webb). *See also* W.D. Kay, *Problem Definitions and Policy Contradictions: John F. Kennedy and the "Space Race"*, 31 POL'Y STUDIES J. 53 (2003) (describing Sputnik as "a serious threat not only to America's prestige but also to U.S. national security itself").

[47] JOHN L. SEITZ, GLOBAL ISSUES: AN INTRODUCTION 222 (2d ed. 2002) ("The huge financial strain on [the Soviet] economy caused by the arms race undoubtedly contributed to its collapse."); MIRA DURIC, THE STRATEGIC DEFENSE INITIATIVE: US POLICY AND THE SOVIET UNION 51 (2003) ("The S[trategic]D[efense]I[nitiative] . . . presented the Soviets with the choice of falling behind technologically or restructuring their political system.").

[48] *See* Alexander F. Cohen, *Cosmos 954 and the International Law of Satellite Accidents*, 10 YALE J. INT'L L. 78, 80 (1985); Peter P. C. Haanappel, *Some Observations on the Crash of Cosmos 954*, 6 J. SPACE L. 147, 148 (1978).

[49] *See* Convention on International Liability for Damage Caused by Space Objects, art. II, Mar. 29, 1972, 24 U.S.T. 2389, 961 U.N.T.S. 187 [hereinafter Liability Convention] (assigning absolute liability to a launching state for damage caused by its space object on the surface of the earth); *id.* at art. XI (requiring States to present a claim for damages via diplomatic channels); *id.* at art. XII (mandating a claims commission for the resolution of claims unsettled after one year).

[50] Cohen, *supra* note 48, at 80 (citation omitted).

[51] The total cost to Canada exceeded C$14 million, while the additional costs incurred by the U.S. for its participation totaled nearly $2.5 million. However, Canada only sought C$6 million in reparations, limiting its request to direct damages, and accepted, without incident, a fifty-percent settlement. Cohen, *supra* note 48, at 80.

"externality" in economic terms[52]—was borne by the Canadian government and those partner nations who incurred costs during the recovery and reclamation of *Cosmos 954*.[53]

While the above example easily demonstrates the concept of externalities associated with space activities, uncontrolled satellite reentries are not particularly common,[54] and as such, impose relatively few external costs. On the other hand, the complex and highly synchronized process of launching satellites creates significant negative externalities. A payload atop a launch vehicle usually navigates several stages before successfully attaining orbit, during which various boosters or motors may propel the satellite to its desired altitude in succession. Eventually, the satellite will establish its orbital attitude, and begin deploying antennae, solar panels, and other external appendages, sometimes through the use of pyrotechnic devices, before it is ready to fulfill its operational mission.[55] Though essential, these preliminary stages produce debris that can remain in orbit for long periods of time.[56] Similarly, anti-satellite weapons testing has produced innumerable uncontrolled, and often untrackable objects in Earth orbit.[57] Finally, when satellites can no longer

---

[52] An externality, in economic terms, "arises when a person engages in an activity that influences the well-being of a bystander and yet neither pays nor receives any compensation for that effect." N. GREGORY MANKIW, PRINCIPLES OF ECONOMICS 204 (5th ed. 2008). Economists recognize two basic types of externalities: positive and negative. "A negative externality results when the activity of an individual or a business imposes a cost on someone else," whereas a positive externality occurs when a non-paying individual enjoys the benefit of another's labor. JEFFREY L. HARRISON, LAW AND ECONOMICS: POSITIVE, NORMATIVE AND BEHAVIORAL PERSPECTIVES 43-44 (2d ed. 2007). Such benefits can be seen in the realm of space activities in systems like the Global Positioning System (GPS). *See* BRADFORD W. PARKINSON & JAMES J. SPIKER, THE GLOBAL POSITIONING SYSTEM: THEORY AND APPLICATIONS 24-26 (1996) (noting the wide variety of terrestrial applications across the commercial, civil and military sectors that rely on GPS).

[53] *See supra* note 52 and accompanying text.

[54] *But see Nation: Cosmos 954: An Ugly Death*, TIME, Feb. 6, 1978 (describing several satellite and rocket reentries during the early days of the U.S. and Soviet space programs); DAVID SHAYLER, SKYLAB: AMERICA'S SPACE STATION 311-14 (2001) (describing the planned reentry of the first United States space station); ORGANIZATION AT THE LIMIT: LESSONS FROM THE COLUMBIA DISASTER 12-17 (William H. Starbuck & Moshe Farjoun, eds., 2005) (detailing the events surrounding the Columbia disaster).

[55] SPACECRAFT SYSTEMS ENGINEERING 15, 34 (Peter W. Fortescue et al., eds., 3d ed. 2003).

[56] HEINER KLINKRAD, SPACE DEBRIS: MODELS AND RISK ANALYSIS 2 (2006).

[57] *See, e.g.*, James Mackey, *Recent US and Chinese Antisatellite Activities*, AIR & SPACE POWER J. (Fall 2009), at 82, 85 tbl.3, 89 (noting that the 2007 intercept of China's

function as intended, operators must choose whether to dispose of the spacecraft through controlled reentry or by moving the satellite to a "disposal orbit." If the satellite is not destroyed by atmospheric reentry, it remains in space and itself becomes a piece of debris.[58] Each of these scenarios add human-made debris to the near-Earth space environment. Until recently, however, this was not seen as a cost among space-faring nations. Rather, the ability to discard unnecessary equipment or to test satellite weapons was viewed as a positive externality—a costless benefit—to national activities in outer space. However, as described below, this attitude has resulted in thousands of pieces of trackable, and probably millions of pieces of untrackable, debris in orbit—debris which threatens the freedoms of states in their current and future activities in outer space.[59]

II. DEFINING THE DEBRIS PROBLEM

"Ruin is the destination toward which all men rush, each pursuing his own best interest in a society that believes in the freedom of the commons."[60]

A. An Impending Kessler Syndrome: Tragedy in the Global Outer Space Commons

In his 1968 article, *The Tragedy of the Commons*, Professor Garrett Hardin described the crisis of population growth in a world with finite resources as a "no technical solution problem."[61] Drawing an analogy to a commons upon which herders grazed their livestock, Hardin proposed that when environmental and social factors make it possible for individuals to in-

---

FY-1C satellite produced upwards of 20,000 pieces of debris which may remain in orbit for 20-100 years, and stating, "These fragments pose a significant threat to satellites from many nations.").

[58] *See infra* notes 139-40 and accompanying text.

[59] COPUOS Technical Report on Space Debris, *supra* note 3; National Research Council, Orbital Debris: A Technical Assessment (1995); US Interagency Report on Debris (1995); *See also* Mackey, *supra* note 57, at 85; Benko & Schrogl, *supra* note 5, at 749; *Contamination and the Outer Space Treaty*, *supra* note 20, at 68.

[60] Garrett Hardin, *The Tragedy of the Commons*, 162 SCIENCE 1243, 1244 (1968).

[61] *Id.* at 1243.

crease their consumption without limitation, each will act in a manner that maximizes self-interest. In the case of the commons, each herder will weigh the benefit of adding an additional animal to the herd against the cost of overgrazing the commons. The benefit of adding an animal to the herd is wholly realized only by the individual herder, yet the cost of overgrazing the commons is distributed among all herders who graze their herds upon the land. Therefore, the herder's benefit—the full value of an additional animal—significantly outweighs the costs incurred—a fraction of the detriment from overgrazing the commons.[62] In Hardin's model, "tragedy" results when all herders, acting in self-interest, increase the number of animals in their herds, overgrazing the commons to its eventual destruction.[63] In this way, the herders, though acting in an apparently reasoned and self-interested manner, destroy the very thing on which their interests rely—the commons.

"A finite world can support only a finite population."[64]

Hardin further noted that the tragedy of the commons was recognizable, albeit in the reverse, in problems of pollution.[65] With public resources like water, an individual acting in self interest will choose to pollute when "his share of the cost of the waste he discharges is less than the cost of purifying his wastes before releasing them."[66] Thus, instead of taking something from the commons—as in the case of grazing herds—actors will spoil the public resource by their additions, ultimately leading to a decline in the utility of the resource.

Hardin described the pollution problem as a consequence of population.[67] Presumably, given the vast supply of the Earth's natural resources and the environmental processes that "renew" them over time, a single polluter, no matter how voluminous his

---

[62] *Id.* at 1244.

[63] *Id.*

[64] *Id.* at 1243.

[65] *Id.* at 1245. *See also Contamination and the Outer Space Treaty*, *supra* note 20, at 67 (defining pollution as "a human alteration of the environment by the introduction of undesirable elements or by the undesirable use of elements").

[66] *The Tragedy of the Commons*, *supra* note 60, at 1245.

[67] *Id.*

discharges, could not destroy the commons. Rather, the commons would only befall such tragedy when the number of users, and consequently polluters, exceeded the commons' natural capacity to sustain. Where the number of polluters is relatively low, then, the cost of pollution is insignificant. Similarly, the near-Earth outer space environment may be able to sustain debris-causing activities absent comprehensive mitigation practices when there are few users. Especially in low-Earth orbit, the Earth's gravity and its atmosphere will degrade the orbits of space objects, eventually leading to reentry and effectively cleansing space of even the smallest pieces of debris. At higher orbits, these physical processes may be less effective or slower to take effect,[68] but the volume of space affected by the debris is greater, and thus the "cost" imposed to outer space activities appears similarly low. Consequently, the "renewability" of the near-Earth outer space environment appears facially similar to that of other globally common resources.

Nevertheless, the physical properties of outer space differ from those of other commons, especially with regard to pollution. At altitudes above 110 km, debris tends to remain in orbit for progressively long periods of time.[69] The amount of orbital debris has steadily risen over the past 40 years, and experts assess that "space debris grew 13 percent in 2009."[70] Additionally, orbital debris is uncontrolled (as compared to operational payloads) and is frequently unobservable.[71] Scientists statistically estimate that the number of pieces of space debris larger

---

[68] *See* Mackey, *supra* note 57, at 88-89 & tbl.3 (comparing the USA-193 intercept—at an altitude of 247 km—with the FY-1C intercept—at an altitude of 864 km, and noting that "[e]stimates for the debris from USA-193 indicate no remaining pieces in orbit after 40 days; meanwhile, modeling suggests that debris from Feng Yun may stay in orbit for up to 100 years").

[69] *See Contamination and the Outer Space Treaty*, *supra* note 20, at 68 & n.4 (describing the life span of space debris as "rang[ing] from just a few hours to centuries"). *See also* David R. Hager, *The Orbiting Junkyard*, SATURDAY REV. 44 (Sept. 5, 1960).

[70] Roy Mark, *Space Debris Reaching Tipping Point?*, http://www.eweek.com/c/a/Government-IT/Space-Debris-Reaching-Tipping-Point-380204/ (last visited Jan. 3, 2010).

[71] *See, e.g.*, *id.* (discussing the United States Air Force's ability to track nearly 19,000 of the estimated 300,000 objects currently orbiting the Earth).

than one centimeter in Low Earth Orbit exceeds 300,000.[72] Yet the Department of Defense Space Surveillance Network (SSN) is not capable of tracking objects smaller than 5 centimeters in diameter.[73] It is no surprise, then, that NASA officials have declared non-trackable debris to be "[t]he greatest risk [to] space missions."[74] Unfortunately, no technology has been developed which is capable of widespread debris removal.[75]

"Satellite collisions will produce a number of fragments, some of which may be capable of fragmenting another satellite upon collision, creating even more fragments. The result would be an exponential increase in the number of objects with time, creating a belt of debris around the Earth."[76]

With space objects traveling at speeds greater than 17,000 miles per hour,[77] collisions between two pieces of debris, or between debris and operational space equipment, can result in high energy explosions which can create thousands of new pieces of debris.[78] Consequently, even minimal human space ac-

---

[72] Nicholas Johnson, Remarks at the NASA News Update: Space Debris (Apr. 28, 2009), at 5, *available at* http://www.nasa.gov/pdf/338099main_space_debris_update.pdf [hereinafter NASA News Update].

[73] David Wright, *Space Debris*, PHYSICS TODAY 35, 36 (Oct. 2007). This figure represents the trackable pieces of debris in LEO. The SSN is capable of tracking only those objects in GEO that are greater than one meter in diameter.

[74] NASA News Update, *supra* note 72, at 8. In 1995, the U.S. Office of Science and Technology Policy (OSTP) estimated the number of untrackable pieces of debris in Earth orbit to number in the tens of millions. INTERAGENCY REPORT ON DEBRIS 6, table 2 (1995).

[75] Leonard David, *NASA, DARPA Host Space Junk Wake-up Call*, FOXNEWS.COM (Dec. 9, 2009), http://www.foxnews.com/scitech/2009/12/09/nasa-darpa-host-space-junk-wake/.

[76] David J. Kessler & Burton G. Cour-Palais, *Collision Frequency of Artificial Satellites: The Creation of a Debris Belt*, 83 J. GEOPHYS. RESEARCH 2637 (1978).

[77] *See* Mark, *supra* note 70. Additionally, the matter of debris collection in outer space is fraught with geopolitical challenges, not the least of which is the fact that this same technology can be used for space-based weapons and for other forms of harmful interference. *See* Robert P. Merges & Glenn H. Reynolds, *Rules for the Road for Space?: Satellite Collisions and the Inadequacy of Current Space Law*, 40 ENV. L. REPORTS 10009, 10010 (2010); David A. Koplow, *ASAT-isfaction: Customary International Law and the Regulation of Anti-Satellite Weapons*, 30 MICH. J. INT'L L. 1187, 1209-1214 (2009) (describing several different kinetic and non-kinetic anti-satellite weapons technologies).

[78] *See* Kessler & Cour-Palais, *supra* note 76, at 2637.

tivity without debris mitigation practices poses a highly destructive threat to the near-Earth space environment. Such destruction was described in a 1978 article by NASA physicists Donald Kessler and Burton Cour-Palais.[79] The authors demonstrated a direct correlation between the number of objects in outer space and the number of collision between such objects. Based on mathematical modeling, they portended an exponential increase in the number of orbital collisions, leading to an increase in the number of near-Earth space objects, ultimately resulting in a belt of debris encircling the Earth.[80] This cascading effect, known as the "Kessler Syndrome," requires only minimal human input to gain inertia, and is not solely a "consequence of population" as described by Hardin.[81] Under the Kessler Syndrome, even one space-faring nation acting upon reasoned self-interest could create enough debris in the near-Earth environment to substantially limit or eventually preclude future space activities. Thus, in the absence of debris mitigation techniques, the population issue does not create, but accelerates the Kessler problem. Still, the orbital debris problem fits the tragedy-of-the-commons model, since it results from cost-benefit analyses by actors in outer space who choose not to mitigate debris, thereby realizing all of the benefit of their space activities without internalizing all of the costs. Instead, these self-interested actors distribute the costs of their space activities across all humankind. This negative externality keeps the cost of space exploration artificially low, encouraging further debris-causing activity while simultaneously jeopardizing future space activities. Indeed, failure to mitigate such collisions has been specifically identified as a threat to current and future human space activity.[82] Consequently, while Hardin's 1968 pollution

---

[79] *See generally id.*

[80] *Id.*

[81] *Compare id.*, *with The Tragedy of the Commons*, *supra* note 60, at 1245.

[82] Kessler & Cour-Palais, *supra* note 76, at 2645. *See also* Space Debris Mitigation Guidelines, *in Report of the Scientific and Technical Subcommittee on Forty-Fourth Session*, *supra* note 12, at 42 [hereinafter Space Debris Mitigation Guidelines] ("The implementation of space debris mitigation measures is recommended since some space debris has the potential to damage spacecraft, leading to loss of mission, or loss of life in the case of manned spacecraft. For manned flight orbits, space debris mitigation measures are highly relevant due to crew safety implications.").

examples might have been able to overcome self-interested decision-making when few actors were involved, the near-Earth outer space environment may not. Ultimately, the true cost of debris-causing activity might not be borne by the actor who fails to mitigate debris, but by the party whose space object is destroyed by such debris. Given the relative inability to identify individual pieces of orbital debris, the current regimes for establishing liability and state responsibility in outer space are likely inadequate to protect public and private space interests.

The scenario described by Garret Hardin provides an illuminating, albeit oversimplified,[83] model for explaining the hazards of mismanaging common resources. As applied to outer space, the Kessler Syndrome makes clear just how devastating such mismanagement can be. Yet, Hardin and his supporters have argued that only two strategies are available to prevent the tragedy of the commons: government regulation[84] or private property rights.[85] Similarly, several commentators have criticized the ambiguity, breadth, and general disregard of the space treaties regarding several modern challenges in calling for more positivistic legal regimes in outer space.[86]

B. The Debris "Vacuum" in Outer Space Law

The matter of debris is difficult to resolve without first defining the problem. But what exactly is "space debris"? Several

---

[83] *See, e.g.*, Elinor Ostrom et al., *Revisiting the Commons: Local Lessons, Global Challenges,* 284 SCIENCE 278, 278 (1999) ("An important lesson from the empirical studies of sustainable resources is that more solutions exist than Hardin proposed.").

[84] *See* GARRETT HARDIN, STALKING THE WILD TABOO 314 (1978) ("[I]f ruin is to be avoided in a crowded world, people must be responsive to a coercive force outside their individual psyches, a 'Leviathan' to use Hobbe's term."); Ian Carruthers & Roy Stoner, *Economic Aspects and Policy Issues in Groundwater Development* 29 (World Bank Staff, Working Paper No. 496, 1981) ("[C]ommon property resources require public control if economic efficience is to result from their development.").

[85] *See* HARDIN, *supra* note 84, at 314. *See also* Robert J. Smith, *Resolving the Tragedy of the Commons by Creating Private Property Rights in Wildlife*, 1 CATO J. 439, 467 (1981) ("[The only way to avoid the tragedy of the commons in natural resources and wildlife is to end the common property system by creating a system of private property rights."); W.P. Welch, *The Political Feasibility of Full Ownership Property Rights: The Cases of Pollution and Fisheries*, 16 POL'Y SCI. 165, 171(1983) ("[T]he establishment of full property rights is necessary to avoid the inefficient of overgrazing.").

[86] *See supra* note 20 and accompanying text.

definitions exist, though each share the same basic characteristics. Space debris includes (1) human-made objects, (2) which are in earth-orbit (3) are non-functional, and (4) will not reassume functionality.[87] But while scholars and scientists may be able to qualify the debris problem, policy makers are generally without legal tools to prevent the tragedy forecast by Kessler. This is because the matter of space debris is not specifically addressed by the Outer Space Treaty or its progeny.[88] Still, the

---

[87] Space Debris Mitigation Guidelines, *supra* note 82, at 42 ("[S]pace debris is defined as all man-made objects, including fragments and elements thereof, in Earth orbit or re-entering the atmosphere, that are non-functional."). *Cf.* COPUOS Technical Report on Space Debris 2, *supra* note 3 (defining space debris as "all man-made objects, including their fragments and parts, whether their owners can be identified or not, in Earth orbit or re-entering the dense layers of the atmosphere that are non-functional with no reasonable expectation of their being able to assume or resume their intended functions or any other functions for which they are or can be authorized"); Ernst Fasan, *Technical and Policy Issues Related to the Use of the Space Environment*, 23 J. SPACE L. 89, 91-92 (1995) (providing the International Academy of Astronautics expert group definition: space debris is "any man-made earth-orbiting object which is non-functional with no reasonable expectation of assuming or resuming its intended function or any other function for which it is or can be expected to be authorized, including fragments and parts thereof"); Benko & Schrogl, *supra* note 5, at 752 ("The term space debris means a space object, regardless [of] whether it still exists as a whole or whether it is fragmented to any size, in the event that such an object is non-functional and there is no reasonable expectation of it assuming or reassuming its function. (E.g., deactivated satellites, spent rocket stages, fragments of rockets and satellites, engine exhaust particles, refuse, paint flakes)."); Buenos Aires International Instrument on the Protection of the Environment from Damage Caused by Space Debris, art. 1(c), *reprinted in* 23 J. SPACE L. 113 (1995) [hereinafter Buenos Aires International Instrument] (defining space debris as "man-made objects in outer space, other than active or otherwise useful satellites, when no change can reasonably be expected in these conditions in the foreseeable future"). *See also* Maureen Williams, *The ILA Finalizes Its International Instrument on Space Debris in Buenos Aires, August 1994*, 23 J. SPACE L. 47 (1995) (providing historical background on the Buenos Aires International Instrument from the report by the Rapporteur of the ILA Space Law Committee). *Accord*, NASA News Update, *supra* note 72, at 5 ("Orbital debris is any man-made object in orbit about the Earth which no longer serves a useful function.").

[88] The Outer Space Treaty codifies several of the Legal Principles and serves as the foundation upon which the Convention on International Liability for Damage Caused by Space Objects (Liability Convention), the Convention on Registration of Objects Launched into Outer Space (Registration Convention), and the Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space (Rescue and Return Agreement) are built. For a thorough discussion of the space treaties' interrelatedness, see Joanne Irene Gabrynowicz, *The Outer Space Treaty and Enhancing Space Security*, *in* BUILDING THE ARCHITECTURE FOR SUSTAINABLE SPACE SECURITY 113 (2006); *accord* UNITED NATIONS TREATIES AND PRINCIPLES ON OUTER SPACE v, U.N. Doc. ST/SPACE/11 (2002) ("The 1967 [Outer Space Treaty] could be viewed as furnishing a general legal basis for the peaceful uses of outer space and pro-

treaties do discuss several principles that help frame the responsibilities of States and can help establish international guidelines with respect to debris.[89]

First, the space treaties seek to protect the interests of all States in the exploration and use of outer space, including those of undeveloped nations who may be unable to exercise these rights.[90] As explained above, scientists now recognize that increasing levels of debris in Earth orbit jeopardize the current interests of space-faring States, and could eventually preclude future space exploration and scientific research. The treaties further prohibit national appropriation of outer space by any means,[91] but provide that States do retain jurisdiction and control of their objects launched into space.[92] Concomitantly, States must observe international law in the conduct of their space activities.[93] Because international law recognizes that States have an obligation to "ensure that activities within their jurisdiction and control respect the environment,"[94] it does not overextend the treaties to interpret them as imposing some affirmative obligations on States to mitigate space debris. Thus, to the extent objects in space are identifiable and attributable, States have an obligation to control them, notwithstanding the nonfunctional nature of debris.

---

viding a framework for the developing law of outer space. The four other treaties may be said to deal specifically with certain concepts included in the 1967 Treaty.").

[89] Benko & Schrogl, *supra* note 5, at 749. *See also* IAN BROWNLIE, PRINCIPLES OF PUBLIC INTERNATIONAL LAW 273 (6th ed., 2003) ("Environmental concerns have for long been reflected in general international law.").

[90] *See* Outer Space Treaty, *supra* note 2, at art. 1. *Accord* Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space art. 2, G.A. Res. 1962 (XVIII), U.N. Doc. A/RES/1962 (Dec. 24, 1963), 3 I.L.M. 157 [hereinafter Declaration of Legal Principles] ("Outer space and celestial bodies are free for exploration and use by all States on a basis of equality and in accordance with international law.").

[91] Outer Space Treaty, *supra* note 2, at art. II; Declaration of Legal Principles, *supra* note 90, at art. 3.

[92] Outer Space Treaty, *supra* note 2, at art. VII; Declaration of Legal Principles, *supra* note 90, at art. 7.

[93] Outer Space Treaty, *supra* note 2. at art. III; Liability Convention, *supra* note 49,at art. XII; Declaration of Legal Principles, *supra* note 90, at art. 4.

[94] BROWNLIE, *supra* note 89, at 283. *See Legality of the Threat or Use of Nuclear Weapons* 1996 I.C.J. 226, 241-42. *See also* Trail Smelter Arbitration (U.S. v. Canada), Trail Smelter Arbitral Tribunal, 3. R. Int'l Arbitral Awards 1905 (1941).

The treaties also strive to prevent damage caused to the outer space activities or interests of one state by another state.[95] In its preambulatory material, the Liability Convention highlights that launching states must take "precautionary measures . . . in the launching of space objects," but recognizes that space objects nevertheless may cause damage.[96] As if to acknowledge the inherent risks of space activities, the treaties oblige States to conduct their activities in outer space with "due regard" for the activities and interests of other States party to the treaties,[97] and prohibit causing "harmful contamination" to outer space through their activities.[98] Finally, States are urged not to cause "harmful interference" to the activities and interests of other States, and are obliged to initiate consultations with those nations to whom they anticipate their own activities may cause harm.[99] Keeping in mind the pervasive themes of maintaining "international peace and security," promoting "international cooperation," and ensuring "mutual assistance" among States,[100] presumably space-faring nations must even conduct their activities with due regard for, and without harmful interference to, the interests of non-space-faring States. That is, States are obligated to take measures to ensure that the ability to use and explore the cosmos is available to future generations.[101] Because

---

[95] *See*, *e.g.*, Outer Space Treaty, *supra* note 2, at arts. VII, IX; Liability Convention, *supra* note 49, at arts II, III, VII; Declaration of Legal Principles, *supra* note 90, at arts. 5, 8. "The term 'damage' means 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 organizations." Liability Convention, *supra* note 49, at art. I(a).

[96] Liability Convention, *supra* note 49, at preamble .

[97] Outer Space Treaty, *supra* note 2, at art. 9; Declaration of Legal Principles, *supra* note 90, at art. 6.

[98] Outer Space Treaty, *supra* note 2, at art. IX.

[99] *Id.* art. IX; Declaration of Legal Principles, *supra* note 90, at art. 6.

[100] *See*, *e.g.*, Outer Space Treaty, *supra* note 2, at preamble and arts. III, V, VII, IX, X, XI; Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space, preamble, Apr. 22, 1968, 19 U.S.T. 7570, 672 U.N.T.S. 119 [hereinafter Rescue and Return Agreement]; Liability Convention, *supra* note 49, at preamble; Convention on Registration of Objects launched into Outer Space, preamble, Jan. 14, 1975, 1023 U.N.T.S. 15 [hereinafter Registration Convention]; Declaration of Legal Principles, *supra* note 90, at preamble and arts. 4, 6, 9.

[101] Outer Space Treaty, *supra* note 2, at preamble ("Recognizing the common interest of all mankind in the progress of the exploration and use of outer space for peaceful purposes"); Liability Convention, *supra* note 49, at preamble (same); Registration Con-

science and experience has empirically demonstrated that space debris indeed jeopardizes current and future exploration and use of outer space, it seems reasonable to suggest, at a minimum, intentional debris-creating activities are in derogation of the treaties. Still, the absence of specific prohibitions regarding debris makes it difficult to establish and enforce such an interpretation.

The treaties also provide a starting point for a legal definition of space debris—a prerequisite to establishing obligations regarding space debris at international law. The treaties repeatedly refer to the rights and duties of States with respect to "space objects." The clearest definitions of this term come from the Liability and the Registration Conventions, which state: "The term 'space object' includes component parts of a space object as well as its launch vehicle and parts thereof."[102] Probably because it predates the Liability and Registration Conventions, the Rescue and Return Agreement lacks this kind of specific definition, but refers inclusively to "a space object or its component parts."[103] The Outer Space Treaty, on the other hand, uses the term "space object" without defining it, and does so only in the context of launching.[104] Since "[t]he term 'launching' includes attempted launching," and because States retain jurisdiction and control—and are hence responsible for—space objects, their responsibilities extend to those objects that successfully make it to orbit as well as those that do not.[105] Thus, one can reasonably deduce that States retain responsibility for satellites (whether functional or not), satellite components, launch vehicles, launch vehicle components, and other associated components, whether in the intended orbit, some unintended orbit, or a suborbital trajectory. Conveniently, all of these objects—except, perhaps,

---

vention, *supra* note 100, at preamble (same); Declaration of Legal Principles, *supra* note 90, at preamble (same); Rescue and Return Agreement, *supra* note 100, at preamble ("Prompted by sentiments of humanity").

[102] Liability Convention, *supra* note 49, at art. 1(d); *accord* Registration Convention, *supra* note 100, at art. 1(b).

[103] *See* Liability Convention, *supra* note 49, at arts. 5(1)-(5).

[104] *See* Outer Space Treaty, *supra* note 2, at art. X.

[105] Liability Convention, *supra* note 49, at art. 1(b); *see also* Outer Space Treaty, *supra* note 2, at arts. VII (responsibility), VIII (jurisdiction and control).

fully functioning satellites—also likely fall within the scientific definition of "debris."[106] Yet, as mentioned previously, the treaties are completely barren of specific references to the term "debris."[107] Thus, objects like spent fuel and paint chips—which arguably were never "functional"—or the copper dipoles utilized by the United States in Project West Ford[108]—which were arguably "functional" for their entire orbital life—remain difficult to classify. Not surprisingly, this leaves the matter of what legally constitutes debris open to dispute.

If the treaties are ambiguous as to the definition of debris and the obligations arising therein, then the enforcement regime established under the laws of outer space remains difficult to execute. While the space treaties seek to hold States parties responsible for the damage they cause, and to compensate States parties who suffer reasonably avoidable harms in outer space,[109] it may not be possible to attribute debris to a specific State. Even though States are internationally liable for damage caused by objects they launch or procure the launch of, as well as those objects launched from their territory or facilities,[110] debris will likely not be on a State's registry, may be unidentifiable because it is the result of a previous accident, or may be too small to track and thus impossible to attribute to a "launching state." Failure to mitigate debris may have a deleterious effect on the near-Earth outer space environment, but this effect is probably legally insufficient to establish responsibility. Debris is often—though not always—difficult to positively identify, and thus it may be difficult to show any State's practices in outer space caused a specific harm. Additionally, accidents in outer space are difficult, if not impossible, to investigate and the space environment is extraordinarily harsh. Thus it is extremely diffi-

---

[106] *See supra* note 87 and accompanying text (providing technical definition of space debris).

[107] *See* Benko & Schrogl, *supra* note 5, at 752 (discussing absence of "debris" from all core space treaties).

[108] *See generally* I. I. Shapiro, *Last of the West Ford Dipoles*, 154 SCIENCE 1445 (1966); Richard N. Gardner, *Outer Space: A Breakthrough for International Law*, 50 A.B.A. J. 30 (1964).

[109] *See* Liability Convention, *supra* note 49, at arts. III, VI, VIII.

[110] Outer Space Treaty, *supra* note 2, at art. VII.

cult to determine whether debris is truly the cause of a specific event, or the sole cause of such event. Consequently, while the legal regime in outer space intimates against debris-causing practices, it neither restricts States from creating, nor requires States to prevent, debris in outer space.

While all of the aforementioned provisions are binding upon States parties, and several are binding on all nations as customary international law,[111] none of these provisions squarely address the matter of space debris. Thus, only inferential conclusions can be drawn from the prevailing legal language with respect to space debris mitigation. This is most likely because the critical issues at the time the space treaties were drafted concerned liability and remuneration, as well as protecting outer space from weaponization and protection of civilians from the inherently dangerous activity of space launch.[112] The prevailing "Big Sky Theory" hardly justified proactive debris mitigation regulations.[113] Moreover, implications of several provisions might actually impede the mitigation of space debris. For example, the Agreement on the Rescue of Astronauts states, "Upon request of the launching authority, objects launched into outer space or their component parts found beyond the territorial limits of the launching authority shall be returned to or held at the disposal of representatives of the launching authority, which shall, upon request, furnish identifying data prior to their return."[114] Since outer space is beyond the territorial limits of a State, a plain meaning interpretation of this provision suggests that debris mitigation may require orbital debris to be returned to the launching State to the extent the launching State can be

---

[111] Andrei D. Terekhov, *U.N. General Assembly Resolutions and Outer Space Law*, *in* SPACE LAW: A TREATISE 101, 103–05 (Francis Lyall & Paul B. Larsen eds., 2009) (describing the position of the United States and the U.S.S.R, that the Declaration of Legal Principles constitutes customary international law).

[112] Benko & Schrogl, *supra* note 5, at 751.

[113] James Dunstan & Berin Szoka, *Beware of Space Junk*, FORBES.COM, Dec. 17, 2009, http://www.pff.org/issues-pubs/ps/2009/pdf/ps5.14-beware-of-space-junk.pdf; Jim Wolf, *Iridium Says In Dark Before Orbital Crash*, REUTERS, Feb. 12, 2009, http://www.reuters.com/article/idUSN1244243120090212; John J. Kruzel, *General Calls for Focus on Protecting Satellites*, AMERICAN FORCES PRESS SERVICE, Nov. 5, 2009, http://www.globalsecurity.org/space/library/news/2009/space-091105-afns01.htm.

[114] Rescue and Return Agreement, *supra* note 100, at art. 5(3).

identified.[115] Consequently, active debris mitigation practices which resemble the practice of salvage in maritime law, may be prohibited under the laws of outer space.[116] Still, it is unfathomable that under international law States could be free from all obligations regarding debris, though, as previously noted, minimal preventative obligations without enforcement mechanisms are inherently weak an international law. This perception has led some to call for a positivistic legal regime to address space debris.[117] Nevertheless, several space-faring States have adopted an alternative approach to space resource management; one not contemplated by Hardin and his proponents—self-governance.

---

[115] Plain meaning interpretation is a cannon of customary international law, and is codified at Article 31 of the Vienna Convention on the Law of Treaties. *See* Evan J. Criddle, *The Vienna Convention on the Law of Treaties in U.S. Treaty Interpretation*, 44 VA. J. INT'L L. 431, 438-39 (2004). While the United States is not party to the Vienna Convention, the International Court of Justice has recognized that several provisions of the Convention, including the rules for treaty interpretation, constitute customary international law. *See, e.g.*, Competence of the General Assembly for Admission of a State to the United Nations, Advisory Opinion, 1950 I.C.J. 4, 8 (Mar. 3) ("The Court considers it necessary to say that the first duty of a tribunal which is called upon to interpret and apply the provisions of a treaty, is to endeavor to give effect to them in their natural and ordinary meaning in the context of which they occur.").

[116] While this article does not attempt to design a salvage scheme for outer space, the author notes that the jurisdiction and control provision of the Outer Space Treaty, *supra* note 2, at art. VIII, and the harmful interference provision, *id.* at art. IX, militate against national salvage activities except in the case of that State's own space objects. For an alternative view, see generally Craig Fishman, Comment, *Space Salvage: A Proposed Treaty Amendment to the Agreement on Rescue of Astronauts, the Return of Astronauts, and the Return of Objects Launched into Space*, 26 VA. J. INT'L L. 965 (1986).

[117] *See supra* note 20 and accompanying text.

III. DUE REGARD FOR THE DEBRIS PROBLEM

The continuing relevance of the principle of state responsibility is not to be underestimated. The difficulty is that state responsibility, like duty situations in the law concerning civil responsibility in national systems, depends ultimately upon the emergence of social and moral criteria which are generally acceptable.[118]

A. State Debris Mitigation Policies—Initial Attempts at Mitigation

Despite the several inferences drawn from the aforementioned international agreements, the legal regime in outer space is devoid of specific duties with regard to orbital debris. Yet this vacuum has not prevented States and international organizations from taking measures to begin to mitigate the problem. "Following the establishment in 1995 of detailed space debris mitigation guidelines for all NASA space projects and programs, several additional space debris mitigation policies were developed, including by the space agencies of Japan, France, and Russia, as well as the European Space Agency."[119] A 1997 report by the United Nations (UN) Committee on the Peaceful Uses of Outer Space (COPUOS) reflects five key areas of concentration by States in mitigating orbital debris: (1) avoidance of mission-related objects; (2) improved structural integrity of space objects; (3) de-orbiting and reorbiting of space objects; (4) protection by shielding; and (5) collision avoidance.[120]

The first and most self-interested area of prevention involves protecting active on-orbit payloads from debris.[121] Japan's National Space Development Agency (NASDA) requires that operators avoid releasing mechanical devices during satellite

---

[118] BROWNLIE, *supra* note 89, at 283.

[119] Johnson, *supra* note 10, at 907.

[120] *See generally* U.N. Comm. on Peaceful Uses of Outer Space, *Steps Taken By Space Agencies For Reducing The Growth Or Damage Potential Of Space Debris*, U.N. Doc. No. A/AC.105/681 (Dec. 17, 1997) [hereinafter Steps Taken 1997].

[121] States obviously have an interest in protecting their national space systems. Thus, measures taken in this arena, though voluntary, have the impact of protecting a State's own systems from self-created debris as well as protecting other States' national space systems.

separation and solar panel deployment.[122] The French National Center for Space Studies (CNES)[123] limits operators to one piece of passive space debris per satellite launched and proscribes the use of solid propellants on orbit due to the clouds of aluminum particles they produce.[124] CNES also requires operators to conduct a thorough pre-launch mission analysis to "guarantee" no orbital collision will occur.[125] To prevent the creation of new debris, private space operators in the United Kingdom are designing new satellites with an emphasis on securing all component parts to the spacecraft structure, especially those susceptible to breakage during launch and early orbit operations,[126] while the Canadian Radarsat program was designed with the requirement of containing any debris created during launch and early orbit.[127] Similarly, the Russian Federation has undertaken measures to eliminate the separation of staging materials from satellite launch vehicles in order to prevent creating new debris.[128] COPUOS has recognized that while these measures will successfully decrease the growth rate of orbital debris, they do not alone solve the debris problem, as the total number of orbital debris will continue to rise.[129]

Spacefaring nations have also sought to prevent the break-up of space-objects, namely inert objects like launch vehicle upper-stages. This process may—though not necessarily—involve significant technical and financial investment for redesigning equipment.[130] Yet such investment does not ultimately serve the on-orbit mission. Consequently, these processes may be seen as lacking a short-term return on investment. Nevertheless, such

---

[122] Steps Taken 1997, *supra* note 120.

[123] *Centre National d'Études Spatiales*.

[124] Steps Taken 1997, *supra* note 120.

[125] Operators must establish that the probability of orbital collision is less than 1.10^{-4}. *Id.*

[126] *Id.*

[127] Examples include explosive bolts or tethers which are frequently released during solar panel or antenna deployment. *Id.*

[128] *Id.*

[129] *Id.*

[130] For example, the *Ariane-4* upper stage was modified by adding two pyrotechnic valves to the fuel tank pressurization circuit, forcing the tank to open at the end of the launch vehicle mission. This design feature was implemented after the on-orbit explosion of an Arian 4 upper stage only nine months after the 1986 *SPOT-1* launch. *See id.*

measures are critical to slow the growth rate of orbital debris, which unequivocally reduces the threat to active payloads, ultimately prolonging the mission life of these systems. For example, NASA requires venting Delta upper stages of unspent propellants and gases to prevent explosions caused by volatile leftover fuel.[131] Since 1985, NASDA has employed a similar policy.[132]

A third method of decreasing the quantity of debris in Earth orbit is the removal of mission payloads from active orbits at the end of mission life. NASA, NASDA, and the Russian Federation have employed one or several of these techniques for disposal of low Earth orbiting satellites. NASA, NASDA, CNES, the Russian Federation, and ESA have employed the technique of reorbiting geosynchronous satellites to a disposal altitude.[133] Yet, regardless of the circumstances under which these techniques are employed, two considerations must be weighed when implementing these practices. First, the altitude of the operational orbit will determine whether a controlled reentry can be used to remove the satellite from the near-Earth environment, or whether a boost maneuver must be executed to push the satellite further into space and away from other active payloads.[134] Second, the fuel budget for the satellite mission must incorporate sufficient fuel reserves to accomplish the de-orbit or reorbit maneuver. These reserves will likely increase satellite cost[135] by

---

[131] *Id.*

[132] Steps Taken by Space Agencies for Reducing the Growth or Damage Potential of Space Debris, U.N. Doc. No. A/AC.105/663 (Dec. 13 1996) [hereinafter Steps Taken 1996].

[133] The International Telecommunications Union (ITU) recommends that satellites in geosynchronous orbit be disposed at an altitude of 300 kilometers above GEO. However, several older satellites were not designed with sufficient fuel reserves to accomplish this, as earlier estimates suggested 40-70 kilometers was sufficient. Steps Taken 1997, *supra* note 120.

[134] There are generally three end-of-life options for removing spacecraft from orbit: direct retrieval and de-orbit (i.e., using the STS to directly recover a satellite fro LEO); maneuver to a lower orbit at which altitude atmospheric drag or gravity will cause atmospheric reentry; or maneuver to a predetermined disposal orbit at an altitude where the space object will not interfere with active orbital payloads. *Id.*

[135] *See id.* ("since planned disposal is a new concept in most cases, it is perceived as a significant added cost burden on new programmes").

shortening the total on-orbit life of the satellite,[136] or by increasing the required capacity of the launch vehicle.[137]

As noted, the majority of the debris in Earth orbit escapes the tracking capabilities of even the most sophisticated space surveillance systems.[138] Thus, States have recognized that shielding is the "only alternative to collision avoidance" maneuvers.[139] Shielding against small debris has a two-fold effect on a national space activity. First, it protects the State's investment in the technology deployed to orbit, helping to maximize the State's return on investment by preventing mission degradation.[140] Additionally, shielding protects systems from potential break-up causing impacts, thereby preventing accidents which might create more debris. Consequently, several national and international space programs have adapted debris shielding measures. For example, the *International Space Station* (*ISS*) is protected against impacts by debris one centimeter or smaller, and the most effective shielding is placed in the highest-risk areas of the station: the forward-facing components.[141] Similarly, *ISS* crewmembers are protected during extravehicular activities by multi-layered spacesuits and redundant oxygen systems.[142] High-fidelity modeling and simulation was used to create shielding for Canada's *Radarsat*.[143] Relying on NASA databases containing observed and extrapolated debris hazards, Canadian

---

[136] For most satellites, the on-orbit life is more constrained by fuel budget than by any other factor. Since fuel is necessary for attitude control, a satellite without sufficient fuel can become effectively uncontrollable, and likely will not be able to continue to serve its intended mission. *See* Steps Taken 1997, *supra* note 120 ("To reboost for 300 kilometres is comparable to three months station-keeping.").

[137] Satellite fuel directly translates to satellite mass, which requires a greater lift capacity to achieve the same orbital attitude. SPACECRAFT SYSTEMS ENGINEERING, *supra* note 55, at 3, 241.

[138] *See supra* notes 72-74 and accompanying text (discussing the tracking abilities of the U.S. Space Surveillance Network and estimating the number of untrackable pieces of debris in orbit).

[139] Steps Taken 1997, *supra* note 120, at 7.

[140] *See* Nicholas L. Johnson, The Threat of Orbital Debris and Protecting NASA Space Assets from Satellite Collisions, presented April 28, 2009, at slide 7, *available at* http://www.secureworldfoundation.org/siteadmin/images/files/file_308.pdf (noting that "[u]nshielded portions of satellite subject can lead to mission degradation or loss").

[141] Steps Taken 1997, *supra* note 120, at 8.

[142] *Id.*

[143] *Id*.

scientists predicted the debris environment for *Radarsat* based on its orbital parameters. They then modeled the debris vulnerability of individual satellite components to determine how best to shield against the predicted hazard.[144] Again, this approach not only protects the Canadian investment in the *Radarsat* program, but decreases the likelihood of an on-orbit break-up due to debris impacts.

Finally, States have adopted collision avoidance procedures to mitigate the risk of on-orbit breakups. When an identified, trackable object is expected to pass within a predefined, mission-specific proximity to an orbiting spacecraft, operators conduct calculated maneuvers to increase the miss distance between the two. Indeed, the U.S. *Space Transportation System* executed three collision avoidance maneuvers between 1986 and 1997.[145] Similarly, the *International Space Station* has conducted several such maneuvers.[146]

As evidenced by the voluntary adoption of domestic debris mitigation practices, States recognize that "[o]rbital debris poses a risk to continued reliable use of spacebased services and operations and to the safety of persons and property in space and on Earth."[147] However, in order to promote the cooperative spirit embodied in these practices, major spacefaring States have moved toward establishing international debris mitigation guidelines.

B. International Debris Mitigation Guidelines—the Current State of Affairs

"In recent years, emphasis has shifted from national efforts to control the space debris population to international ones. . . . Today, a firm international consensus is rapidly building on the principal space debris mitigation measures."[148] Specifically, the

---

[144] *Id.*
[145] *Id.* at 9; Steps Taken 1996, *supra* note 132, at 5.
[146] The Threat of Orbital Debris, *supra* note 140.
[147] NSPD-49, *U.S. National Space Policy*, at 9 (2006).
[148] Johnson, *supra* note 10, at 907.

IADC[149] and the Committee on the Peaceful Uses of Outer Space (COPUOS) of the United Nations identified four common practices among major space-faring states: (1) limitation of debris released during normal operations; (2) minimization of the potential for on-orbit break-ups during and after space operations; (3) post-mission disposal recommendations for vehicles in low Earth orbit (LEO),[150] geosynchronous Earth orbit (GEO),[151] and other orbital regimes; and (4) prevention of on-orbit collisions.[152] From these "best practices," the UNCOPUOS developed seven international guidelines with the goal of developing "wider acceptance among the global space community."[153] This section briefly reviews the substance of these guidelines.

1. Guideline 1: Limit debris released during normal operations

Guideline 1 acknowledges "the threat posed by" space debris, and seeks to eliminate the practice of releasing debris during the conduct of space activities.[154] The text specifically refers to common debris-causing practices during the advent of the space age, and suggests that States discontinue any such practices where "feasible."[155]

2. Guideline 2: Minimize the potential for break-ups during operational phases

This guideline calls upon States to incorporate break-up prevention into the design of operational space systems. It also guides satellite operators to take steps to deactivate and dispose

---

[149] The IADC is an association of the space agencies of ten countries (China, France, Germany, India, Italy, Japan, Russia, Ukraine, the United Kingdom, and the United States) and the European Space Agency, representing 17 countries of which four (France, Germany, Italy, and the United Kingdom) are also full IADC members.

[150] Below 2000 km altitude. *See* U.N. Comm. on Peaceful Uses of Outer Space, *Inter-Agency Space Debris Coordination Committee Space Debris Mitigation Guidelines*, ¶ 3.3.2(1), U.N. Doc. A/AC.105/C.1/L.260 (Nov. 29, 2002) [hereinafter IADC Guidelines].

[151] An altitude of 35,786 km ± 200 km. *Id.*

[152] *See generally id.*

[153] Space Debris Mitigation Guidelines, *supra* note 82, at 42.

[154] *Id.* at 43 ("Space systems should be designed not to release debris during normal operations. If this is not feasible, the effect of any release of debris on the outer space environment should be minimized.").

[155] *Id.*

of satellites in a manner so as to reduce the likelihood of catastrophic malfunctions while on orbit.[156]

3. Guideline 3: Limit the probability of accidental collision in orbit

Guideline 3 implicitly recognizes Kessler's predictions regarding debris growth arising from collisions between objects in orbit.[157] It recommends that States rely on orbital data in the planning, scheduling, and execution of their launch activities so as to avoid collisions. It further recognizes the value of collision avoidance maneuvers for on orbit systems in preventing debris.

4. Guideline 4: Avoid intentional destruction and other harmful activities

Guideline 4 calls upon States to minimize the intentional destruction of objects in space. It recognizes the potential for harm that such destruction can cause, and recommends that, where unavoidable, intentional destruction of objects in space "should be conducted at sufficiently low altitudes to limit the orbital lifetime of resulting fragments."[158]

5. Guideline 5: Minimize potential for post-mission break-ups resulting from stored energy

Recognizing that the majority of cataloged space debris originated from non-operational space vehicles and launch stages, Guideline 5 calls upon to states to "remove all forms of stored energy"[159] from these objects by venting residual fuel, and other compressed fluids and gasses. It also recommends the discharge of "all electrical storage devices."[160]

---

[156] *Id.* at 43-44.
[157] *Id.* at 44.
[158] *Id.*
[159] A process called "passivation." *Id.*
[160] *Id.*

6. Guideline 6: Limit the long-term presence of spacecraft and launch vehicle orbital stages in the low Earth orbit region after the end of their mission

Because the greatest concentration of space debris exists in LEO, Guideline 6 calls upon States to actively remove objects from LEO where possible. It recommends de-orbiting objects in a controlled manner so that they disintegrate in the atmosphere, or alternatively, return to the Earth's surface in a manner that protects people, property, and the environment from "undue risk."[161] Where de-orbit is not possible, the guideline recommends transferring objects to a "disposal orbit" that removes the objects from LEO.

7. Guideline 7: Limit the long-term interference of spacecraft and launch vehicle orbital stages with geosynchronous region after the end of their mission

Guideline 7 applies exclusively to objects in GEO, and calls upon States to boost satellites to an altitude beyond GEO at the end of mission life so as to avoid future interference with GEO activities.[162] Compliance with Guidelines 6 and 7 thus requires operators to account for disposal operations in a space object's fuel budget.

"Adherence to the aforementioned space debris mitigation policies and guidelines is gaining momentum yearly."[163] Though they are expressly "not legally binding under international law,"[164] they influence the behavior of States in the conduct of space activities. As the next section will explain, such non-binding international agreements are important political tools in international relations. And with time, continued State adherence to the guidelines, and international reliance upon the

---

[161] *Id.* at 45.

[162] *Id.*

[163] Nicholas L. Johnson, *Recent Developments in Space Debris Mitigation Policy and Practices*, at 4, *available at* http://ntrs.nasa.gov/archive/nasa/casi.ntrs.nasa.gov/20060052514_2006254659.pdf.

[164] Space Debris Mitigation Guidelines, *supra* note 82, at 42.

guidelines, they may eventually take on a more concrete legal form.

IV. ENLIGHTENED STATE-INTEREST: A COOPERATIVE LEGAL REGIME FOR TRAGEDY MITIGATION

Hardin's conclusion that rational actors are unlikely to cooperate in the case of common resources is consistent with the results of what economists call the "prisoner's dilemma." In this game:

> Two prisoners, unable to confer with one another, must decide whether to take the prosecutor's offer: confess, inculpate the other, and serve a year in jail, or keep silent, and serve five years. If the prisoners could make a . . . bargain with each other, they would keep silent and both go free. But they can't communicate, and each fears that the other will talk. So both confess.[165]

In fact, the prisoner's dilemma plays out in a number of "social dilemmas," which "occur whenever individuals in interdependent situations face choices in which maximization of short-term self-interest yields outcomes leaving all participants worse off than feasible alternatives."[166]

Still, the game's primary constraint, namely that the players cannot communicate, belies its applicability to the management of international common resources. Indeed, social scientists have observed that in both single and multiple iterations of the prisoner's dilemma, where the players can communicate their intentions, both are more likely to choose to remain silent, despite the potential the other will default, thus achieving the

---

[165] Page v. United States, 884 F.2d 300, (1989) (Easterbrook, J.). *See also* ROBERT AXELROD, THE EVOLUTION OF COOPERATION 7-8 (1984) ("In the prisoner's dilemma game there are two players. Each has two choices, namely cooperate or defect. . . . The dilemma is that if both defect, both do worse than if both cooperated.").

[166] Elinor Ostrom, *A Behavioral Approach to the Rational Choice Theory of Collective Action*, *in* POLYCENTRIC GAMES AND INSTITUTIONS: READINGS FROM THE WORKSHOP IN POLITICAL THEORY AND POLICY ANALYSIS 472, 473 (Michael D. McGinnis ed. 2000) [hereinafter *A Behavioral Approach*].

optimal outcome—freedom.[167] Communication yields enlightenment, which in turn yields optimal decision making.

This "enlightened-self interest," has been observed in several settings, and the concept can be traced back to Alexis de Tocqueville's observations of the burgeoning American society. Tocqueville described a continental society of individuals, each exercising individual sovereign rights. Strong analogies can be drawn between that post-Revolutionary community and the international community today—at least as it relates to outer space. As a medium of human interaction, outer space is relatively young, not unlike the early American continent. And like the earliest Americans, State actors are inherently sovereign—their decisions and actions are subject only to the structures and institutions to which they surrender their sovereignty. Returning to law and economics, in the case of States with national space programs, States themselves function as actors, generally pursuing national interests through rational decision-making. Arguably, the most "efficient" decisions are those which produce the greatest utility at the absolute lowest cost. Yet, with common resources, economists have recognized the role of self sacrifice in generating the greatest individual utility because it respects the role of the individual as a member of the community. Nobel Prize winning economist Elinor Ostrom notes that research "shows that individuals systematically engage in collective action to provide local public goods or manage common-pool resources without an external authority to offer inducements or impose sanctions."[168] This dynamic, what Tocqueville called "self-interest well understood,"[169] or in this case "enlightened *State*-interest" reflects the realization that a State's "enlightened love of [itself] constantly brings [the State] to aid [others] and disposes [the State] willingly to sacrifice a part of [its] time and [its] wealth to the good of [all States]."[170]

---

[167] *See, e.g.*, *Collective Action and the Evolution of Social Norms*, *supra* note 41, at 140.

[168] *A Behavioral Approach*, *supra* note 166, at 474-75.

[169] ALEXIS DE TOCQUEVILLE, DEMOCRACY IN AMERICA 501 (Harvey C. Mansfield & Delba Winthrop, trans. & eds. 2002).

[170] *Id.*

A. Rational Choice, Legal Incentives, & International Cooperation

State decisions with regard to space debris can accurately be characterized on the basis of economic rationality. As previously mentioned, the decisions States make with regard to global commons reveal their preferences. In the case of outer space, where States commit time and resources to the development of guidelines, and when States voluntarily accept and adhere to such guidelines despite their being *sans portée juridique* (without legal effect),[171] States reveal a preference for cooperation in the management of the near Earth space environment. On its face, this preference does not appear to be one that maximizes the economic utility of space for an individual spacefaring state, yet viewed through the lens of enlightened State-interest, the decision appears perfectly rational. Indeed, COPUOS has recently recognized that "the implementation of voluntary guidelines for the mitigation of space debris at the national level would increase mutual understanding on acceptable activities in space, thus enhancing stability in space and decreasing the likelihood of friction and conflict."[172] States obviously have an interest in these ends, and their decisions to voluntarily and cooperatively mitigate debris reflect the relative values they assign to such ends. Furthermore, enlightened space debris decision-making is likely to produce collateral effects that will help establish international collective norms.

The first such effect regards the ease with which non-binding guidelines can be enacted. Non-binding international agreements—what some authors refer to as "soft law"[173]—are "best understood as . . . device[s] for minimizing the impediments to cooperation, at both the domestic and international

---

[171] International Status of South-West Africa, Advisory Opinion, 1950 I.C.J. 128, 140 (Jul. 11).

[172] Report of the Scientific and Technical Subcommittee on its Forty-sixth Session, U.N. Doc. A/AC.105/933, at 13, para. 68 (2009).

[173] ANDREW T. GUZMAN, HOW INTERNATIONAL LAW WORKS: A RATIONAL CHOICE THEORY 142 (2008).

levels."[174] Soft law "requires less domestic process than do treaties,"[175] is more flexible than treaty law, is more easily amended, and can be concluded and implemented quickly.[176] Yet scholars note that these benefits come with a cost.[177] In this case, the IADC and COPUOS debris mitigation guidelines are not binding, and thus, may be criticized as lacking the force necessary to effectively prevent the scenarios discussed above.

Despite the non-binding nature of the various debris mitigation guidelines, "there is nonetheless an expectation of, and reliance upon, compliance by the parties."[178] This expectation carries a moral or political weight at international law, one which can be expected to influence the behaviors of space-faring states.[179] International agreements have both an internal effect—they provide direction to State officials and "should give rise to an internal legislative or administrative response"—and an external effect—they provide bases upon which States can comment about the conduct of other states.[180] Thus, international political reputation can be damaged even without violation of international law. Presumably States adopting any of the various debris guidelines take seriously their reputations with respect to space activities.[181] Thus, the mere possibility that a State's space activities might be viewed by international part-

---

[174] Charles Lipson, *Why are Some International Agreements Informal?*, *in* INTERNATIONAL LAW AND RELATIONS 293, 298 (Beth A. Simmons & Richard H. Steinberg eds. 2006).

[175] GUZMAN, *supra* note 173, at 145.

[176] *Lipson*, *supra* note 174, at 298-99. Professor Lipson notes that, "[I]n complex, rapidly changing environments, speed is a particular advantage." *Id.* at 299.

[177] *Id.*

[178] Oscar Schachter, *The Twilight Existence of Non-binding International Agreements*, 71 AM. J. INT'L L. 296, 299 (1977).

[179] *Id.* at 303 (noting that non-binding agreements are still "agreements which the parties intend to observe and which they consider to impose restraints on their freedom to act as if the agreements did not exist.").

[180] *Id.* at 303-04.

[181] *See* GUZMAN, *supra* note 173, at 144 ("A failure to comply with the provisions of soft law can, just as is the case for treaties, lead to reputational harm, reciprocal non-compliance, and retaliation. The incentive may be weaker (all else equal) for soft law, but the basic mechanism encouraging compliance is the same."); *id.* at 40 ("[T]here seems to be near universal agreement that states are, indeed, concerned with their reputations. Even critics of reputational theories in political science and international law skeptics concede as much.") (internal citations omitted).

ners as in derogation of accepted guidelines should be enough to at least give pause to national policymakers. Moreover, game theory suggests that players in an iterative prisoner's dilemma, when given the opportunity to communicate, rely on the reputation of fellow players—in other words, a player's history of cooperating or defaulting—when making their own decision as to whether to default or cooperate.[182] Consequently, the cooperative nature of the various debris mitigation guidelines, at least in theory, should significantly persuade State compliance. This theory is supported by State practice in other arenas. For example, Guzman has demonstrated that rational States "evaluate the behavior of all other states, whether friend or foe, by using the available evidence and rationally attributing behavior to reputational or nonreputational payoffs on the basis of information the observer possesses."[183] While Guzman notes that "[t]he relative importance of an international legal obligation affects the reputational consequences of violating it"[184]—which would suggest that non-binding debris mitigation guidelines are relatively inefficetive, as they carry no *legal* weight—he further explains that "[t]he most important obligations are those where cooperation yields large gains."[185] Because debris mitigation requires the collective management of a global commons, even non-binding guidelines can have a significant effect on State practice.

Moreover, adoption of internationally recognized debris guidelines may estop a State from pursuing significant debris-causing activities in outer space. "By entering into an international pact with other states, a party may be presumed to have agreed that the matters covered are no longer exclusively within its concerns."[186] Consequently, "when other parties make representations or offer criticism about conduct at variance with the undertakings in the agreement, the idea of a commitment is reinforced, even if it is labeled as political or moral."[187] Scientists

---

[182] *A Behavioral Approach*, *supra* note 166, at 494-96.
[183] GUZMAN, *supra* note 173, at 77.
[184] *Id.* at 85.
[185] *Id.*
[186] Schachter, *supra* note 178, at 304.
[187] *Id.* at 304.

recognize that "a firm international consensus is rapidly building on the principal space debris mitigation measures."[188] Thus, at least the 26 members of the IADC,[189] and possibly all current (and future) space-faring members of the UN, could not legitimately subvert the provisions and recommendations that they themselves drafted and adopted.

Nevertheless, where cooperation among States would be difficult in the absence of an agreement, States place significant import on the agreement while simultaneously possessing strong incentives to defect.[190] Thus, the effectiveness of non-binding debris mitigation guidelines will likely require something more than mere reputational persuasion. Fortunately, the nature of cooperative arrangements, especially those regarding outer space, are well suited to reciprocity.[191] Traditional acts of reciprocity may involve a party's suspension of its obligations in response to the violation of an obligation by another party. Clearly this form of reciprocity would be detrimental to a multilateral, cooperative arrangement like that which exists for mitigating space debris. Thus, other forms of reciprocity may help to ensure compliance with these legally non-binding guidelines. For example, States party to the *International Space Station* Intergovernmental Agreement may condition membership or benefits therein on compliance with the debris guidelines. A space-faring non-party, like China, might be compelled (politically, not legally) to adhere to the guidelines in order to obtain party status. Alternatively, Russia might choose to withhold launch services from parties or non-parties on the basis of non-compliance with the guidelines. As Guzman notes, "[r]eciprocity

---

[188] Johnson, *supra* note 10, at 907.

[189] *See supra* note 14.

[190] GUZMAN, *supra* note 173, at 85. The incentive to defect is high when trust between parties is low, or when a party's reputation for compliance is low, since the worst outcome for a player in a two-party prisoner's dilemma game occurs when that player cooperates while the other defects. In a multi-party game, the outcome becomes that of a free-rider, where the defecting player bears none of the costs of cooperation, but enjoys all the benefits of the cooperative arrangement.

[191] Guzman defines reciprocity as "an adjustment in a state's behavior motivated by a desire to maximize the state's payoff in light of new circumstances or information." *Id.* at 33.

can serve as a powerful compliance-enhancing tool in the right circumstances."[192]

B. Could Non-Binding Guidelines Become Binding Customary Norms?

To minimize [the] value [of nonbinding international agreements] would exemplify the old adage that "the best is the enemy of the good." It would seem wiser to recognize that nonbinding agreements may be attainable when binding treaties are not and to seek to reinforce their moral and political commitments when they serve ends we value.[193]

Because, "the normative value of an instrument does not necessarily depend on its formal legal status,"[194] documents formally recognized as nonbinding may still constitute "evidence of the acceptance by the participating States of certain principles as principles of customary or general international law."[195] Indeed, "[a]s long as they do last, even nonbinding agreements can be authoritative and controlling for the parties. There is no *a priori* reason to assume that the undertakings are illusory because they are not legal."[196] Certainly some scholars have argued that, without legally binding regulations, States may not be willing to restrict their production of space debris.[197] Yet scientists have noted that, "[o]verall, the prospects for controlling the near-Earth space debris environment are very bright, thanks to the dedication and energies of space debris scientists, the indus-

---

[192] *Id.* at 42.

[193] Schaechter, *supra* note 178, at 304.

[194] BROWNLIE, *supra* note 89, at 534.

[195] *Id.* at 535 (discussing the legal status of the Final Act of the Conference on Security and Co-operation in Europe, 14 I.L.M. 1292, Aug. 1, 1975). *See also* Case Concerning Nicaragua, 1986 I.C.J. 100 ("Acceptance of [an otherwise nonbinding text] confirms the existence of an *opinio juris* of the participating States . . . .").

[196] Schachter, *supra* note 178, at 304.

[197] *See, e.g.*, Benko & Schrogl, *supra* note 5, at 749 (describing Indonesia and China as a "leading space nation[s]," but noting that their short-term space goals are so motivated by financial constraints and market dominance that space debris is at a best an issue of secondary concern). *See also* Senechal, *supra* note 20, at 13 ("A global convention is needed for the simple reason that the successful approval of voluntary guidelines has not been consistent over the last years.").

trial aerospace community, and national organizations and governments."[198] In Ostrom's words, "[t]he self-interest of those who negotiated the [agreements] will lead them to monitor each other and to report observed infractions so that the [agreements are] enforced."[199] Thus, despite their legal impotence, the IADC and UNCOPUOS guidelines can achieve the desired effect.

Moreover, States' routine adherence to non-binding guidelines can establish the foundation upon which customary international law may be built.[200] Indeed, "the modern practice of states in the exploration and use of outer space continues to produce new customary rules."[201] These rules require a general, consistent, and uniform practice of adherence to widely accepted norms.[202] Arguably, the U.N. guidelines already meet these requirements. First, the guidelines adopted in 2008 were adopted by consensus of the general assembly, and reflect the uniform opinion of the twenty-six leading space nations with regard to debris mitigation practices. Thus, one can make a strong case that the guidelines reflect the *opinio juris* of the leading space States.[203] Second, States—though not bound to do so—have voluntarily enacted domestic laws conforming in whole or in part

---

[198] *Recent Developments in Space Debris Mitigation Policy and Practices*, *supra* note 163, at 5.

[199] ELINOR OSTROM, GOVERNING THE COMMONS: THE EVOLUTION OF INSTITUTIONS FOR COLLECTIVE ACTION 17 (1990).

[200] In the *Asylum Case*, the International Court of Justice indicated that a customary rule must be founded upon "a constant and uniform usage." Asylum Case (Columbia v. Peru), 1950 I.C.J. 266, 277 (Mon. Day) (holding that a rule of international law could not be discerned because the evidence disclosed uncertainty and contradiction).

[201] Vladlen S. Vershchetin & Gennady M. Danilenko, *Custom as a Source of International Law of Outer Space*, 13 J. SPACE L. 22, 23 (1985).

[202] *See id.* at 25. *See also* Nicaragua v. United States (Merits), 1986 I.C.J. 14, 108-09 (June 27) ("[F]or a new customary rule to be formed, not only must the acts concerned 'amount to a settled practice' but they must be accompanied by the *opinio juris necessitatis*. Either the States taking such action or other States in a position to react to it, must have behaved so that their conduct is 'evidence of a belief that this practice is rendered obligatory by the 'existence of a rule of law requiring it. The need for such a belief, ie, the existence of a subjective element, is implicit in the very notion of the *opinio juris sive necessitatis*.'" (citing North Sea Continental Shelf Case, 1969 I.C.J. 3, 44 (Feb. 20))).

[203] *See* JOHN O'BRIEN, INTERNATIONAL LAW 71 (2001) ("In the case of outer space law . . . the conduct of those states possessed of the requisite technology will assume a greater importance than the conduct of those states who do not participate in such activities.").

to the suggested guidelines. Consequently, there appears to be a growing pattern of adherence by States independent of binding legal obligation.[204] Though the guidelines have only recently been formally adopted, "the passage of only a short period of time is not necessarily, or of itself, a bar to the formation of a new rule of customary international law."[205] Thus, while States disclaim the binding nature of the UNCOPUOS and IADC debris mitigation guidelines, their adoption and implementation of, and their adherence to the basic principles therein, may establish customary norms with international legal effect.

V. CONCLUSION

Addressing the issue of space debris need not involve an overhaul of existing space laws or even amendment of these treaties.[206] Indeed doing so jeopardizes the continued viability of these foundational legal instruments.[207] Nor does it require enacting a new formal and legally binding treaty on the subject of debris. Instead of centralized control or private property regimes, cooperation remains the key to sustainable activity in outer space. States have already taken substantial steps to curtail their own debris creation internally, and the most agreeable and most effective of these steps have been compiled by the UNCOPUOS and unanimously adopted by the U.N. General

---

[204] However, scholars have criticized the 2007 actions of China in destroying its FY-1C satellite because of the orbital debris created by the event. *See* Mackey, *supra* note 57, at 85. The United States subsequently destroyed its *USA-193* satellite in orbit one year later, but several scholars have contrasted this even with the *FY-1C* event, noting specifically that "[e]stimates for the debris from *USA-193* indicate no remaining pieces in orbit after 40 days; meanwhile, modeling suggests that debris from Feng Yun may stay in orbit for up to 100 years." *Id.* at 89. *See also* Michael C. Mineiro, *FY-1C and USA-193 ASAT Intercepts: An Assessment of Legal Obligations Under Article 9 of the Outer Space Treaty*, 34 J. SPACE L. 321 (2008).

[205] North Sea Continental Shelf (Ger. v. Neth.), 1969 I.C.J. 42 (Feb. 20).

[206] *Contra* Benko & Schrogl, *supra* note 5, at 753 ("[T]he negotiations on space debris must not create a new and separate legal regime, but already existing and internationally adopted legal regulations have to be amended.").

[207] *See id.* at 752-53 (noting that renegotiating the provisions of the Outer Space Treaty or the Liability Convention might lead to an attempt by developing countries to soften the existing provisions, leaving the treaties in an altogether weaker position than their original condition). *Accord* Gabrynowicz, *supra* note 88, at 114 ("Because the Outer Space Treaty functions like a constitution, opening it for revision means that all of its provisions will be vulnerable to change.").

Assembly. It therefore appears that momentum is gaining, with regards to space debris mitigation, in such a way that formal legal mechanisms are unnecessary to protect the near-Earth space environment. Indeed, a law and economics analysis of the situation strongly suggests that cooperative arrangements and non-binding guidelines are more effective tools for common resource management than socialist legal regimes or private property rules. Consequently, current and future space-faring States, exercising "enlightened State-interest," can be expected to forgo some additional degrees of freedom in the exercise of their national space activities if doing so will ensure their long-term interests in outer space. Still, "because of negative externalities, individually rational decisions and socially optimal outcomes do not [generally] coincide."[208] Thus, the "core question" regarding collective action "is how potential cooperators signal one another and design institutions that reinforce rather than destroy conditional cooperation."[209] International channels of communication are essential to cooperative behavior, since rational actors in a prisoner's dilemma are likely to optimize outcomes only when communication occurs.

---

[208] Armin Falk, et al., *Appropriating the Commons: A Theoretical Explanation*, *in* NATIONAL RESEARCH COUNCIL, THE DRAMA OF THE COMMONS 157, 157 (2002).

[209] *Collective Action and the Evolution of Social Norms*, *supra* note 41, at 138.

BIBLIOGRAPHY

AVIATION AND SPACE LAW: RELEVANT PUBLICATIONS

P.J. Blount

AVIATION LAW

Laws and Regulations

European Union

European Commission Regulation (EU) No 18/2010 of 8 January 2010 amending Regulation (EC) No 300/2008 of the European Parliament and of the Council as far as specifications for national quality control programmes in the field of civil aviation security are concerned, 2020 J.O. (L 7) 3.

Commission Regulation (EU) No 133/2010 of 4 February 2010 amending Regulation (EC) No 820/2008 laying down measures for the implementation of the common basic standards on aviation security, 2010 J.O. (L 43) 1.

Commission Regulation (EU) No 134/2010 of 9 February 2010 amending Regulation (EC) No 820/2008 laying down measures for the implementation of the common basic standards on aviation security, 2010 J.O. (L43) 3.

European Parliament legislative resolution of 5 May 2010 on the proposal for a directive of the European Parliament and of the Council on aviation security charges (COM(2009)0217 – C7–0038/2009 – 2009/0063(COD)) on May 5, 2010, EUR. PARL. DOC. P7_TA-PROV(2010)0123 (2010).

United Kingdom

The Policing of Aerodromes (Belfast International Airport) Order 2010, S.I. 2010/575 (U.K. 2010).

The Air Navigation (Amendment) Order 2010, S.I. 2010/770 (U.K. 2010).

The Rules of the Air (Amendment) Regulations 2010, S.I. 2010/841 (U.K. 2010).

The Aviation Security Regulations 2010, S.I. 2010/902 (U.K. 2010).

The Civil Aviation (Working Time) (Amendment) Regulations 2010, S.I. 2010/1226 (U.K. 2010).

The Airports (Sale of Aircraft) Regulations (Northern Ireland) 2010, 2010 S.R. 2010/25 (N. Ir.).

United States

Fiscal Year 2010 Federal Aviation Administration Extension Act, Part II, Pub. L. No. 111–116 (2009).

Airport and Airway Extension Act of 2010, Pub. No. L. 111–161 (2010).

Final Rule on Aircraft Noise Certification Documents for International Operations, 74 Fed. Reg. 9327-9333 (Mar. 2, 2010).

Administrative Decisions

ITT Corporation, Systems Division, B-310102.6; B-310102.7; B-310102.8; B-310102.9, (Gov't Accountability Office, Dec. 4, 2009).

Lockheed Martin Systems Integration-Owego; Sikorsky Aircraft Company–Modification of Recommendation, B-299145.7; B-299145.8 (Gov't Accountability Office, Dec. 15, 2009).

Cases

Roberts v. Delta Air Lines, Inc., 599 F.3d 73 (1st Cir. 2010).

In re Delta Air Lines, Nos. 08-5002-bk, 08-5230-bk, 08-5236-bk, 2010 U.S. App. LEXIS 12829 (2d Cir. 2009).

Elassaad v. Independence Airlines, Inc., 604 F.3d 804 (3d Cir. 2010).

Revell v. Port Auth., 598 F.3d 128 (3d Cir. 2010).

News & Observer Publ'g Co. v. Raleigh-Durham Airport Auth., 597 F.3d 570 (4th Cir. 2009).

United States v. Wilkinson, 590 F.3d 259 (4th Cir. 2010).

Bremer Bank v. John Hancock Life Ins. Co., 601 F.3d 824 (8th Cir. 2010).

Friedman & Friedman v. Tim McCandless, Nos. 08-2976/08-3128, 2010 U.S. App. LEXIS 10550 (8th Cir. 2009).

Crandall v. City & County of Denver, 594 F.3d 1231 (10th Cir. 2010).

Raytheon Aircraft Co. v. United States, 590 F.3d 1112 (10th Cir. 2009).

Alaska Airlines, Inc. v. Transp. Sec. Admin., 588 F.3d 1116 (D.C. Cir. 2009).

Dillmon v. NTSB, 588 F.3d 1085 (D.C. Cir. 2009).

Donley v. Lockheed Martin Corp., No. 2009-1261, 2010 U.S. App. LEXIS 11822 (Fed. Cir. 2010).

Charter Servs. v. DL Air, LLC, No. 09-00281-KD-N, 2010 U.S. Dist. LEXIS 45177 (S.D. Ala. 2010). Bogor v. Am. Pony Express, Inc., No. 09-2260-PHX-JAT, 2010 U.S. Dist. LEXIS 57559 (D. Ariz. 2010).

Kitaguchi v. County of Ventura Dep't of Airports, No. CV 08-6839 ODW (SSx), 2009 U.S. Dist. LEXIS 111300 (C.D. Cal. 2009).

Nankin v. Cont'l Airlines, Inc., No. CV 09-07851 MMM (RZx), 2010 U.S. Dist. LEXIS 11879 (C.D. Cal. 2010).

Getz v. Boeing Co., 690 F. Supp. 2d 982 (N.D. Cal. 2010).

Goings v. Elliot, No. C 08-2544 PJH, 2010 U.S. Dist. LEXIS 26015 (N.D. Cal. 2010).

Gund v. Pilatus Aircraft, Ltd., No. C07-4902 TEH, 2010 U.S. Dist. LEXIS 22434 (N.D. Cal. 2010).

Hanni v. Am. Airlines, Inc., No. C 08-00732 CW, 2010 U.S. Dist. LEXIS 38436 (N.D. Cal. 2010).

Ibrahim v. Dep't of Homeland Sec., No. C 06-00545 WHA, 2009 U.S. Dist. LEXIS 122598 (N.D. Cal. 2009).

DA Air Taxi, LLC v. Diamond Aircraft Indus., No. 09-60157-CIV-UNGARO/SIMONTON, 2010 U.S. Dist. LEXIS 12696 (S.D. Cal. 2010).

Excel-Jet, Ltd. v. United States, No. 07-cv-02181-KHV-BNB, 2010 U.S. Dist. LEXIS 60056 (D. Col. 2010).

Lawson v. Western Skyways, Inc., No. 09-cv-01165-LTB-BNB, 2010 U.S. Dist. LEXIS 51872 (D. Col. 2010).

Telluride Reg'l Airport Auth. v. Am. Shelter Techs., Inc., No. 09-cv-00410-JLK-LTM, 2010 U.S. Dist. LEXIS 60151 (D. Col. 2010).

U. S. Aviation Underwriters, Inc. v. Pilatus Bus. Aircraft, Ltd., No. 01-K-2056, 2010 U.S. Dist. LEXIS 48678 (D. Col. 2010).

Aviamax Aviation Ltd. v. Bombardier Aero. Corp., No. 3:08-cv-1958 (CFD), 2010 U.S. Dist. LEXIS 45705 (D. Conn. 2010).

Goodspeed Airport, LLC v. E. Haddam Inland Wetlands & Watercourses Comm'n, 681 F. Supp. 2d 182 (D. Conn. 2010).

Ctr. Capital Corp. v. JR Lear 60-099, LLC, 674 F. Supp. 2d 569 (D. Del. 2009).

Jones v. Air Line Pilots Ass'n, Int'l, No. 09-1075, 2010 U.S. Dist. LEXIS 51483 (D.D.C. 2010).

Nat'l Bus. Aviation Ass'n v. FAA, 686 F. Supp. 2d 80 (D.D.C. 2010).

EHR Aviation, Inc. v. Starwood Aviation, Inc., No. 3:09-cv-210-J-32TEM, 2009 U.S. Dist. LEXIS 122943 (M.D. Fla. 2009).

Harris Corp. v. Fed. Express Corp., No. 6:07-cv-1819-Orl-28KRS, 2010 U.S. Dist. LEXIS 36994 (M.D. Fla. 2010).

Horowitch v. Diamond Aircraft Indus., No. 6:06-cv-1703-Orl-19KRS, 2010 U.S. Dist. LEXIS 52725 (M.D. Fla. 2010).

Avera v. United Air Lines, 686 F. Supp. 2d 1262 (N.D. Fla. 2009).

Beach-Mathura v. Am. Airlines, Inc., No. 08-21925-CIV-UNGARO/SIMONTON, 2010 U.S. Dist. LEXIS 37004 (S.D. Fla. 2010).

Castillo v. Cessna Aircraft Co., No.. 08-21850-CIV-GOLD/McALILEY, 2010 U.S. Dist. LEXIS 40678 (S.D. Fla. 2010).

Fly Braz. Group, Inc. v. Gov't of Gabon, No. 09-60239-CV-ZLOCH/ROSENBAUM, 2010 U.S. Dist. LEXIS 51566 (S.D. Fla. 2010).

King v. Cessna Aircraft Co., No. 03-20482-CIV-MORENO/TORRES, 2010 U.S. Dist. LEXIS 50728 (S.D. Fla. 2010).

Murillo v. Am. Airlines, Inc., No. 09-22894-Civ-COOKE/BANDSTRA, 2010 U.S. Dist. LEXIS 52607 (S.D. Fla. 2010).

Abdul-Rahim v. AirTran Airways, No. 1:08-CV-3857-TWT, 2009 U.S. Dist. LEXIS 121217 (N.D. Ga. 2009).

Aviation Fin. Group, LLC v. Duc Hous. Partners, Inc., No. CV 08-535-LMB, 2010 U.S. Dist. LEXIS 56661 (D. Idaho 2010).

Aeroground, Inc. v. Centerpoint Props. Trust, No.: 10 C 652, 2010 U.S. Dist. LEXIS 52204 (N.D. Ill. 2010).

City of Livonia Employees' Ret. Sys. v. Boeing Co., No.: 09 C 7143, 2010 U.S. Dist. LEXIS 52271 (N. D. Ill. 2010).

Graham v. Carter, No. 09 C 2360, 2010 U.S. Dist. LEXIS 14783 (N.D. Ill. 2010).

Hemme v. Airbus, No. 09 C 7239, 2010 U.S. Dist. LEXIS 31920 N.D. Ill. 2010).

SFG Commer. Aircraft Leasing, Inc. v. N59CC, LLC, No. 3:09 CV 101 PPS, 2010 U.S. Dist. LEXIS 20931 (N.D. Ind. 2010).

Ireland v. Dodson, No. 07-4082-JAR, 2010 U.S. Dist. LEXIS 29468 (D. Kan. 2010).

Stephenson v. Honeywell Int'l, Inc., No. 07-2494-JWL, 2010 U.S. Dist. LEXIS 32978 (D. Kan. 2010). Atia v. Delta Airlines, Inc., No. 08-150-DLB, 2010 U.S. Dist. LEXIS 18806 (E.D. Ken. 2010).

Crouch v. Honeywell Int'l, Inc., 682 F. Supp. 2d 788 (W.D. Ken. 2010).

Exec. Transp. Sys. LLC v. Louisville Reg'l Airport Auth., 678 F. Supp. 2d 503 (W.D. Ken. 2010).

Vesey Air, LLC v. Mayberry Aviation, LLC, No. 1:09-CV-00011-TBR, 2010 U.S. Dist. LEXIS 16578 (W.D. Ken. 2010).

Breaux v. Halliburton Energy Servs., No. 04-1636 C/W 05-0896 2009 U.S. Dist. LEXIS 112374 (E.D. La. 2009).

Tigert v. Am. Airlines, No. 09-958, 2009 U.S. Dist. LEXIS 120928 (W.D. La. 2009).

Dosso v. British Airways, PLC, No. AW-07-2710, 2010 U.S. Dist. LEXIS 542 (D. Md. 2010).

Errivares v. Transp. Sec. Admin., No. DKC 09-1138, 2010 U.S. Dist. LEXIS 13721 (D. Md. 2010).

Newman v. European Aeronautic Defence & Space Co. EADS N.V., No. 09-cv-10138, 2010 U.S. Dist. LEXIS 30558 (D. Mass. 2010).

Overka v. Am. Airlines, Inc., No. 08-10686-WGY, 2010 U.S. Dist. LEXIS 12300 (D. Mass. 2010).

Giasson Aero. Sci., Inc. v. RCO Eng'g, Inc., 680 F. Supp. 2d 830 (E.D. Mich. 2010).

Sweitzer v. Pinnacle Airlines, Inc., No. 1:09-CV-469, 2010 U.S. Dist. LEXIS 46983 (W.D. Mich. 2010).

GE Capital Corp. v. JLT Aircraft Holding Co., LLC, Civil No. 09-1200 (JNE/AJB), 2009 U.S. Dist. LEXIS 118543 (D. Minn. 2009).

Orsak v. Metro. Airports Comm'n Airport Police Dep't, 675 F. Supp. 2d 944 (Minn. 2009).Johnson v. Avco Corp., No. 4:07CV1695 CDP, 2010 U.S. Dist. LEXIS 33646 (E.D. Mo. 2010)

Ctr. Capital Corp. v. Eagle Jet Aviation, Inc., No. 2:09-cv-01367-RLH-PAL, 2010 U.S. Dist. LEXIS 38683 (D. Nev. 2010).

Sobel v. Hertz Corp.,No. 03:06-cv-00545-LRH-RAM, 2010 U.S. Dist. LEXIS 25276 (D. Nev. 2010).

U.S. Aviation Underwriters, Inc. v. WesAir, LLC, No. 2:08-CV-00891-PMP-LRL, 2010 U.S. Dist. LEXIS 42461 (D. Nev. 2010).

AIG Aviation Ins. & Curtis & Curtis v. Avco Corp., No. 09-352 BB/LFG, 2010 U.S. Dist. LEXIS 52132 (D.N.M. 2010).

Red Line Air, Inc. v. G. Howard Assocs., No. CV-09-3928 (RRM) (JMA), 2010 U.S. Dist. LEXIS 55955 (E.D.N.Y. 2010).

Pert 35, Inc. v. Amari Aviation Ltd., No. 3:09-CV-0448 (TJM/DEP), 2010 U.S. Dist. LEXIS 28761 (N.D.N.Y. 2010).

Somers v. Am. Airlines, Inc., No. 05-CV-2814 (SMG), 2010 U.S. Dist. LEXIS 36146 (E.D.N.Y. 2010).

Vanbrocklen v. United States, Transp. Sec. Admin., No. 1:08-CV-312 (TJM/RFT), 2010 U.S. Dist. LEXIS 34166 (N.D.N.Y. 2010).

In re European Aeronautic Defence & Space Co. Sec. Litig.,No. 08 Civ. 5389 (WHP), 2010 U.S. Dist. LEXIS 29742 (S.D.N.Y. 2010).

Lidle v. Cirrus Design Corp., No .08 Civ. 1253 (BSJ)(HBP), (S.D.N.Y. 2009).

Martegani v. Cirrus Design Corp., 687 F. Supp. 2d 373 (S.D.N.Y. 2010).

Nastych v. British Airways PLC, No. 09 Civ. 9082 (AJP), 2010 U.S. Dist. LEXIS 8522 (S.D.N.Y. 2010).

Constellation Leasing, LLC v. Oxford Aviation, Inc., No. 08-CV-6558, 2010 U.S. Dist. LEXIS 30212 (W.D.N.Y. 2010).

Okeke v. Northwest Airlines, Inc., No. 1:07CV538, 2010 U.S. Dist. LEXIS 17607 (M.D.N.C. 2010).

Braithwaite v. Dep't of Homeland Sec., No. 3:08CV01771, 2010 U.S. Dist. LEXIS 24452 (N.D. Ohio 2010).

Air Century, S.A. v. Atlantique Air Assistance, No. CIV-08-1324-D, 2010 U.S. Dist. LEXIS 41721 (W.D. Okla. 2010).

Grimes v. Cirrus Indus., No. CIV-08-1222-D, 2010 U.S. Dist. LEXIS 35785 (W.D. Okla. 2010)

Blue Sky Avgroup, LLC v. EPIC Air LLC, No. 3:09-628-AC, 2010 U.S. Dist. LEXIS 16124 (D. Ore. 2010).

Albani v. United States, No. 09-4790, 2010 U.S. Dist. LEXIS 56699 (E.D. Penn. 2010).

Altman v. Liberty Helicopters, Inc., No. 09-4437, 2010 U.S. Dist. LEXIS 3009 (E.D. Penn. 2010).

Carey v. Dylan Aviation, LLC, No. 09-cv-02888-JF, 2010 U.S. Dist. LEXIS 27834 (E.D. Penn. 2010).

Lucas v. Dylan Aviation, LLC, No. 09-cv-2889-JF, 2010 U.S. Dist. LEXIS 27779 (E.D. Penn. 2010).

Schaefer-Condulmari v. US Airways Group, Inc., No. 09-1146, 2009 U.S. Dist. LEXIS 114723 (E.D. Penn. 2009).

Pease v. Kelly Aero., Inc., No. 4:10-CV-00843, 2010 U.S. Dist. LEXIS 56215 (M.D. Penn. 2010).

Borges-Santiago v. Am. Airlines, Inc., 685 F. Supp. 2d 289 (D.P.R. 2010).

McMillan v. Pee Dee Reg'l Airport Comm'n, No. 4:08-01728-TLW, 2010 U.S. Dist. LEXIS 15116 (D.S.C. 2010).

Flight Solutions, Inc. v. Club Air, Inc., No. 3:09-cv-1155, 2010 U.S. Dist. LEXIS 3721 (M.D. Tenn. 2010).

Glass v. Northwest Airlines, 686 F. Supp. 2d 770 (W.D. Tenn. 2010).

Jain v. Memphis Shelby County Airport Auth., No. 08-2119-STA-dkv, 2010 U.S. Dist. LEXIS 16842 (W.D. Tenn. 2010).

Dickson v. Am. Airlines, Inc., 685 F. Supp. 2d 623 (N.D. Tex. 2010).

King Aero. Commer. Corp. v. Al-Anwa Aviation, Inc., No. 3:08-CV-0999-L, 2010 U.S. Dist. LEXIS 5112 (N.D. Tex. 2010).

Coalition for an Airline Passengers' Bill of Rights v. Delta Airlines, Inc., No. H-09-3305, 2010 U.S. Dist. LEXIS 7407 (S.D. Tex. 2010).

U.S. Aviation Underwriters Inc. v. United States, 682 F. Supp. 2d 761 (S.D. Tex. 2010).

Iniekpo v. Avstar Int'l Corp., No. SA-07-CV-879-XR, 2010 U.S. Dist. LEXIS 26952 (W.D. Tex. 2010).

N653CT, LLC v. Players Air, Inc., No. 2:07-CV-683, 2010 U.S. Dist. LEXIS 10816 (D. Utah 2010).

Signature Flight Support Corp. v. Landow Aviation Ltd. P'ship, No. 1:08cv955 (JCC/TRJ), 2010 U.S. Dist. LEXIS 24877 (E.D. Vir. 2010).

Pressly v. Hitchens, No.. C08-5765RJB, 2010 U.S. Dist. LEXIS 31990 (W.D. Wash. 2010).

United States Cellular Operating Co., LLC v. Waukesha County, No. 08-CV-796, 2010 U.S. Dist. LEXIS 51719 (E.D. Wis. 2010).

Mike's Contr., LLC v. United States, 92 Fed. Cl. 302 (Fed. Cl. 2010).

Over and Out, Inc. v. Eclipse Aviation Corp. (In re AE Liquidation, Inc.), Chapter 7, 426 B.R. 511 (Bankr. D. Del. 2010).

Skyranch Flight Ass'n v. Maricopa County, No. TX 2007-000430, 2010 Ariz. Tax LEXIS 5 (Ariz. T.C. 2010).

Int'l Society for Krishna Consciousness of Cal., Inc. v. City of Los Angeles, 227 P.3d 395 (Cal. 2010).

Sunset Sky Ranch Pilots Assn. v. County of Sacramento, 220 P.3d 905 Cal. 2009).

Rogers v. Bell Helicopter Textron, Inc., 185 Cal. App. 4th 301 (Cal. Ct. App. 2010).

Watsonville Pilots Assn. v. City of Watsonville, 183 Cal. App. 4th 1059 (Cal. Ct. App. 2010).

Key Air, Inc. v. Comm'r of Revenue Servs., 983 A.2d 1 (Conn. 2009).

Avco Corp. v. Neff, 30 So. 3d 597 (Fla. Ct. App. 2010).

Vreeland v. Ferrer, 28 So. 3d 906 (Fla. Ct. App. 2010).

Barber v. Am. Airlines, Inc., 925 N.E.2d 1240 (Ill. Ct. App. 2010).

S. Side Trust & Sav. Bank of Peoria v. Mitsubishi Heavy Indus., 2010 Ill. App. LEXIS 278 (Ill. Ct. App. 2010).

Southside Trust & Sav. Bank of Peoria v. Mitsubishi Heavy Indus., 2009 Ill. App. LEXIS 1324 (Ill. Ct. App. 2009).

Hauptman v. WMC, Inc., 224 P.3d 1175 (Kan. Ct. App. 2010).

Estate of Fortier v. City of Lewiston, 2010 ME 50 (Me. 2010).

Fletcher v. Cessna Aircraft Co., 991 A.2d 859 (N.J. Super. Ct. App. Div. 2010).

Potomac Aviation, LLC v. Port Auth. of N.Y. & N.J., No. A-3128-08T2, 2010 N.J. Super. LEXIS 75 (N.J. Super. Ct. App. Div. 2010).

Asheville Jet, Inc. v. City of Asheville, 689 S.E.2d 162 (N.C. Ct. App. 2010).

Empower Aviation, LLC v. Butler County Bd. of Comm'rs, 924 N.E.2d 862 (Ohio Ct. App. 2010).

Amspacher v. State, No. 10-09-00221-CR, 2009 Tex. App. LEXIS 9819 (Tex. Ct. App. 2009).

Dallas-Fort Worth Int'l Airport Pub. Facility Improvement Corp. v. Banks, No. 2-09-176-CV, 2010 Tex. App. LEXIS 144 (Tex. Ct. App. 2010).

LJ Charter, L.L.C. v. Air Am. Jet Charter, Inc., No. 14-08-00534-CV, 2009 Tex. App. LEXIS 9469 (Tex. Ct., App. 2010).

Morrison v. Standerfer, No. 2-09-250-CV, 2010 Tex. App. LEXIS 2152 (Tex. Ct. App. 2010).

Flight Options, LLC v. Dep't of Revenue, 225 P.3d 354 (Wash. Ct. App. 2010).

Articles

Ruwantissa Abeyratne, *The ICAO Conventions on Liability for Third-Party Damage Caused by Aircraft*, 34 AIR & SPACE L. 403 (2009).

Ruwantissa Abeyratne, *Legal and Aeronautical Issues Concerning the Earthquake in Haiti*, 35 J. AIR & SPACE L. 183 (2010).

Ruwantissa Abeyratne, *Negligent Entrustment of Leased Aircraft and Crew: Some Legal Issues*, 35 J. AIR & SPACE L. 33 (2010).

Ruwantissa Abeyratne, *The NW 253 Flight and the Global Framework of Aviation Security*, 35 J. AIR & SPACE L. 167 (2010).

Michel Adam, *Report on the 21st Annual Conference of the European Air Law Association*, 35 J. AIR & SPACE L. 59 (2010).

Alan Armstrong, *Call for a Congressional Inquiry Into the Arbitrary and Capricious Decisions of the National Transportation Safety Board*, 75 J. AIR. L. & COM. 3 (2010).

Kinga Arnold & Pablo Mendes de Leon, *Regulation (EC) 261/2004 in the Light of the Recent Decisions of the European Court of Justice: Time for a Change?!*, 35 J. AIR & SPACE L. 91 (2010).

Joe Van Asten, note, *Air Traffic Controller liability—First Circuit Undermines FAA's Efforts to Incorporate Redundancy Into Aviation Safety Procedures: Wojciechowicz v. United States*, 75 J. AIR. L. & COM. 213 (2010).

John Balfour, note, *Airline Liability for Delays: The Court of Justice of the EU Rewrites EC Regulation 261/2004*, 35 J. AIR & SPACE L. 71 (2010).

Justin T. Barkowski, comment, *Managing Air Traffic Congestion Through the Next Generation Air Transportation System: Satellite-Based Technology, Trajectories, and - Privatization?*, 37 PEPP. L. REV. 247 (2010).

Sunil Bector, note: "*Your Laptop, Please:*" *The Search and Seizure of Electronic Devices at the United States Border*, 24 BERKELEY TECH. L.J. 695 (2009).

Amy Cawthon Bellah, note, *Jurisdiction—Determining the Line Between OCSLA and DOSHA—In an Already Murky Area of the Law, the Fifth Circuit Leaves Open More Questions Than It Answers*, 75 J. AIR. L. & COM. 181 (2010).

Mervyn E. Bennun & Gavin McKellar, *Flying Safely, the Prosecution of Pilots, and the ICAO Chicago Convention: Some Comparative Perspectives*, 74 J. AIR L. & COM. 737 (2009).

Joachim Bentzien, *Die Luftverkehrsaußenpolitik der EU nach den „Open Skies"-Urteilen des EuGH vom 5. November 2002 / The EU External Aviation Policy after the Open Skies Judgments of the European Court of Justice of November 5, 2002 / La politique externe de l'UE après les jugements « Ciel Ouvert » de la Cour de Justice Européenne du 5. novembre 2002*,2009 ZLW 566 (2009).

Moira Bergin, comment, *Packing Heat? Defining the Scope of the Transportation Security Administration's Authority to Protect America's Airports* 59 CATH. U.L. REV. 201 (2009).

Hans-Georg Bollweg & Kristina Moll, *Die Drittschadenshaftung im internationalen Luftverkehr nach der Revision des Römer Haftungsabkommens / Third Party Liability in International Air Transport after the Revision of the Rome Convention / Responsabilité des tiers en transport aérien après la révision de la Convention de Rome*, 2009 ZLW 587 (2009).

Jason R. Bonin, *Strategic Liberalization Policies in Bilateral and Multilateral Settings: The Case of China and Vietnam*, 34 AIR & SPACE L. 371 (2009).

Harold Caplan, *The Crime of Flying: The Way Forward to 1784*, 34 AIR & SPACE L. 351 (2009).

Roger W. Clark & Thomas M. Richardson, *Is Lessor More?*, 75 J. AIR. L. & COM. 69 (2010).

Aubrey B. Colvard, NOTE, *Bumping Passengers—Airline Service That Just Doesn't Fly*, 75 J. AIR. L. & COM. 189 (2010).

John T. Conklin, *National Transportation Safety Board Aircraft Accident Reports: The Long Lost Legislative History of Section 701 (E)*, 74 J. AIR L. & COM. 781 (2009).

Berend Crans, *The Implications of the EU Accession to the Cape Town Convention*, 35 J. AIR & SPACE L. 1 (2010).

Pablo Mendes de Leon, note, *ATA and others v. the UK Secretary of State for Energy and Climate Change (2009)*, 35 J. AIR & SPACE L. 199 (2010).

Travis Dunlap, comment, *We've Got Our Eyes on You: When Surveillance by Unmanned Aircraft Systems Constitutes a Fourth Amendment Search*, 51 S. TEX. L. REV. 173 (2009).

Peter A. Dutton, *Caelum Liberum: Air Defense Identification Zones Outside Sovereign Airspace*, 103 AM. J. INT'L L. 691 (2009).

Cameron W. Eubanks, note, *Laptops, Airports, and the Border: Expanding Technology and the Shrinking Fourth Amendment in United States v. Arnoldm*, 64 U. MIAMI L. REV. 1117 (2010).

Kelly Flanagan, note, *False Claims Act—The Tenth Circuit Fails to Fully Consider the Harm to Public Policy Caused by Enforcement of a Prefiling Release Agreement in a Qui Tam Action: United States ex rel. Ritchie v. Lockheed Martin Corp.*, 75 J. AIR. L. & COM. 197 (2010).

Mark Franklin & Sarah Porter, note, *Sovereignty over Airspace and the Chicago Convention: Northern Cyprus*, 35 J. AIR & SPACE L. 63 (2010).

Jonathan R. Friedman & Joshua S. Wood, *Recent Trends and Development: Aviation Law: A Survey of Recent Trends and Developments*, 61 MERCER L. REV. 585 (2010).

John A. Gallagher, comment, *Civil Rights - First Circuit Incorrectly Adopts Arbitrary-or-Capricious Standard for Reviewing Airliner's Decision to Remove Passengers - Cerqueira v. American Airlines, Inc., 520 F.3d 1 (1st Cir. 2008)*, cert. denied, 129 S. Ct. 111 (2008), 42 SUFFOLK U. L. REV. 303 (2009).

Stephen R. Ginger & Will S. Skinner, *DOHSA's Commercial Aviation Exception: How Mass Airline Disasters Influenced Congress on Compensation for Deaths on the High Seas*, 75 J. AIR. L. & COM. 137 (2010).

Giuseppe Guerreri, note, *Italian Court Denies Recovery for Cerebral Haemorrhage Following 18.5-Hour Aircraft Journey*, 35 J. AIR & SPACE L. 79 (2010).

Alexandra R. Harrington, *Germs on a Plane!: Legal Protections Afforded to International Air Travelers and Governments in the Event of a Suspected Or Actual Contagious Passenger And Proposals To Strengthen Them,* 22 J.L. & HEALTH 295 (2009).

Brian F. Havel & Niels van Antwerpen, *Dutch Ticket Tax and Article 15 of the Chicago Convention (Continued)*, 34 AIR & SPACE L. 447 (2009).

Christa Meyer Hinckley, Hays Hettinger & Jeremy E. Juenger, *The Argument for Federal Legislation Protecting the Confidentiality of Aviation Safety Action Program Information*, 75 J. AIR. L. & COM. 161 (2010).

Jane Hong, *Liability of Aviation Security Service Providers and Responsibility of States*, 35 J. AIR & SPACE L. 9 (2010).

Jarret Jackson, *Market Failures, Government Solution? The Proper Role of Government in the Economy: The Unique Role of Government in the Aviation Industry,* 14 GEO. PUBLIC POL'Y REV. 43 (2009).

William D. Janicki, *Aircraft Accident Reports and Other Government Documents: Evidentiary Use in International Air Crash Litigation in the United States*, 74 J. AIR L. & COM. 801 (2009).

Stefan A. Kaiser, *Aviation Security: Technical and Regulatory Measures against MANPADS*, 35 J. AIR & SPACE L. 45 (2010).

Geoff Kass & Violet O'Brien, *Aircraft Crashes: Should Aircraft Lessors be Held Liable?*, 74 J. AIR L. & COM. 845 (2009).

Norberto E. Luongo, *Watchlists in United States and Canada: An Intricate Web*, 35 J. AIR & SPACE L. 157 (2010).

Michael Lyons, note, *Reasonably Precise Specifications and the Military Contractor Defense—The Eleventh Circuit Misapplies the Boyle Test: Brinson v. Raytheon Co.*, 75 J. AIR. L. & COM. 205 (2010).

Douglas Marshall, *Unmanned Aerial Systems and International Civil Aviation Organization Regulations*, 85 N. DAK. L. REV. 693 (2009).

Patrick J. McDonald, *Cerqueira v. American Airlines: What are the Appropriate Limits of an Air Carrier's Permissive Refusal Power?,* 20 GEO. MASON U. CIV. RTS. L.J. 111 (2009).

Tobias W. Mock, comment, *The Tsa's New X-Ray Vision: The Fourth Amendment Implications Of "Body-Scan" Searches At Domestic Airport Security Checkpoints,* 49 SANTA CLARA L. REV. 213 (2009).

Ryan Mylrea, comment, *A Growing Body of Law: Obesity, Disability, And The Airline Industry*, 18 TUL. J. INT'L & COMP. L. 207 (2009)

Nicholas D. O'Conner, note, *Too Experienced for the Flight Deck? Why the Age 65 Rule Is Not Enough*, 17 ELDER L.J. 375 (2010).

Michael Olbrich, Gerrit Brösel & Manus Hasslinger, *The Valuation of Airport Slots*, 74 J. AIR L. & COM. 897 (2009).

Claus Pegatzky & Sebastian Rockstroh, *Die Reform des europäischen Luftverkehrsrechts durch die Verordnung (EG) Nr. 1008/2008/ The Reform of European Air Traffic Law after Regulation (EC) No. 1008/2008 / La réforme du droit aérien en Europe par la régulation (CE) No. 1008/2008*, 2009 ZLW 541 (2009).

Geoffrey Christopher Rapp, *Unmanned Aerial Exposure: Civil Liability Concerns Arising From Domestic Law Enforcement Employment Of Unmanned Aerial Systems* 85 N. DAK. L. REV. 623 (2009).

Timothy M. Ravich, *The Integration Of Unmanned Aerial Vehicles into the National Airspace,* 85 N. DAK. L. REV. 597 (2009).

Chris Sagers, *"Rarely Tried, And … Rarely Successful": Theoretically Impossible Price Predation Among the Airlines*, 74 J. AIR L. & COM. 919 (2009).

Francis Schubert, *Legal Aspects of Cross-Border Service Provision in the Single European Sky*, 35 J. AIR & SPACE L. 113 (2010).

Arpad Szakal, *Conference Report European Air Law Association: 7th Munich Liability Seminar*, 35 J. AIR & SPACE L. 195 (2010).

George N. Tompkins, Jr., *The 1999 Montreal Convention: Alive, Well and Growing*, 34 AIR & SPACE L. 421 (2009).

George N. Tompkins, Jr., note, *Report from the United States – The Montreal Convention and the Doctrine of Forum Non Conveniens*, 35 J. AIR & SPACE L. 77 (2010).

Andrew Tulloch & Marcus Saw, note, *Report from Australia*, 35 J. AIR & SPACE L. 81 (2010).

Joseph J. Vacek, *Big Brother Will Soon Be Watching - Or Will He? Constitutional, Regulatory, and Operational Issues Surrounding the Use Of Unmanned Aerial Vehicles in Law Enforcement*, 85 N. DAK. L. REV. 673 (2009).

Heiko van Schyndel, *Gesetz der Russischen Föderation „Über die staatliche Registrierung von Rechten an Luftfahrzeugen und Rechtsgeschäften mit diesen" / Law of the Russian Federation on State Registration of Rights in Aircraft and Legal Transactions Concerning such Rights / La loi de la Fédération Russe sur l'immatriculation étatique des droits sur aéronefs et*

des opérations juridiques concernant tels droits,2009 ZLW 608 (2009).

Thomas J. Whalen, *Arbitration of International Cargo Claims*, 34 AIR & SPACE L. 417 (2009).

Hui Yang, *Flight Accidents and Criminal Responsibility in China*, 34 AIR & SPACE L. 393 (2009).

Books and Reports

ANGELA KLINGMÜLLER & ULRICH STEPPLER, EU EMISSIONS TRADING SCHEME AND AVIATION (2010).

PROGRAM ON HUMANITARIAN POLICY AND CONFLICT RESEARCH AT HARVARD UNIVERSITY, MANUAL ON INTERNATIONAL LAW APPLICABLE TO AIR AND MISSILE WARFARE (2009)

GEORGE N TOMPKINS, LIABILITY RULES APPLICABLE TO INTERNATIONAL AIR TRANSPORTATION AS DEVELOPED BY THE COURTS IN THE UNITED STATES : FROM WARSAW 1929 TO MONTREAL 1999 (2009).

HEIKO VON SCHYNDEL, AVIATION CODE OF THE RUSSIAN FEDERATION (2009).

SPACE LAW

International Materials

Ga. Res. 64/28, Prevention of an arms race in outer space, A/RES/64/28 (2009).

Ga. Res. 64/49, Transparency and confidence-building measures in outer space activities, A/RES/64/49 (2009).

Ga. Res. 64/86, International cooperation in the peaceful uses of outer space, A/RES/64/86 (2009).

Laws and Regulations

European Union

European Union Commission Decision of 5 February 2010 setting up the GMES Partners Board (2010/67/EU), 2010 J.O. (L 35) 23.

European Parliament legislative resolution of 16 June 2010 on the proposal for a regulation of the European Parliament and of the Council on the European Earth observation programme (GMES) and its initial operations (2011–2013) (COM(2009)0223 – C7-0037/2009 – 2009/0070(COD)), EUR. PARL. DOC. P7_TA-PROV(2010)0214 (2010).

European Parliament legislative resolution of 16 June 2010 on the proposal for a regulation of the European Parliament and of the Council amending Council Regulation (EC) No 1321/2004 on the establishment of structures for the management of the European satellite radio-navigation programmes (COM(2009)0139 – C7-0103/2009 – 2009/0047(COD)), EUR. PARL. DOC. P7_TA-PROV(2010)0213.

United Kingdom

The INSPIRE Regulations 2009, 2009 S.I. 3157 (U.K. 2009).

The Authorisation of Frequency Use for the Provision of Mobile Satellite Services (European Union) Regulations 2010, 2010 S.I. 672 (U.K. 2010).

The INSPIRE (Scotland) Regulations 2009, 2009 S.I. 2009/440 (Scot. 2009).

United States

Commercial Space Transportation Liability Regime Extension, Pub. L. No. 111–125 (2009).

Satellite Televison Extension Act of 2010, Pub. L. No. 111–151 (2010).

Satellite Television Extension and Localism Act of 2010, Pub. L No. 111-175 (2010).

Civil Penalty Inflation Adjustment for Commercial Space Adjudications, 75 Fed. Reg. 30690 (June 2, 2010).

Coordination Between the Non-Geostationary and Geostationary Satellite Orbit, 74 Fed. Reg. 17055-17062 (Apr. 5, 2010).

Procedures to Govern the Use of Satellite Earth Stations on Board Vessels in the 5925-6425 MHz/3700-4200 MHz Bands and 14.0-14.5 GHz/ 11.7-12.2 GHz Bands, 74 Fed. Reg. 7975-7976 (Feb. 23, 2010).

SB 9: Space Flight Informed Consent Act, 49th Leg., 2d Sess. (N.M. 2010).

Administrative Decisions

Honeywell Technology Solutions, Inc., B-400771.6 (Gov't Accountability Office, Nov. 23, 2009).

Space Exploration Technologies Corporation, B-402186, (Gov't Accountability Office, Feb. 1, 2010).

National Aeronautics and Space Administration–Constellation Program and Appropriations Restrictions, Part I, B-319488 (Gov't Accountability Office, May 21, 2010).

Cases

DirecTV, Inc. v. Barczewski, 604 F.3d 1004 (7th Cir. 2010).

Russian Media Group, LLC v. Cable Am., Inc., 598 F. 3d 302 (7th Cir. 2010).

SiRF Tech., Inc. v. ITC, 601 F.3d 1319 (Fed. Cir. 2010).

Walsh v. Globalstar, Inc., No. C07-1941 TEH, 2010 U.S. Dist. LEXIS 24229 (N.D. Cal. 2010).

Sprint Nextel Corp. v. DBSD N. Am., Inc. (In re DBSD N. Am., Inc.), No. 09 Civ. 9144 (VM), 2010 U.S. Dist. LEXIS 33953 (S.D.N.Y. 2010).

United States v. ASCAP (In re MobiTV, Inc.), No. 09 Civ. 7071 (DLC), 2010 U.S. Dist. LEXIS 45992 (S.D.N.Y. 2010).

Charvat v. EchoStar Satellite, LLC, 676 F. Supp. 2d 668 (S.D. Ohio 2009).

Minerva Indus. v. Motorola, Inc., No. 2:07-CV-229-CE, 2010 U.S. Dist. LEXIS 9329 (E.D. Tex. 2010).

Articles

Ben Baseley-Walker, *Responsible launching: space security, technology, and emerging space states*, THE SPACE REVIEW, Mar. 29, 2010, http://www.thespacereview.com/article/1596/1.

Brian Beck, *The Next, Small, Step for Mankind: Fixing the Inadequacies of the International Space Law Treaty Regime to Accommodate the Modern Space Flight Industry,* 19 ALB. L.J. SCI. & TECH. 1 (2009).

John W. Bellflower, *The Influence of Law on Command of Space,* 65 A.F. L. REV. 107 (2010).

Richard B. Bilder, *A Legal Regime for the Mining of Helium-3 on The Moon: U.S. Policy Options*, 33 FORDHAM INT'L L.J. 243 (2010).

P.J. Blount, *Informed consent v. ITAR: Regulatory conflicts that could constrain commercial human space flight*, 66 ACTA ASTRONAUTICA 1608 (2010).

Mike N. Gold, *Thomas Jefferson, We Have A Problem: The Unconstitutional Nature of the U.S.'s Aerospace Export Control Regime as Supported by Bernstein v. U.S. Department of Justice,* 57 CLEV. ST. L. REV. 629 (2009).

David Malfitano, note, *Space Tourism: The Final Frontier of Law,* 35 RUTGERS COMPUTER & TECH. L.J. 203 (2009).

Christopher Miles, *Assessing the Need for an International Patent Regime for Inventions in Outer Space*, 11 TUL. J. TECH. & INTELL. PROP. 59 (2009)

Monroe E. Price, *Satellite Transponders and Free Expression*, 27 CARDOZO ARTS & ENT L.J. 1 (2009).

Ronald L. Spencer, *State Supervision of Space Activity*, 63 A.F. L. REV. 75 (2009).

Christopher Stone, *Space export control reform: the different schools of thought and a proposed way forward*, THE SPACE REVIEW, Mar. 15, 2010, http://www.thespacereview.com/article/1587/1.

Zhao Yun, *A Legal Regime for Space Tourism: Creating Legal Certainty in Outer Space*, 74 J. AIR L. & COM. 959 (2009).

Books and Reports

PHILIPPE ACHILLÉAS, DROIT DE L'ESPACE : TÉLÉCOMMUNICATION, OBSERVATION, NAVIGATION, DÉFENSE, EXPLORATION (2009).

S. BHATT, ENVIRONMENT PROTECTION: ROLE OF SPACE LAW, AIR LAW (2009).

NATALIE BORMANN & MICHAEL SHEEHAN, SECURING OUTER SPACE: INTERNATIONAL RELATIONS THEORY AND THE POLITICS OF SPACE (2010).

COMMITTEE TO REVIEW NEAR-EARTH OBJECT SURVEYS AND HAZARD MITIGATION STRATEGIES SPACE STUDIES BOARD; NATIONAL RESEARCH COUNCIL, DEFENDING PLANET EARTH: NEAR-EARTH OBJECT SURVEYS AND HAZARD MITIGATION STRATEGIES: FINAL REPORT (2010).

CONGRESSIONAL RESEARCH SERVICE, THE FUTURE OF NASA: SPACE POLICY ISSUES, FACING CONGRESS (Apr. 19, 2010).

FAA/AST, POINT-TO-POINT COMMERCIAL SPACE TRANSPORTATION IN NATIONAL AVIATION SYSTEM (2010).

GOV'T ACCOUNTABILITY OFFICE, COMMERCIAL SPACE TRANSPORTATION: DEVELOPMENT OF THE COMMERCIAL SPACE LAUNCH INDUSTRY PRESENTS SAFETY OVERSIGHT CHALLENGES FOR FAA AND RAISES ISSUES AFFECTING FEDERAL ROLES, STATEMENT OF GERALD L. DILLINGHAM, PH. D., DIRECTOR, PHYSICAL INFRASTRUCTURE ISSUES BEFORE THE SUBCOMMITTEE ON AVIATION, HOUSE COMMITTEE ON TRANSPORTATION AND INFRASTRUCTURE, GAO-10-286T (Dec. 2, 2009).

GOV'T ACCOUNTABILITY OFFICE, ENVIRONMENTAL SATELLITES: STRATEGY NEEDED TO SUSTAIN CRITICAL CLIMATE AND SPACE WEATHER MEASUREMENTS, GAO-10-456 (Apr. 27, 2010).

HIGHLIGHTS IN SPACE 2009: PROGRESS IN SPACE SCIENCE, TECHNOLOGY AND APPLICATIONS, INTERNATIONAL COOPERATION AND SPACE LAW, U.N. Doc. ST/SPACE/46 (2009).

RAM S. JAKHU, NATIONAL REGULATION OF SPACE ACTIVITIES (2010).

GBENGA ODUNTAN, SOVEREIGNTY, JURISDICTION, AND EXPLOITATION OF THE SEAS, POLAR REGIONS, AIRSPACE AND OUTER SPACE (2010).

NINA-LOUISA REMUSS, THE EUROPEAN INTERPARLIAMENTARY SPACE CONFERENCE (EISC) – PAST, PRESENT , FUTURE, ESPI Perspectives 29 (2009)

NINA-LOUISA REMUSS, RESPONSIVE SPACE FOR EUROPE – ELEMENTS FOR A ROADMAP FOR EUROPE BASED ON A COMPARATIVE ANALYSIS WITH THE U.S. OPERATIONAL RESPONSIVE SPACE CONCEPT, ESPI Report 22 (2010).

REPORT OF THE EXPERT ON SPACE APPLICATIONS, U.N. Doc. A/AC.105/969 (2010).

THE REPORT OF THE SCIENTIFIC AND TECHNICAL SUBCOMMITTEE ON ITS FORTY-SEVENTH SESSION, HELD IN VIENNA FROM 8 TO 19 FEBRUARY 2010, U.N. doc. A/AC.105/958 (2010).

G.S. SACHDEVA, OUTER SPACE: SECURITY AND LEGAL CHALLENGES (2010).

SPACE SECURITY INDEX 2009 (2010)

PETER STUBBE, COMMON BUT DIFFERENTIATED RESPONSIBILITIES FOR SPACE DEBRIS – NEW IMPETUS FOR A LEGAL APPRAISAL OF OUTER SPACE POLLUTION, ESPI Perspectives 31 (2010).

ELIAS WIKBORG, SPACE TOURISM ISSUES (2010).

JOURNAL OF SPACE LAW

Reprints of vols. 1-13 of the
JOURNAL OF SPACE LAW
Contact
William S. Hein & Co., Inc., 1285 Main Street, Buffalo, New York 14209

Subscriptions should be made payable to the "University of Mississippi, JOURNAL OF SPACE LAW" and paid for by check drawn on a U.S. bank or money order in U.S. dollars or by VISA/MasterCard:

Mail Order JOURNAL OF SPACE LAW
1 Grove Loop
558 Lamar Law Center
University, MS 38677-1858 USA

Fax Order 1.662.915.6921
Email: jsl@olemiss.edu
Tel: 1.662.915.6857

The 2009 subscription rate for two issues, incl. postage and handling:
Domestic USA individuals…….$100.00
Domestic organizations……..$120.00
Foreign individuals, regular mail……$105.00; air mail…….$125.00
Foreign organizations, regular mail……...$125.00; air mail…….$140.00

Single issues price for vols. 14-35: $70.00
Single 2007 Special Publication Bibliography price: $70.00

Order for 2009 Volume 35 (Nos. 1 & 2) $_____._____
Order for 2010 Volume 36 (Nos. 1 & 2) $_____._____
TOTAL **$_____._____**

Name: _____
Company/Organization: _____
_____
Address: _____
_____
City: _____ State: _____
Country: _____ Zip: _____
Telephone No: (_____) _____; Fax No: (_____) _____
Email: _____
For Credit Order (please add 5%) _____ VISA _____MASTERCARD
No: _____ Exp Month: _____ Year:_____