

Journal of Space Law

Volume 41

Number 2

2017



In Memoriam: George S. Robinson

Articles

The Non Kármán Line: An Urban Legend of the Space Age.....Thomas Gangale

Incentives for Keeping Space Clean: Orbital Debris
and Mitigation Waivers.....Stephen J. Garber

The Intersection of U.S Space Policy Goals and National
Security Needs: An Argument for a Regulatory Regime
Oversight Commission That Balances Space Related
Policy Interests.....Rebekah Rounds

Student Article

Stakeout from Space: Fourth Amendment Concerns
Resulting from the Onset of Satellite Video.....Blake Knight

Translation

1865 International Telegraph Convention with Translator's Introduction.....Harrison Parker

Bibliography

Space Law Bibliography.....Kyle Hansen

Vol. 41, No. 2

Journal of Space Law

Pages
151
to
315

2017

JOURNAL

OF

SPACE

LAW

VOLUME 41, NUMBER 2

2017

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 41

2017

NUMBER 2

Editor-in-Chief

P.J. Blount, J.D., LL.M., Ph.D.

Executive Editor

Andrea Harrington, J.D., LL.M., D.C.L.

Senior Student Editors

Nathaniel Celeski
Haley Grantham
Kyle Hansen
Blake Knight

Student Editors

Alexis Danielle Banks
Sammy Brown
Brittney Eakins
Sam Martin
Javan Porter
Brianna Warner
Caroline Weber

Editing Staff

Michael Dodge, J.D., LL.M.

Business Manager

April Chaney

Founder, Dr. Stephen Gorove (1917-2001)

Editor-in-Chief, Joanne Irene Gabrynowicz (2001-2013)

Editor-in-Chief Emerita, Joanne Irene Gabrynowicz (2013 -)

All correspondence with reference to this publication should be directed to the JOURNAL OF SPACE LAW, University of Mississippi School of Law, 481 Coliseum Drive, 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 2014 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.

Copyright © Journal of Space Law 2014. 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 41	2017	NUMBER 2
-----------	------	----------

CONTENTS

Call for Papers iii

In Memoriam: George S. Robinson v

Articles

The Non Kármán Line:

An Urban Legend of the Space Age Thomas Gangale 151

Incentives for Keeping Space Clean:

Orbital Debris and Mitigation Waivers.....Stephen J. Garber 179

The Intersection of U.S Space Policy Goals and National

Security Needs: An Argument for a Regulatory Regime

Oversight Commission That Balances Space Related

Policy Interests.....Rebekah Rounds 203

Student Article

Stakeout from Space: Fourth Amendment Concerns

Resulting from the Onset of Satellite VideoBlake Knight 231

Translation

1865 International Telegraph Convention

with Translator's Introduction.....Harrison Parker 251

Bibliography

Space Law BibliographyKyle Hansen 311

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 42, Issues 1 & 2

The LL.M. program in Air and Space Law at the University of Mississippi School of Law is delighted to announce that it will publish double-issue Volume 42, Issues 1 & 2 of the JOURNAL OF SPACE LAW in 2018.

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 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)

The JOURNAL OF SPACE LAW will continue to accept and review submissions on an on-going basis.

IN MEMORIAM: GEORGE S. ROBINSON

We note with sadness the passing of Dr. George Robinson. George was a longstanding member of the space law community having received the first doctoral degree in Space Law from the McGill University Institute of Air and Space Law. George had a storied career serving the United States federal government at the Federal Aviation Administration, the National Aeronautics and Space Administration, and the Smithsonian Institute, where he served as general counsel.

George was the type of person who would have described himself a “garrulous old curmudgeon.” A reputation he cultivated by asking offbeat, irrelevant questions to unsuspecting moot courtiers in the North American Regionals of the Manfred Lachs Space Law Moot Court Competition. He did this in order “to see how they reacted” - many reacted with stunned looks, which brought great amusement to his fellow judges on the bench. Despite George’s active pursuit of this reputation, he was anything but a garrulous old curmudgeon. George gave generously of his time to support the space law community in D.C., at his alma mater McGill, and internationally. In particular, George was always interested in meeting and encouraging a younger generation of space lawyers. The first time I met George was at the Galloway Symposium in 2007. I was just starting in space law, and at lunch, I found myself at a table with handful of other people who were newbies. As we began to pick awkwardly at our sandwiches, George foregoes all the other tables to interrogate us about our interest in space law. Stories like this abound in the space law community, and George’s kindness has touched numerous individuals.

George was also a scholar. His work is philosophical and probes deep questions about how space exploration will change humankind and the legal evolution that will need to occur to accommodate these changes. His work on space and transhumanism gives insight on how contemporary rules affect future developments, and his take is a visionary one of human migration into space. George’s work is challenging and rewarding as it digs into the very questions that initially attract so many to the space field.

George was a scholar, a mentor, and a friend to many people in space law. He will be missed dearly.

*-P.J. Blount
Luxembourg 2018*

ARTICLES

THE NON KÁRMÁN LINE: AN URBAN LEGEND OF THE SPACE AGE

*Thomas Gangale**

I. INTRODUCTION

The von Kármán line, named for the Hungarian-American aerodynamicist Theodore von Kármán, is commonly represented as lying at an altitude of 100 kilometers (62.1 statute miles) above the Earth's mean sea level. It is commonly represented by the *Fédération Aéronautique Internationale* (FAI), an international standard setting and record-keeping body for aeronautics and astronautics, as the boundary between the Earth's atmosphere and outer space. The von Kármán line has long been proposed as the basis for the legal delimitation between airspace and outer space; however, the available evidence suggests that von Kármán himself never proposed a boundary at 100 kilometers, and that his engineering work was misinterpreted by lawyers who were seeking an altitude of physical significance as the basis for delimitation. It is doubtful that a line of lasting significance based on aerodynamic theory alone, independent of technological assumptions, can be drawn.

For several reasons, the discussion on the legal delimitation of outer space is becoming more topical and important. Since the 1950s, a major role in that discussion has been played by references to the von Kármán line as a feasible boundary of lasting significance based on immutable physical principles; however, those references are inconsistent as to both the altitude of the line and the

* J.S.D. in space, cyber and telecommunications law, University of Nebraska-Lincoln College of Law, 2017; M.A. in international relations, San Francisco State University, 2006; B.S. in aerospace engineering, University of Southern California, 1978.

scientific reasoning supporting it. As interest in solving the delimitation issue rises within the legal community, it becomes increasingly important to investigate the origin of the von Kármán line, what it means, and how it came to be used. This article is in part a guided tour through legal history, and in part a discussion of the technical insignificance of the von Kármán line and why it should not be used as the basis for the legal delimitation between airspace and outer space.

II. THE 50-MILE LINE – U.S. EXPERIENCES

The issue underlying the discussion regarding the von Kármán line had drawn early attention in the United States in particular. Already in 1963, a footnote in McDougal *et al.*¹ discussed a Col. Schofield of the US Air War College, who in 1958 referred to a line at 50 nautical miles (303,800 feet, 57.54 statute miles, 92.59 kilometers). The altitudes and downrange distances reached by ballistic missiles were traditionally expressed in nautical miles, and this practice carried over into National Aeronautics and Space Administration (NASA) mission operations to also include the expression of apogees and perigees in such terms. Given that the United States established the use of nautical miles at the beginning of human spaceflight,² it is unfortunate that the literature on the legal delimitation of outer space has been extraordinarily imprecise, in that authors who express altitudes in terms of miles typically have neglected to specify whether they mean statute miles (5,280 feet) or nautical miles (6,076 feet).³ Of course, authors who express altitudes in terms of kilometers did so without such ambiguity. Aviators only use statute miles to the extent that they also happen to have driver's licenses; statute miles are used on land, but nautical miles rule the sea and the air. As a former United States Air Force (USAF) aviator, this author's initial bias was to assume that other authors, despite mostly being non-aviators, meant nautical miles

¹ Myres S. McDougal et al., LAW AND PUBLIC ORDER IN SPACE, 334 n.450 (1963).

² NASA Public Affairs Office voice over commentary of Space Shuttle mission events switched from nautical miles to statute miles in 2000.

³ The nautical mile is a "natural" unit of distance for navigation on Earth, since it is equal to a minute of latitude; since there are 60 minutes in a degree, it is $90 \times 60 = 5,400$ nautical miles from the equator to either pole. The *Système Internationale's* unit of distance is also based on the dimensions of Earth; it is 10 million meters from equator to pole.

implicitly; however, there are enough instances in the literature on the legal delimitation of outer space in which such an assumption is certainly incorrect. Thus, this author has concluded the opposite: that most jurists have used statute miles.

In fact, such authors are not the only imprecise ones. Air Force Instruction (AFI) 11-402, dated 13 December 2010, defines the criterion for being eligible to wear an astronaut badge on one's uniform:

2.3.2. A USAF rated officer qualified to perform duties in space (50 miles above the earth's surface) who completes a minimum of one operational mission is eligible for the astronaut qualifier (pilot astronaut, CSO [Combat Systems Officer] astronaut, observer astronaut, ABM [Air Battle Manager] astronaut, and flight surgeon astronaut).⁴

7.4.1.4. Member was assigned to perform aircrew member duties and completed a minimum of one operational mission in space (50 miles above the earth). In addition to eligibility for permanent award of the aircrew member badge, the individual is eligible for the astronaut qualifier.⁵

At first blush, this does not settle the issue; the instruction could mean either statute miles or nautical miles.⁶ Indeed, it is strange that the instruction uses the word "miles," whatever the type of mile that is intended, as cockpit altimeters are calibrated in feet and that is what aviators use; as noted *supra*, the expression of altitude in nautical miles originated in the development of ballistic missiles. This instruction replaced Air Force Regulation (AFR) 60-13, "Aviation Service, Aeronautical Ratings and Badges," which in turn replaced AFR 35-13, which dated from 1962. On 17 July of that year, Robert M. White piloted North American X-15A No. 3⁷ to an altitude of 95.9 kilometers. Since this was above 50 miles (nautical

⁴ AFI 11-402, *Aviation and Parachutist Service, Aeronautical Ratings and Aviation Badges*, 19 (13 December 2010), http://static.e-publishing.af.mil/production/1/af_a3_5/publication/afi11-402/afi11-402.pdf.

⁵ *Id.* at 103.

⁶ A brother retired USAF officer related to this author that when he inquired on this author's behalf whether the AFI meant statute miles or nautical miles, the cognizant Pentagon office responded, "That's a good question. What do you think it should be?"

⁷ Mark Wade, *X-15*, *Encyclopedia Astronautica*, <http://www.astronautix.com/project/x15.htm>.

as well as statute), the USAF awarded White an astronaut badge. Altogether, there were thirteen X-15A flights that exceeded fifty statute miles (80.45 kilometers, 264,000 feet) altitude, only four of which also exceeded fifty nautical miles (92.59 kilometers, 303,800 feet). Thus, the nine flights which were above fifty statute miles, but below fifty nautical miles, are of interest. Did the USAF award the pilots astronaut badges? It *did* award them to the USAF pilots, but not to the four civilian NASA pilots who participated in the program and who also flew above fifty statute miles.

That inequity was rectified [on 23 August 2005] when retired NASA pilot Bill Dana, and family members representing deceased pilots John B. McKay and Joseph A. Walker, received civilian astronaut wings acknowledging their flights above 264,000 feet altitude - 50 miles high.⁸

Indeed, 264,000 feet is fifty statute miles.⁹ So ultimately, the regulation was interpreted as meaning fifty statute miles, whatever its original intent.

The Federal Aviation Administration (FAA) followed the USAF's suit, getting its hand into the game not quite a year ahead of NASA.

After SpaceShipOne won the \$10 million Ansari X Prize competition last week, the man who took it into space, Brian Binnie, became the second person ever to receive a new kind of honor: commercial astronaut wings awarded by the Federal Aviation Administration for those who fly more than 50 miles above Earth.

Michael W. Melvill, who flew the plane on its first two successful missions, in June and in September, is the only other person to receive the pin, which resembles those worn by spacefarers in NASA and the military.¹⁰

⁸ Frederick A. Johnsen, *X-15 Space pioneers Now Honored as Astronauts*, Dryden Flight Research Center (23 August 2005), <http://www.nasa.gov/centers/dryden/news/News-Releases/2005/05-57.html#UhhVOO5h33dm>.

⁹ A number of Internet sources misreport the criterion for U.S. military astronaut badges as 100 kilometers. See e.g., Wikipedia, *Astronaut Badge*, https://en.wikipedia.org/wiki/Astronaut_badge.

¹⁰ John Schwartz, *Now Earning Wings, a New Kind of Astronaut*, THE NEW YORK TIMES (12 October 2004), <http://www.nytimes.com/2004/10/12/science/space/12astr.html>.

Currently, the FAA has not issued formal regulatory guidance for the issuance of a Commercial Astronaut Certificate, but as an interim measure, it has established the practice of awarding ‘Commercial Astronaut Wings’ to commercial pilots who have demonstrated the requisite proficiency.¹¹ Thus, there is as of yet no FAA commercial astronaut rating, much less an FAA-certified training course, for such a rating; meanwhile, flying above fifty statute miles demonstrates the requisite proficiency.¹²

The question remains: what was the origin of the 50-mile number, whether statute or nautical? And, did it have a rational basis in aeronautics?

III. THE 275,000-FOOT LINE

According to lore, the Hungarian-American aerodynamicist Theodore von Kármán initially calculated circa 1957 an altitude of 275,000 feet (83.81 kilometers, 52.08 statute miles, 45.3 nautical miles), and he did so specifically for the purpose of indicating where airspace gave way to outer space. This is incorrect. Furthermore, from this point, like a multiple independently-targetable reentry vehicle (MIRV), this original idea appears to have fissioned off onto several independent trajectories.

Andrew G. Haley coined the term “Kármán line” in 1957, referring to 275,000 feet as:

a critical jurisdictional line, marking the theoretical limit of air flight, which I term the Kármán Line. It must be noted with care that the exact location of this line of primary jurisdiction

¹¹ United States Government Accountability Office, *Commercial Space: FAA Should Examine How to Appropriately Regulate Space Support Vehicles*, www.gao.gov/assets/690/681227.pdf.

¹² *Remarks by Patricia Grace Smith, Associate Administrator for Commercial Space Transportation, Federal Aviation Administration*, Presentation of FAA commercial astronaut wings to SpaceShipOne pilot Mike Melvill, 21 June 2004, https://www.faa.gov/about/office_org/headquarters_offices/ast/media/PGS_Melvill_wings_2004-06-21.pdf. “Like U.S. military and NASA astronauts, the FAA now has its own way to recognize those who reach space in the United States through private endeavors. DOT/FAA Commercial Astronaut Wings are awarded to pilots and flight crew on board an AST-licensed launch vehicle on a flight that exceeds 50 miles.” The inference of statute miles is by reference to U.S. military and NASA practices. *See also* Erik Seedhouse, *ASTRONAUTS FOR HIRE: THE EMERGENCE OF A COMMERCIAL ASTRONAUT CORPS*, 44 (2012): “[T]he United States Air Force and the Federal Aviation Administration (FAA) consider an altitude of 80 km (50 miles, 264,000 feet) as the altitude to qualify as space flight.”

is not presented as an apodictic solution of the problem. The Kármán primary jurisdictional line may eventually remain, or, after due consideration of such developments as improved techniques of cooling and the discovery of more heat resistant materials, this line may be changed significantly. But, while these changes will be in the exact location of the Kármán Line, the existence of the line is certain and wherever the line is finally drawn will be the place where "airspace" terminates."¹³

From this passage, it is to be understood that the scientific rationale for the von Kármán line was aerothermal, that atmospheric friction was the principal barrier to aircraft attaining high altitudes. It can also be noted that Haley considered 275,000 feet to be a soft number which "may be changed significantly."¹⁴ Despite this, he accepted as an article of faith that "the existence of the line is certain."¹⁵ It is possible, although by no means certain, that the USAF's criterion of fifty miles for awarding astronaut wings derived from a rounding downward from 52.08 statute miles.

Elsewhere Haley stated:

The basic advantage of a criterion such as the Karman Line lies in its practical application—it effectively separates the territory of air-breathing vehicles from that of rocket vehicles.¹⁶

Here, Haley invoked a different basis for the von Kármán line: a distinction in the methods of propulsion; however, in terms of aerodynamics, thrust is thrust. Although it is true that jet engines can operate at higher altitudes than piston-driven propeller engines, there is considerable overlap in the operational altitude regimes of jets and propeller aircraft; in turn, this is also true of jet-propelled "air-breathing vehicles" *versus* rocket-propelled "non-air-breathing

¹³ Andrew G. Haley, *Space Exploration: The Problems of Today, Tomorrow and in the Future*, 2 PROC. ON THE L. OF OUTER SPACE OF OUTER SPACE, 49, 50 (1959).

¹⁴ *Id.*

¹⁵ *Id.*

¹⁶ Andrew G. Haley, *Survey of Legal Opinion on Extraterrestrial Jurisdiction*, paper given at the 11th Congress, International Astronautical Federation, Sweden, reprinted in Legislative Reference Service, Library of Congress, LEGAL PROBLEMS OF SPACE EXPLORATION, S. Doc. No. 26, 87th Cong., 1st Sess., 723 (1961).

vehicles.”¹⁷ Nor is the altitude limit of “air-breathing vehicles” set in stone; the advancement of supersonic combustion ramjet (scramjet) technology has long been considered the key to the development of single-stage-to-orbit vehicles, such as NASA’s abandoned Rockwell X-30 National Aero-Space Plane.¹⁸ Further blurring the dichotomy of aeronautics/air-breathing engines *versus* ballistic missile technology, sources in the Russian military have stated that a scramjet test on 12 February 1998 related to the development of a maneuverable ICBM warhead. In the United States, scramjet development achieved a milestone with the 1 May 2013 flight of the Boeing X-51 at Mach 5.1 (2,900 knots, 3,400 statute miles per hour; 5,400 kilometers per hour).¹⁹ If there is a separation, either in speed or altitude, of the “territory of air-breathing vehicles from that of rocket vehicles,” it has yet to be determined, and therefore no proposed line can have a “practical application.”

The literature citing the von Kármán line as 275,000 feet, 52.08 statute miles, or 83.81 kilometers is extensive and fairly continuous: Gorove 1958,²⁰ Haley 1958,²¹ Quigg 1958,²² Cooper 1959,²³ Bookout 1960,²⁴ Seara Vázquez 1960,²⁵ Lipson and Katzenbach 1961,²⁶ Schrader 1962,²⁷ Haley 1963,²⁸ McDougal *et al.* 1963,²⁹

¹⁷ For example, the Messerschmitt Me-163 Komet, a rocket propelled fighter aircraft, entered service in 1944. See Mano Ziegler, ROCKET FIGHTER: THE STORY OF THE MESSERSCHMITT ME 163 (1976).

¹⁸ Mark Wade, *X-30*, Encyclopedia Astronautica, <http://astronautix.com/lvs/x30.htm>.

¹⁹ United States Air Force, *Factsheets: X-51A Waverider*, <http://www.af.mil/About-Us/Fact-Sheets/Display/Article/104467/x-51a-waverider/>.

²⁰ Stephen Gorove, *On the Threshold of Space: Toward a Cosmic Law Problems of the Upward Extent of Sovereignty*, 1 PROC. ON L. OUTER SPACE 69, 72 (1958).

²¹ A. G. Haley, *Space Law—The Development of Jurisdictional Concepts*, 7 PROC. INT’L ASTRONAUTICAL CONG. 170 (1958).

²² Philip Quigg, *Open Skies and Open Space*, 37 FOREIGN AFFAIRS 95 (October 1958).

²³ John Cobb Cooper, *The Problem of a Definition of “Air Space,”* 1 PROC. ON THE L. OF OUTER SPACE 38, 40 (1958).

²⁴ Hal H. Bookout, *Conflicting Sovereignty Interests in Outer Space: Proposed Solutions Remain in Orbit!*, 7 MIL. L. REV. 23-49 (January 1960).

²⁵ Modesto Seara Vázquez, *The Functional Regulation of the Extra-Atmospheric Space*, 2 PROC. ON THE L. OF OUTER SPACE 143 (1960).

²⁶ Leon Lipson & Nicholas deB. Katzenbach, REPORT TO THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ON THE LAW OF OUTER SPACE §636, §643 (1961).

²⁷ George D. Schrader, *National Sovereignty in Space*, 17 MIL. L. REV. 41, 52 (July 1962).

²⁸ Andrew G. Haley, SPACE LAW AND GOVERNMENT, 78-79, 98 (1963).

²⁹ McDougal *et al.*, *supra* note 1, at 220, 264-265, 333.

Christol 1966,³⁰ Hyman 1966,³¹ Johnson 1966,³² Lachs 1966,³³ Smith 1969,³⁴ Taubenfeld 1969,³⁵ Lay and Taubenfeld 1970,³⁶ Mushkat 1970,³⁷ UNCOPUOS 1970,³⁸ Lachs 1972,³⁹ Haanappel 1977,⁴⁰ Perek 1977,⁴¹ Rosenfield 1979,⁴² Bridge 1980,⁴³ Gallagher 1986,⁴⁴ Orr 1997,⁴⁵ Dolman 2002,⁴⁶ Hobe 2007,⁴⁷ Dodge 2009,⁴⁸ and Gerhard 2011.⁴⁹

³⁰ Carl Q. Christol, *THE INTERNATIONAL LAW OF OUTER SPACE*, 248 (1966).

³¹ William A. Hyman, *MAGNA CARTA OF OUTER SPACE*, 188 (1966).

³² Rodney W. Johnson, *Problems of Law and Public Order in Space*, 52 AM. BAR ASSOC. J. 6: 555, 556-557 (June 1966), <http://www.jstor.org/stable/25723642>.

³³ Manfred Lachs, *The International Law of Outer Space*, III RECUEIL DES COURS, 35 (1966).

³⁴ Delbert D. Smith, *The Legal Ordering of Satellite Telecommunication: Problems and Alternatives*, 44 IND. L. J. 3, 379 (1969), <http://www.repository.law.indiana.edu/ilj/vol44/iss3/1>.

³⁵ Howard J. Taubenfeld, *Outer Space: The "Territorial" Limits of Nations*, 38 FORDHAM L. REV. 1, 5 (1969), <http://ir.lawnet.fordham.edu/flr/vol38/iss1/9>.

³⁶ S. Houston Lay & Howard J. Taubenfeld, *The Law Relating to Activities of Man in Space*, 43 (1970).

³⁷ Marion Mushkat, *New Developments in Outer Space Law and Their Role in Increasing International Security*, ZAÖRV 123 (1970).

³⁸ U.N. Doc. A/AC.105/C.2/7, *The Question of the Definition and/or the Delimitation of Outer Space*, 44 (7 May 1970).

³⁹ Manfred Lachs, *THE LAW OF OUTER SPACE: AN EXPERIENCE IN CONTEMPORARY LAW-MAKING*, 83 (1972).

⁴⁰ Peter P.C. Haanappel, *Definition of Outer Space and Outer Space Activities*, 20 PROC. ON L. OUTER SPACE 53, 54 (1977).

⁴¹ Lubos Perek, *Scientific Criteria for the Delimitation of Outer Space*, 5 J. SPACE L. 1:111, 114 (1977), <http://www.spacelaw.olemiss.edu/jsl/pdfs/back-issues/jsl-5-1.pdf>.

⁴² Stanley B. Rosenfield, *Where Air Space Ends and Outer Space Begins*, 7 J. SPACE L. 2: 137, 139 (Fall 1979), <http://www.spacelaw.olemiss.edu/jsl/pdfs/back-issues/jsl-7-2.pdf>.

⁴³ Robert L. Bridge, *International Law and Military Activities in Outer Space*, 13 AKRON L. REV. 649, 651 (1980).

⁴⁴ Michael G. Gallagher, *Legal Aspects of the Strategic Defense Initiative*, 111 MIL. L. REV. 11, 20 (Jan. 1986).

⁴⁵ Shannon H. Orr, *NATIONAL SELF-INTEREST IN THE COSMOS: A REGIME ANALYSIS OF OUTER SPACE*, 59 (1997). M.A. thesis, University of Guelph.

⁴⁶ Everett Dolman, *ASTROPOLITIK: CLASSICAL GEOPOLITICS IN THE SPACE AGE*, 115 (2002).

⁴⁷ Stephan Hobe, *Legal Aspects of Space Tourism*, 86 NEB. L. REV. 439, 442 (2007).

⁴⁸ Michael S. Dodge, *Sovereignty and the Delimitation of Airspace: A Philosophical and Historical Survey Supported by the Resources of the Andrew G. Haley Archive*, 35 J. SPACE L. 1: 5, 27 (2009).

⁴⁹ M. Gerhard, *Space Tourism: The Authorisation of Suborbital Space Transportation*, in *NATIONAL SPACE LEGISLATION IN EUROPE: ISSUES OF AUTHORISATION OF PRIVATE SPACE ACTIVITIES IN THE LIGHT OF DEVELOPMENTS IN EUROPEAN SPACE COOPERATION*, 280 (Frans G. von der Dunk ed. 2011).

US Army Lieutenant Colonel Hal H. Bookout related a concise explanation of the von Kármán line in 1960:

The X-2 rocket plane flight whereby Captain Ivan [*sic*] C. Kincheloe attained the altitude of 126,000 feet is cited by its proponent to illustrate the separate parts played by aerodynamic lift and centrifugal force. The flight is characterized as strictly an aeronautical adventure and not partaking of space flight. It is contended that at the altitude indicated, aerodynamic lift carries ninety-eight percent of the weight while only two percent is attributed to centrifugal force. In carrying forward this concept of measuring the separate contributions made to aerial flight by aerodynamic lift and centrifugal force, the Karman line is drawn at approximately 275,000 feet or 52 miles—where an object traveling in a so-called corridor of continuous flight at 26,000 feet per second is completely taken over by centrifugal force. At this point where “all” aerodynamic lift is said to be gone, the sovereignty of the underlying state would find a boundary “capable of physical and mathematical demonstration at a reasonably stable height.”⁵⁰

Arguably, the best recent assessment of Haley’s original work on this subject, including his personal letters, was by Michael S. Dodge in 2009, who stated that the “von Kármán Primary Jurisdictional Line” is 275,000 feet.⁵¹

IV. THE 100-KILOMETER LINE

Haley himself was inconsistent in his references to the von Kármán line. From his initial citing of 275,000 feet,⁵² a year later he referred to an agreement between delegates to the *Fédération Aéronautique Internationale* (FAI)⁵³ from the United States and the Soviet Union regarding a 100-kilometer line as a determination of space flight records as “this coincides with the Karman line theory.”⁵⁴ Obviously, 275,000 feet (83.8 kilometers, 52.08 statute

⁵⁰ Bookout, *supra* note 24.

⁵¹ Dodge, *supra* note 48.

⁵² Haley, *supra* note 13, at 50.

⁵³ A nongovernmental organization, which therefore does not represent the official positions of governments.

⁵⁴ Andrew G. Haley, *Survey of Legal Opinion on Extraterrestrial Jurisdiction*, 3 PROC. ON THE L. OF OUTER SPACE 41 (1961).

miles) does not “coincide” with 100 kilometers (328,100 feet, 62.14 statute miles) in an exact sense. Similarly, McDougal *et al.* viewed the FAI line as “supporting” the von Kármán line without realizing the two were miles apart:

In support of this altitude [of 275,000 feet/52 statute miles] it is also emphasized that agreement has been reached within the Federation Astronautique Internationale to the effect that for the purposes of keeping records the flight exceeding 62 miles (100 km) altitude will be considered as “space flight.”⁵⁵

It is not clear that the von Kármán calculation and the IAF number ever had anything to do with each other.⁵⁶ Antonio Ambrosini, the first chairman of the Legal Subcommittee of the Ad Hoc Committee on the Peaceful Uses of Outer Space, had urged a delimitation of outer space at 100 kilometers (62.14 statute miles) in 1958;⁵⁷ thus, this altitude might be more properly called the Ambrosini line. Alternatively, the genealogy of any proposed delimitation of outer space at approximately 100 kilometers altitude may be traced to John Cobb Cooper, who in 1951 suggested 60 statute miles (96.55 kilometers) as the upper limit of airspace; thus this altitude might be more properly called the Cooper line.⁵⁸ It may be that by 1960, there was more support in the FAI for the Cooper-Ambrosini line than for the von Kármán line. One may speculate that they were viewed as representing more or less the same idea, and thus misappropriating the famed aerodynamicist’s name to grace the 100-kilometer line may have been either an innocent error of inclusion or a generous gesture to von Kármán. The effect, however, was

⁵⁵ McDougal *et al.*, *supra* note 1, at 334. Imagine being able to persuade a traffic policeman that one had been “supporting” the 55 MPH speed limit while driving one’s automobile at 62 MPH.

⁵⁶ This was not the first time that von Kármán’s name was taken in vain. A 1940 report of the National Academy of Science stated that the gas turbine engine would never fly; this was a year after the Germans began flight-testing a prototype jet aircraft. Von Kármán wrote in his autobiography that he was very embarrassed about this because he was the chairman of the committee that was responsible for the report; he claimed that he was on travel on the day they wrote up the final draft. See Peter J. Mantle, *Introducing New Technology into the Navy*, in LECTURES ON ADVANCED TECHNOLOGIES AT U.S. NAVAL ACADEMY, 1985-1987, 41-62, 53 (A. E. Bock ed., 1989).

⁵⁷ U.N. Doc. A/C.1/PV.982, 56 (12 November 1958).

⁵⁸ John Cobb Cooper, *High Altitude Flight and National Sovereignty*, 4 INT’L L. Q. 41: 411 (1951).

to imply a technical basis for the 100-kilometer line which did not exist.

V. THE 90-KILOMETER LINE

Elsewhere, Haley referred to “the occurrence of free molecular oxygen in the atmosphere up to 90 km (295,000 ft). It is only above this level (called the von Kármán Line)”⁵⁹ Here, he not only introduced a third altitude, but also a fourth technical rationale.⁶⁰ The “occurrence of free molecular oxygen” had nothing at all to do with an alleged aerothermal barrier, nor to the air-breathing/non-air-breathing propulsion dichotomy, nor to the calculation of aerodynamic lift *versus* centrifugal force.

VI. THE 60-KILOMETER LINE

That Haley had no strong feeling either way is further suggested by the following passage based on information provided by Austrian aerospace engineer Eugen Sänger, who placed the limits “of aeronautics proper at about sixty kilometers, or 37.3 miles.”⁶¹

[I]n scientific terms there are three distinct regimes of flight, each possible within certain ascertainable, but by no means ascertained, limits: the aeronautical regime; the corridor of atmospheric escape and the astronautic regime.⁶²

McDougal *et al.* wrote in 1963:

The “escape corridor” of Haley extends from the altitude of 37.3 miles above the earth’s surface to “about 3,725 miles.” In this corridor operate ballistic missiles and “rocket vehicles” which represent “the transition from aeronautics to astronautics,” whereas satellites are in the “domain of pure astronautics upon reaching orbital velocity.”⁶³

⁵⁹ Andrew G. Haley, *Space Exploration: The Problems of Today, Tomorrow and in the Future*, 2 PROC. ON THE L. OF OUTER SPACE 49 (1959).

⁶⁰ As well as a second name for it: the “von Kármán line” *vs.* the “Kármán line.”

⁶¹ Andrew G. Haley, *The Law of Space and Outer Space*, 33 SO. CAL. L. REV. 370, 373-374 (1960).

⁶² *Id.*

⁶³ McDougal *et al.*, *supra* note 1, at 333-334. It may be observed that here Haley appears to have espoused a mixture of the functional and spatial approaches.

Thus, a fourth altitude was introduced that was attributed to Haley (perhaps erroneously) and to von Kármán by implication.

VII. BLURRED LINES

In sum, the evidence suggests that the von Kármán line of 275,000 feet was just one of several ideas that Haley considered, so it is doubly ironic that it has since taken such significance and at the wrong altitude (100 kilometers). In 1963, McDougal *et al.* referred to the von Kármán line as 275,000 feet,⁶⁴ while also citing separately the FAI line of 100 kilometers. Nevertheless, from the 1960s to date, numerous sources have cited 100 kilometers as being the von Kármán line. It may be suggested that later references to 100 kilometers are explainable as someone having revised von Kármán's figure upward to the value that has since come to be widely reported. If this were so, the question would be whether this upward revision was arrived at via valid aerodynamic data and/or credible physical assumptions, or whether it merely reflected some desire for a rounder and higher number without a scientific basis. What appears to have happened is that the FAI's 100-kilometer line came to be associated with von Kármán; however, this author has found no evidence of any connection between von Kármán himself and the FAI line; rather, Haley declared that the FAI line "coincides with the Kármán line theory."⁶⁵ This suggests that reference to the 100-kilometer line as the von Kármán line is a misnomer, an urban legend that has developed in the course of the past half century and which has now become a "just so" story. The inaccuracies in the reminiscences of S. Sanz Fernández de Córdoba, president of the FAI, bolster this conclusion:

A lot of calculations were made, and finally it was reached the conclusion, accepted by all scientist involved, that around an altitude of 100 km, the boundary could be set. By the way, most calculations, which I could see at the time, were using nautical miles for altitude. That was probably because it was the only unit of length more or less common at the time . . . So the altitude decided upon had a very uneasy number to remember. It

⁶⁴ *Id.* at 264-265.

⁶⁵ Haley, *supra* note 16.

was apparently Von Karman himself who realised, and proposed to the rest, the very round number of 100 Km (very close to the calculated number). The rest of the people eagerly accepted it.

The 100-Km altitude, ever since named the “Karman Line”, came thus into existence as the boundary separating Aeronautics and Astronautics.⁶⁶

Meanwhile, in 1958, Haley, in his position in the International Astronautical Federation (IAF, not to be confused with the FAI; Haley was president 1957-1958 and general counsel 1959-1963) was campaigning for a “definition of airspace.”⁶⁷

I urge that at a plenary session of the Congress, the President of the International Astronautical Federation be authorised to appoint a Committee of seven persons, consisting of four physicists and three lawyers, who will draft a definition of “airspace” and recommend a rule delimiting airspace jurisdiction, such definition and rule to be supported by a statement of Findings of Fact and Conclusions of Law. The resolution should be transmitted to the attention of the Secretary-General of the United Nations and to the Secretary-General of the International Civil Aviation Organization (ICAO), with the statement that the Committee will cooperate with the appropriate officials of said organizations.⁶⁸

In 1960, Haley reported an agreement on 100 kilometers in the FAI. However, if von Kármán had any involvement in this, why would Haley and McDougal *et al.* have referred to the von Kármán line as 275,000 feet in 1963, the year in which von Kármán died? No evidence has been found that von Kármán repudiated the

⁶⁶ S. Sanz Fernández de Córdoba, *100km Altitude Boundary for Astronautics*, Fédération Aéronautique Internationale (2004), <http://webcache.googleusercontent.com/search?q=cache:L8F2R7qfsnsJ:www.fai.org/sig-slider-news/111-icare/35876-100km-altitude-boundary-for-astronautics+&cd=1&hl=en&ct=clnk&gl=us>.

⁶⁷ National Center for Remote Sensing, Air, and Space Law, ANDREW G. HALEY (1904-1966) (2012), <http://www.spacelaw.olemiss.edu/archives/haley/bio.html>. It is noted in passing with some irony that, as opposed to a “definition of outer space,” as one might expect of the IAF, an astronautics organization, Haley instead requested “definition of airspace,” which more properly would have been in the purview of the FAI as an aeronautics organization. Of course, what is not below a line is above the line, *et vice versa*.

⁶⁸ Haley, *supra* note 21, at 174.

275,000-foot line, just as no evidence has been found that he proposed a line in any publication during his lifetime. Also, why in 1963 did McDougal *et al.* cite the FAI line of 100 kilometers as a number which was distinct from the von Kármán line of 275,000 feet? The evidence suggests that the von Kármán line of 275,000 feet (83.81 kilometers) and the IAF line of 100 kilometers are two distinct items that have been conflated. Francis Lyall and Paul Larsen⁶⁹ provided the ultimate expression of this conflation, referring twice to the von Kármán line as “100 km/62 miles (275,000 ft),” thereby having it both ways.

Aside from Haley’s own four technical descriptions of the rationale for the von Kármán line, other authors have described it inaccurately. Perek expressed it as the “theoretical limit of air flight at an altitude where aerodynamic lift is exceeded by the centrifugal force. This happens at about 84 km.”⁷⁰ Centrifugal force exceeds aerodynamic lift when it accounts for more than half of the total lifting force on the vehicle, this could occur as low as 64 kilometers, depending on the assumed lift coefficient. Halstead even mischaracterized the 100-kilometer limit as “the lowest altitude at which Earth orbit can be maintained by a satellite, a somewhat randomly selected altitude of 100 kilometers.”⁷¹ Actually, Halstead’s misrepresentation of the von Kármán line was a description of a competing theory for the delimitation of outer space: the lowest perigee of a satellite.

The Hungarian jurist Gyula Gál wrote in 1961:

According to a theory of Haley, the legally relevant line starts where, in aviation, the aerodynamic factor is replaced by the Kepler force. If, for instance, a body proceeds at an altitude of 80 kilometers with a speed of 10,000 meters per second, the former decreases to 0, and the range of the effect of the latter begins. This limit creates a new physiological-psychological situation which requires a new legal regulation. The Haley line,

⁶⁹ Francis Lyall and Paul B. Larsen, *SPACE LAW: A TREATISE*, 167 (2009).

⁷⁰ Perek, *supra* note 41, at 122.

⁷¹ C. Brandon Halstead, *Prometheus Unbound? Proposal for a New Legal Paradigm for Air Law and Space Law: Orbit Law*, 36 J. SPACE L. 1: 143, 153 (2010).

however, is a mathematical function of altitude and speed, and changes together with these.⁷²

Johannes Kepler's laws were a purely mathematical description of planetary motion without ascribing any "force" as the cause of the planets' behavior,⁷³ thus the so-called "Kepler force" is a misnomer. It was Isaac Newton's laws of motion which stated that mass (*any* mass, not solely planets) had the property of inertia, which in circular motion manifests as centrifugal force. His law of universal gravitation stated that any mass also generated gravitational force.⁷⁴ Although the cited altitude of 80 kilometers can be seen as a rounding down from 275,000 feet (83.81 kilometers), the reference to the speed of 10,000 meters per second requires some explanation. If one accepts the definition of the von Kármán line as being a combination of altitude and speed where aerodynamic lift becomes zero and a vehicle is supported entirely by centrifugal force, a vehicle at 80 kilometers altitude would require a speed of 7,910 meters per second to orbit Earth by inertia alone (neglecting atmosphere entirely). The speed cited by Gál is closer to escape speed, about 11,000 meters per second (depending on altitude) - the speed at which an object leaves Earth orbit and is captured by the Sun's gravity. This speed is not at all relevant to the von Kármán line.

Inaccuracies abound in Nicolas Mateesco Matte's 1969 account:

Dr. von Karman reached the conclusion that the altitude of about 85 kilometers... is the limit at which the aerodynamic displacement ceases and the force of the Kepler laws begins. The Karman line is the foundation of the criterion of the ascensional pressure. However, this "Karman primary jurisdictional line" is now placed at a height of about 100 kilometers, according to new scientific research. Bloomfield considers that the

⁷² Gyula Gál, *Air Space and Outer Space*, UNITED STATES SENATE SYMPOSIUM ON LEGAL PROBLEMS OF SPACE EXPLORATION, 87th Cong., 1st session, Senate Doc. 26, 1141, 1148 (1961).

⁷³ Curtis Wilson, *Kepler's Laws, So-Called* (May 1994). 31 HAD NEWS, Historical Astronomy Division, American Astronomical Society.

⁷⁴ Millard F. Beatty, *PRINCIPLES OF ENGINEERING MECHANICS: VOLUME 2 DYNAMICS—THE ANALYSIS OF MOTION*, Volume 33 of Mathematical Concepts and Methods in Science and Engineering (2005).

Karman line of 55 miles is already obsolete since the X-15 has extended this limit. The Dyna-Soar will travel at speeds of 16,000 miles an hour at an altitude of about 60,000 miles, circling the world in 90 minutes, and will pass from the region of air to that of space.⁷⁵

Again, there is no “force of the Kepler laws.” Moreover, the term “ascensional pressure” is unknown to this aerospace engineer, but it may have been an attempt to refer collectively to the upward forces that act on a hypersonic airplane: aerodynamic lift and centrifugal force (a manifestation of Newtonian inertia). It may be noted that Mateesco Matte alluded to an earlier version of the von Kármán line as 85 kilometers (52.82 statute miles) and as 55 statute miles (88.51 kilometers), both numbers being somewhat above 275,000 feet (52.08 statute miles, 83.81 kilometers). Mateesco Matte did not indicate who subsequently placed the von Kármán line at 100 kilometers. The flight of the X-15A⁷⁶ above the von Kármán line of 275,000 feet did not render the line obsolete, since it flew above 275,000 feet due to the thrust of its rocket engine, not due to aerodynamic lift alone. The Boeing X-20 Dyna-Soar⁷⁷ was to have been launched on a Martin Marietta Titan IIIC rocket,⁷⁸ so its ascent into orbit would have been irrelevant to the von Kármán line. Without going into the mathematics, for the X-20 to have traveled “at speeds of 16,000 miles an hour at an altitude of about 60,000 miles, circling the world in 90 minutes” would have violated Kepler’s third law of motion, but in fact, the X-20 never traveled at any speed, since the US Department of Defense canceled the program in 1963, six years before the publication of Mateesco Matte’s book.

⁷⁵ Nicolas Mateesco Matte, *AEROSPACE LAW*, 30-31 (1969).

⁷⁶ Mark Wade, *X-15*, Encyclopedia Astronautica, <http://www.astronautix.com/x/x-15a.html>.

⁷⁷ Mark Wade, *Dynasoar*, Encyclopedia Astronautica, <http://www.astronautix.com/d/dynasoar.html>.

⁷⁸ Mark Wade, *Titan 3C*, Encyclopedia Astronautica, <http://www.astronautix.com/t/titaniic.html>.

VIII. THE SEARCH FOR THE SOURCE

So, what of von Kármán's own publications, and his mention of an altitudinal line? Hugh L. Dryden, who was Director of the National Advisory Committee on Aeronautics from 1947 to 1958 and Deputy Administrator of NASA from 1958 to 1965, did not mention the von Kármán line in his extensive biographical memoir of von Kármán.⁷⁹ Dryden would certainly have been aware of the von Kármán line had it been among von Kármán's own publications; neither has this author found a publication authored by von Kármán himself that documents any calculation regarding this.

At a 1957 conference (proceeding published in 1958), Haley cited a 1956 paper by von Kármán:

As I have pointed out in earlier papers, Dr. von Kármán has suggested methods of formulating the jurisdiction of space law. Last spring he told me that he had delivered a paper at a luncheon at the University of California, Berkeley, entitled "Aerodynamic Heating—the Temperature Barrier in Aeronautics," and in that paper he had occasion to use a diagram made by Masson and Gazley of the Rand Corporation showing the possible ranges for continuous flight in the velocity-altitude coordinate system. Later on, he sent me a copy of his paper which contains the Masson and Gazley diagram. He said that this diagram, although designed to show the variation of velocity versus altitude for various values of dynamic pressure and equilibrium pressure, in the hands of a skilled person could readily be used to show the regimes of atmospheric and extra atmospheric flight and to depict the jurisdictional boundary lines thereof.

I have unskillfully redone the Masson and Gazley diagram (see Fig. 1) to indicate curves showing the high altitude sounding rocket regime, the earth orbital satellite regime and the Kepler regime (earth escape velocity), and some supernumerary information, but most importantly, I have shown what I now call the Kármán primary jurisdiction line.

I have reproduced the Masson and Gazley right side curve—the so-called temperature barrier, or heat barrier—simply to

⁷⁹ Hugh L. Dryden, *THEODORE VON KÁRMÁN: 1881-1963* (1965). Washington: National Academy of Sciences, <http://www.nasonline.org/publications/biographical-memoirs/memoir-pdfs/von-karman-theodore.pdf>.

show the present state of the art, and thus arbitrarily to delimit the corridor of continuous flight. This line has nothing to do with the jurisdictional question as improved techniques in cooling and discovery of heat resisting materials will undoubtedly change this curve.

Fig. 1 is intended to be illustrative, and it is not presented as an apodeictic solution of jurisdictional boundary lines. The Kármán primary jurisdictional line may eventually actually remain as shown on Fig. 1 or, after due consideration, the line may be significantly changed. In any event, this is the line at which “airspace” terminates.⁸⁰

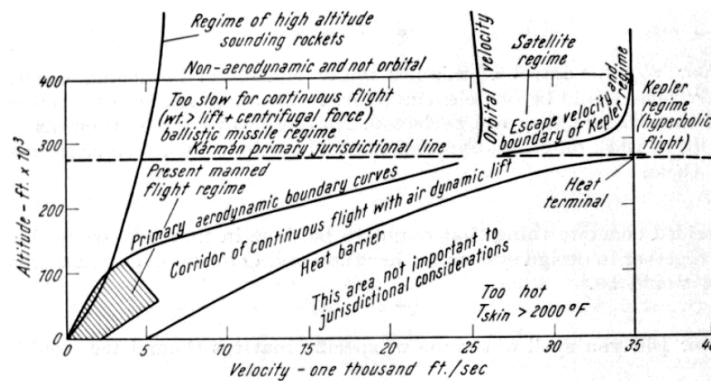


Figure 1: Diagram Showing Regimes of Atmospheric and Extra-Atmospheric Flight and Depicting the Jurisdictional Boundary Lines. *Source: Haley 1958, at 274*

Haley’s diagram depicts the “corridor of continuous flight” to which Bookout referred.⁸¹ Haley referred to the “high altitude sounding rocket regime, the earth orbital satellite regime and the Kepler regime (earth escape velocity)” in relation to the “Kármán primary jurisdiction line.”⁸² This is far from being an unambiguous statement that the line is where aerodynamic lift is completely taken over by centrifugal force. Simultaneously, Haley dismissed

⁸⁰ Haley, *supra* note 21, at 174-175.

⁸¹ Bookout, *supra* note 24.

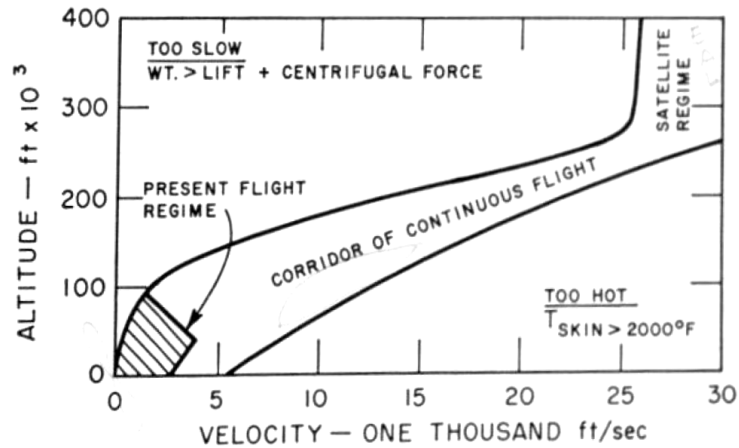
⁸² Haley, *supra* note 21 at 174-175.

the “so-called temperature barrier, or heat barrier” as having “nothing to do with the jurisdictional question as improved techniques in cooling and discovery of heat resisting materials will undoubtedly change this curve;” yet the 1956 von Kármán paper, which Haley cited, dwelt on exactly this: the problems of aerodynamic heating on vehicles traveling at hypersonic velocities.⁸³ Von Kármán’s paper contained a simpler version of the Masson and Gazley diagram. Figure 2 shows no horizontal altitude line of any kind, much less one which is either a barrier to aerodynamic flight or is “jurisdictional,” nor does it depict “escape velocity and boundary of Kepler regime,” as did Haley’s version. The text of von Kármán’s paper contained no reference to any specified altitude, and the one barrier he mentioned was “the temperature barrier” as it related to materials which were then known:

The upper limit for the velocity is computed in this diagram somewhat arbitrarily. The main engineering problem consists of finding methods that allow an extension of the temperature barrier toward higher velocities. The heat emission in continuous flight by radiation varies at a rapid rate as the surface temperature increases and also varies with the altitude. Unfortunately, at surface temperatures permissible for current materials, the radiation represents a small amount in comparison with the heat input to be expected. Therefore, artificial means are necessary to reduce the heat input or to transfer heat from the airplane or missile to the surrounding space.⁸⁴

⁸³ Theodore von Kármán, *Aerodynamic Heating—The Temperature Barrier in Aeronautics*, PROC. HIGH-TEMPERATURE SYMPOSIUM, BERKELEY, CALIFORNIA (1956).

⁸⁴ *Id.* at 141-142.



NOTE: SKIN TEMPERATURE ONE FEET AFT OF LEADING EDGE ON FLAT PLATE AT 5° ANGLE OF ATTACK.

Figure 2: Variation Versus Altitude for Various Values of Dynamic Pressure and Equilibrium Temperature. *Source:* Von Kármán 1956, at 141

What is certain is that von Kármán's 1956 paper included a diagram which contained no horizontal line whatsoever; it would not have made sense to, since he indicated in his article that the curves in the diagram, although based on his long experience, were "somewhat arbitrary." A year later, Haley presented a redrawn diagram at a conference, in which he had "penciled" his proposed "Kármán primary jurisdiction line" at 275,000 feet. This is the proverbial "smoking gun;" von Kármán's 1956 paper depicted the "weapon" as it existed just before it was fired, and Haley's 1957 conference presentation depicted the "smoke" wafting from the end of the barrel.

It may be that Haley interpreted the point of inflection in Figure 1 (around 250,000-280,000 feet) at which the upper line delimiting the "corridor of continuous flight" bends straight upward from a previously rather gradual slope, coupled with the area designated as the "satellite regime," as a kind of "turning point" legitimizing a transition from legal airspace to legal outer space. However, this is pure speculation, as Haley did not explain any rationale for his 275,000-foot line in relation to this. In any case, both boundaries of

the “corridor of continuous flight” depended on the state of the art of materials science in 1956. The lower boundary, labeled the “heat barrier,” depended on the ability of a vehicle to withstand heat loading, and the upper boundary, labeled “primary aerodynamic boundary curves,” depended on a vehicle’s weight *versus* its forward velocity. Assumptions inherent in these curves, which may have been valid in 1956, ceased to be valid as aerospace technology progressed, as will be explained in more detail *infra*. It may be that the von Kármán line had its genesis in an “Ask Yuriy” scenario.⁸⁵ Haley asked von Kármán a question for which there was no documented answer,⁸⁶ so von Kármán jotted down a “back of the envelope” answer (Figure 2) which satisfied Haley, but which he may have misunderstood. Von Kármán returned to his real work, and a legend was born.

The closest thing to a statement by von Kármán regarding the line bearing his name is the following passage:

Where space begins . . . can actually be determined by the speed of the space vehicle and its altitude above the earth. Consider, for instance, the record flight of Captain Ivan [*sic*] Kincheloe in an X-2 rocket plane. Kincheloe flew 2000 mile per hour at 126,000 feet, or 24 miles up. At this altitude and speed aerodynamic lift still carries 98 per cent of the weight of the plane, and only two per cent is carried by centrifugal force, or Kepler Force, as the space scientists call it. But at 300,000 feet or 57 miles up this relationship is reversed because there is no longer any air to contribute lift. Only centrifugal force prevails. This is certainly a physical boundary, where aerodynamics stops and astronautics begins, and so I thought why should it not also be a jurisdictional boundary? Haley has kindly called it the Kármán Jurisdictional Line. Below this line space belongs to each country. Above this level there would be free space.⁸⁷

⁸⁵ As described by Sheryl L. Bishop and Marilyn Dudley-Flores in a personal communication, “Ask Yuriy” refers to an apocryphal situation in the Russian space program in which the answer to a technical question cannot be found in documentation, thus the inquirer is handed off to a reputed expert on the subject, the proverbial Yuriy.

⁸⁶ Haley and von Kármán had known each other at least since 1942, when Haley drew up the articles of incorporation for Aerojet Corporation, of which von Kármán was one of its founding engineers and briefly its first president; Haley succeeded von Kármán as president of Aerojet later that same year.

⁸⁷ Theodore von Kármán, with Lee Edson, *THE WIND AND BEYOND*, 343 (1967).

This passage is notable for several reasons. For one thing, this autobiography was published four years posthumously, which raises the question as to how much the ghost writer rewrote material based on von Kármán's notes without his being able to validate the book's technical content. Also, it perpetuates the controversy as to whether the von Kármán line had its origins in aerothermal concerns or in Newtonian inertia (so-called "Kepler Force"). Another point is that Iven Kincheloe's flight in a Bell X-2⁸⁸ occurred on 7 September 1956 (Bookout⁸⁹ referred to the same flight in 1960). It can be inferred that von Kármán's notes date from no later than 7 March 1961, when X-15A pilot Robert White broke both Kincheloe's speed and altitude records (White had broken the individual records on separate flights the year before; 3,397 kilometers per hour 1,834 knots, 2,111 statute miles per hour) on 12 May 1960 (41.605 kilometers or 25.854 statute miles on 12 August 1960). Then, of course, there is the fact that the passage *supra* references 300,000 feet (91.43 kilometers, 56.82 statute miles) and neither 275,000 feet, 90 kilometers, nor 100 kilometers, three altitudes which Haley cited. This creates additional doubt, rising to the level of reasonable doubt, as to where the von Kármán line was actually supposed to be. Did von Kármán come up with one number (300,000 feet) circa 1956, but suggest another (275,000 feet) to Haley in 1957, or did von Kármán come up with one number (275,000 feet) circa 1956, and relay it to Haley, but calculated another (300,000 feet) at some later date, or did Haley interpret von Kármán's 1956 diagram as implying a line at 275,000 feet without von Kármán's having specified this altitude? Added to the muddle is the true origin of the 100-kilometer line, in which Haley may have had some involvement, although there is no evidence that von Kármán did.

IX. A CONCEPTUAL-LEVEL ANALYSIS

Most remarkable is that von Kármán's calculations, whether based in aerothermal issues or in Newtonian mechanics, have yet to see the light of day, despite the enormous importance that has been imputed to the line that bears his name. All that is extant is

⁸⁸ Henry Matthews, *THE SAGA OF THE BELL X-2, FIRST OF THE SPACESHIPS* (1999).

⁸⁹ Bookout, *supra* note 24.

Figure 2, in which the curves depicted therein were drawn somewhat arbitrarily by von Kármán's own admission. An exhaustive technical analysis of the von Kármán line, based in Newtonian mechanics and aerodynamics, is beyond the scope of the present article; however, the relevant technical issues can be discussed on a conceptual level without mathematical rigor.

Stipulating for the moment that the altitude of the von Kármán line was based on aerothermal problems, the advance of materials science has certainly overtaken any such calculation. The thermal protection blankets and tiles used on the Space Shuttle did not exist in 1956, although carbon phenolic ablative materials were being developed for ballistic missile reentry vehicles and for recoverable spacecraft, this technology was in its infancy. An aeronautical application of the latter technology, in the form of an X-15A with a complete heat-resistant ablative coating, did not take to the air until 28 June 1964.⁹⁰

More credible, and certainly most often cited, is that the altitude of the von Kármán line was based on the dominance of Newtonian inertia over aerodynamic lift in a specified speed regime, resting on the idea that at a certain altitude, an airfoil⁹¹ must have so much speed in order to produce lift that centrifugal force takes over.

If an aerodynamic vehicle were to exceed the von Kármán line, could it be said to have reached the lower limit of outer space? If it were to shut down its engine, drag would decelerate it, lift would decrease, and the vehicle would descend. No vehicle could maintain its speed and height at this altitude by inertia alone. This would also be true of an aerospace vehicle which achieved an altitude and speed one kilometer above the von Kármán line by using its engine to counter not only drag but weight as well; once its engine were shut off, drag would decelerate it and the vehicle would descend. So, there is no justification here for concluding that there is a definite theoretical limit.

Well, but wait a minute, would not such a vehicle have centrifugal force "take over?" Take over what? Centrifugal force can be

⁹⁰ Richard Tregaskis, *X-15 DIARY: THE STORY OF AMERICA'S FIRST SPACE SHIP* (2000).

⁹¹ An airfoil is the cross-sectional shape of a wing, blade (of a propeller, rotor, or turbine), or sail. The motion of this shape through air produces aerodynamic force.

thought of as an upward force (actually the story is more complicated, an interaction of the vehicle's inertia and Earth's gravity), as is aerodynamic lift, but drag is a backward force, acting to decelerate the vehicle's forward motion, against which forward thrust must be continuously applied in order to maintain speed. The slower the forward motion, the less centrifugal force, and the vehicle descends. Anything that is incapable of maintaining straight and level flight at a specified altitude if not under continuous thrust is obviously in the atmosphere and can scarcely be regarded as being in outer space.

Finally, it is untrue that aerodynamic lift is impossible above the von Kármán line, as is sometimes reported.⁹² This is demonstrated in Figure 3. The dashed line curve is the reentry profile for a spherical reentry vehicle, such as Vostok. Being a sphere, it develops no lift but is subject to drag, and of course, having mass, it is subject to acceleration in a gravity field. Thus, the shape of the dashed line curve is due to drag decelerating the forward motion of the vehicle and due to gravity accelerating the vertical motion of the vehicle. The solid line curve is the reentry profile for a Space Shuttle Orbiter. This curve would also become steeper due to drag and gravity were it not for aerodynamic lift. Instead, the curve becomes noticeably shallower at an altitude of about 88 kilometers (55 statute miles), as lift becomes dominant over drag and gravity. Obviously, weaker lift is generated at even higher altitudes during reentry, well before it becomes the dominant force.

⁹² See e.g., Wikipedia, *Kármán line*, https://en.wikipedia.org/wiki/K%C3%A1rm%C3%A1n_line (accessed 27 February 2016).

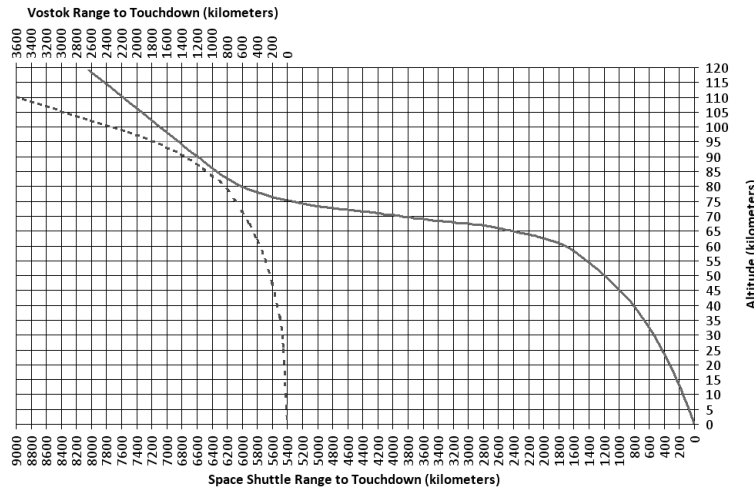


Figure 3: Reentry Profiles of Vostok and Space Shuttle Orbiter

A basic understanding of the technical issues can be obtained by considering the classical lift equation:

$$L = \frac{1}{2}\rho v^2 C_L S \quad (1)$$

where L is the force of lift, ρ is air density, v is velocity, C_L is the airfoil's lift coefficient (for a given angle of attack), and S is the planform area of the lifting surfaces. The higher the altitude, the lower the air density, and therefore the higher the velocity must be to maintain the same lift (and the more frictional heating to which the vehicle is subjected). However, for an aircraft in straight and level flight,⁹³ lift equals weight. If an aircraft could be built lighter, then it would require less lift. Since lift is proportional to the square

⁹³ "Straight and level" flight, synonymous with maintaining constant heading and altitude over a prescribed distance, is in reference to the surface of Earth, which is curved; it is not in reference to an inertial reference system such as orbits and trajectories in outer space. If an airliner flew a constant altitude from Auckland to San Francisco, roughly one quarter of the way around the world, it would of course fly a curved path in the three-axis inertial sense, yet it would be considered to be flying "straight and level" in the aeronautical sense.

of the velocity, a lighter aircraft (requiring less lift) could fly considerably slower while maintaining the same altitude, or alternatively, the aircraft could maintain a higher altitude for the same velocity, a velocity which might be slower than where centrifugal force “takes over.” Gyula Gál understood this in 1961:

The Haley line . . . is a mathematical function of altitude and speed, and changes together with these.⁹⁴

Thus, the upper curve portrayed in Figure 2 can shift depending upon weight, wing area, parasitic drag (as a function of the form and shape of the object), angle of attack, and thrust. If there were such a thing as a von Kármán line, it would depend on the structures technology of the time. In the 21st century, aircraft are constructed with lightweight composite materials that did not exist in von Kármán’s time. Furthermore, the increased heat resistance of advanced materials can shift the lower curve of Figure 2. Whatever calculation one makes involves certain assumptions regarding technology. Absent having in hand the exact set of assumptions with which von Kármán began, one cannot arrive unambiguously at the line he calculated.⁹⁵ As Perek observed in 1977:

The definition is to some degree connected with a particular degree of technological development . . .⁹⁶

Also, a 1977 UNCOPUOS report noted:

[T]he criticism based on the observation that the von Karman line is unstable since it is linked to technological development continues to be maintained.⁹⁷

⁹⁴ Gál, *supra* note 72.

⁹⁵ In his doctoral dissertation, the author examines, in addition to the von Kármán line, many other proposals for the legal definition and delimitation of outer space, as well as arguments against any definition or delimitation, and proposes a solution. See Thomas Gangale, *The Definition and Delimitation of Outer Space and Territorial Airspace in International Law* (2017), J.S.D. dissertation, University of Nebraska).

⁹⁶ Perek, *supra* note 41, at 123.

⁹⁷ U.N. Doc A/AC.105/C.2/7/Add.1, *The Question of the Definition and/or the Delimitation of Outer Space*, 21 (1977).

X. SORRY, WRONG NUMBER

With respect to aerodynamics, there is nothing inherently remarkable about a line drawn at 60 kilometers, at 50 statute miles, 275,000 feet, at 300,000 feet, at 90 kilometers, at 50 nautical miles, at 100 kilometers, or at any other altitude. The von Kármán line, wherever it was drawn and by whomever it was drawn, had its origin in a theoretical calculation based on the aerospace technology of the 1950s, has never found a practical use in engineering, and has been misinterpreted by lawyers as having some physical significance, which in fact it does not have.

INCENTIVES FOR KEEPING SPACE CLEAN: ORBITAL DEBRIS AND MITIGATION WAIVERS

*By Stephen J. Garber**

While many authors have written about the safety, technical, policy, and even legal aspects of orbital debris, certain key aspects remain largely unexplored. Strong economic incentives to mitigate (prevent) and remediate (clean up) debris do not currently exist. Although the U.S. has stringent technical mitigation guidelines, data on NASA and military (the two government launching organizations) waivers to these guidelines are generally not publicly available. In addition, there is no executive branch authority outside of NASA and the military for granting waivers to them. Some options for an improved waiver review process and for new economic incentives to deal with debris are thus presented. Ultimately, more attention should be paid to mitigation before domestic policy-makers can deal with the equally important and more complex remediation issues, and then tackle both prevention and cleanup of debris internationally.

I. BACKGROUND AND CONTEXT

A. Introduction

This essay begins with the framing of the orbital debris issue, explaining that it is a form of pollution that potentially can harm people or property on orbit or even on the ground. It then describes

* NASA History Division, Washington, DC. This article is written in his personal capacity and the views expressed do not represent the views of NASA or the U.S. Government. Quite a number of people assisted me in various ways with this article. Special thanks go to Bill Barry, Jay Finch, Pete Hays, Dana Johnson, Josef Koller, Darren McKnight, Steve Mirmina, Scott Pace, Audrey Schaffer, Brian Weeden, and several others. My sincere thanks to all of these space professionals, as well as a number of family and friends for their patience serving as sounding boards. As is usually the case, any errors are my responsibility.

the extent of the problem and some recent notable events before going on to lay out the relevant domestic and international guidelines to minimize future debris.

In the second section, I argue that the Secretary of Defense and NASA Administrator's authority to permit the launches of military and civilian spacecraft that do not comply with domestic debris prevention guidelines presents a potential or perceived conflict of interest. Fortunately, the military and NASA have taken seriously these responsibilities. I also argue that adequate financial incentives do not exist for government and especially commercial space operators to clean up existing debris.

Section three argues for making waiver data more publicly available and outlines some potential approaches to alleviate the perceived conflict of interest for the NASA Administrator and Secretary of Defense, possible financial incentive structures for reducing debris, and some ways to encourage more international cooperation on debris, an inherently global issue.

I conclude by arguing that while the domestic standards for preventing orbital debris are very sound, the U.S. Government could do more to deal with debris by proactively publicly sharing data on adherence to domestic debris standards and by altering its administrative processes in this regard. Some creative solutions may also be in order to create financial incentives to develop the technologies that will be needed to clean up existing debris. Overall, a more comprehensive domestic and international approach to prevent future debris (i.e. mitigation) and clean up existing debris (i.e. remediation) is needed.

B. Nature of the problem

Orbital debris is a vexing problem that has the potential to disrupt spacecraft operations; destroy expensive and critical national security spacecraft; and cause damage to property and people on the ground. Low Earth Orbit (LEO) is the most congested orbital regime and both small and large pieces of debris are problematic there.

In a lay (non-legal) sense, orbital debris may be considered a “tragedy of the commons.”¹ Some specialists contend that debris is more accurately categorized economically as a “common pool resource” (CPR) issue.² Since it is basically pollution in space, perhaps debris is best characterized as a negative economic externality, in which all users of space potentially suffer from the actions of polluters.

There are definite financial and other costs to mitigating (preventing) future orbital debris and there is little incentive for space operators to pay those costs when the risk of being harmed by debris is relatively low.³ Concern over debris has risen in recent years but has not reached a “critical mass” prompting a paradigmatic shift in action yet.

While physically removing debris (remediation) from LEO may seem intuitively attractive, it is currently considerably more challenging than mitigation because relevant proven technologies

¹ See Garrett Hardin, *The Tragedy of the Commons*, Science, Dec. 13, 1968, at 1243-1248. (term was popularized by this article); See also W. F. Lloyd, *Two Lectures on the Checks to Population* (Oxford Univ. Press, 1833)(Hardin’s concept adapted from this article), reprinted (in part) in Garrett Hardin, *Population, Evolution, and Birth Control* (Freeman, 1964); See also Jared B. Taylor, *Tragedy of the Space Commons: A Market Mechanism Solution to the Space Debris Problem*, 50 COLUM. J. TRANSNAT’L L. 253, 254-279 (2011); Scott J. Shackelford, *Governing the Final Frontier: A Polycentric Approach to Managing Space Weaponization and Debris*, 51 AM. BUS. L. J., 435 (2014) (explicitly using this terminology when referring to orbital debris).

² Henry Hertzfeld, Brian Weeden, and Christopher Johnson, *How Simple Terms Mislead Us: The Pitfalls of Thinking about Outer Space as a Commons*, Int’l Astronautical Congress paper (IAC-15-e7.5.2 x 29369); Brian Weeden and Tiffany Chow, *Taking a Common-Pool Resources Approach to Space Sustainability: A Framework and Potential Policies*, 28 SPACE POLICY 166, 167-172 (2012). Both papers draw on the Nobel Prize-winning economic work of Elinor Ostrom. Shackelford’s *Governing the Final Frontier* article also adds a layer of international relations theory by categorizing the situation as a “prisoner’s dilemma,” in which multiple actors would benefit by cooperating but aren’t able to communicate and thus everybody loses; See p. 443, where he cites Elinor Ostrom *A Polycentric Approach to Coping with Climate Change* (World Bank Policy Research Working Paper No. 5095, 2009), <http://www19.iadb.org/intal/intalcdi/pe/2009/04268.pdf>.

³ Taylor notes that the “current legal regime fails to solve the tragedy of the space commons” issue (p. 264). Citing Jonathan Baert Wiener, *Global Environmental Regulation: Instrument Choice in Legal Context*, 108 YALE L.J. 714 (1999), and Jon Hanson and Kyle Logue, *The Costs of Cigarettes: The Economic Case for Ex Post Incentive-Based Regulation* 107 YALE L.J. 1174 (1998), Taylor also states that the “incentive-based market mechanisms ... are preferable to conduct-based regulatory strategies... on cost-efficiency grounds” (p. 275). This subject of incentives and regulatory mechanisms with respect to orbital debris is addressed further later in this paper.

do not exist yet, and because of political, legal, diplomatic, and national security issues. Engineers need to develop, test, and deploy one or more technologies to clean up the debris; and since there are no “off-the-shelf” products, this will take time and be expensive. There are complex legal liability issues associated with remediating another operator’s property and it is not always possible even to identify the source and thus ownership of objects in space. Moreover, there are significant dual-use issues associated with “rendezvous and proximity operations” because if an operator has the technical capability to move a piece of debris, this technology also could be utilized for military purposes in space.

Technical experts generally agree that working now to prevent creating future debris is more cost-effective, but there are also significant policy hurdles surrounding mitigation. Currently there are a variety of national and international mitigation standards and guidelines for government and commercial launches, although they are all based on certain key principles. Many U.S. launches need waivers from the relatively strict U.S. standard practices, often because of legacy launch vehicles, which would be expensive to retrofit to be compliant or because the launching organization effectively would need to purchase excess capability to ensure proper post-mission disposal.

In addition to the technical and financial challenges, there are policy inconsistencies, both domestically and internationally, as described below. It is likely that a coordinated, collaborative, and comprehensive interagency (“whole of government”) and international approach will be necessary to arrive at appropriate diplomatic, technical, and legal remedies. In general, the United States is considered a world leader in developing and implementing appropriate space policies and has taken the lead in analyzing the debris issue technically. As a leader, the United States could do more to improve the procedures to ensure compliance with domestic mitigation guidelines. Due to the inherent nature of orbital debris, any “solution” likely will include a significant international component.

C. Scope of the problem and a recap of some recent troubling events

Two events in the last decade, one deliberate and one accidental, significantly increased the amount of debris in LEO and

concomitantly, the public awareness of this issue. In January 2007, the Chinese Government conducted an antisatellite (ASAT) test that destroyed their own FengYun 1C satellite and created more than 3,400 pieces of debris. Secondly, in February 2009, the Iridium-33 satellite accidentally collided with the inoperative Cosmos 2251 satellite, creating more than 1,600 pieces of debris.⁴

Graphs from the National Aeronautics and Space Administration (NASA) Johnson Space Center's Orbital Debris Program Office (ODPO) show the total number of objects in space (the vast majority of which are not operational spacecraft) sharply spiked after the 2007 and 2009 incidents. In general, the total keeps climbing. In 2014, the total number of objects 10 cm and bigger dipped slightly because of high solar activity (which increases atmospheric drag on objects in LEO, causing more of them to reenter the atmosphere and burn up). Still, the total mass of space debris continued to increase.⁵

One simple way to characterize the issue is to differentiate between large and small debris. There are more than 500,000 small objects (5 mm to 1 cm) and fewer very large (up to about 9 tons) objects. One prominent expert has estimated that 99 percent of the total debris mass in LEO is from pieces 10 cm or larger.⁶ Together the United States and Russia account for over 85 percent of the mass in LEO, while 900 of 1,100 tons of rocket bodies in LEO and

⁴ See, Phillip Anz-Meador, *Top Ten Satellite Breakups Reevaluated*, Orbital Debris Quarterly News, January/April 2016, at 5, 6; Nicholas L. Johnson, *Orbital Debris: The Growing Threat to Space Operations*, (AAS 10-011) 137 Guidance and Control: Advances in the Astronautical Sciences 5, (2010).

⁵ See, J.C. Liou, *USA Space Debris Environment, Operations, and Measurement Updates* presentation to 52nd session of the Scientific and Technical Subcommittee of the Committee on the Peaceful Uses of Outer Space, United Nations, Feb. 2 – 13, 2015, pp. 3-4 (<http://www.unoosa.org/pdf/pres/stsc2015/tech-28E.pdf>). Regarding the number of operational satellites, one specialist recently estimated that there over 500 operational satellites in LEO, approximately 80 in Medium Earth Orbit (MEO), and approximately 400 in geostationary orbit (GEO). Of these, approximately 180 are classified U.S. satellites; See Joshua Tallis, *Remediating Space Debris: Legal and Technical Barrier*, Strategic Studies Quarterly 86, 94 (2015). More recently, p. 8 of the Satellite Industry Association's (June) 2016 State of the Satellite Industry Report (available at <http://www.sia.org/wp-content/uploads/2016/06/SSIR16-Pdf-Copy-for-Website-Compressed.pdf>).

⁶ J.C. Liou, *An Active Debris Removal Parametric Study for LEO Environment Remediation*, 47 ADVANCES IN SPACE RESEARCH 1866, 1867 (2011).

the vast majority of the number of debris pieces are Russian.⁷ Current collision probability is based on the number of objects in orbit while future collision probability is driven by mass in orbit.⁸

For several years, technical experts have believed that cleaning up about five large objects per year, along with vigorously implementing existing mitigation standards, would stabilize the LEO environment, while removing more than five objects per year would improve the environment by decreasing the risk of a cascade effect. This model assumes that future launch rates could be extrapolated from the rates of 2002-2010 and that active debris remediation (ADR) would begin in 2020.⁹

Similarly, the notable 2011 “Catcher’s Mitt” study¹⁰ supported NASA’s suggestion that annually removing 5-10 large objects in LEO, combined with improved adherence to the U.S. mitigation guidelines (see below), would significantly stabilize that region. Ultimately, the “key issue then is the stabilization or reduction of the population of medium debris” through ADR. Its authors called for the near-term remediation of large objects in LEO and geostationary orbit (GEO) as the only practical way to stabilize those space environments.¹¹

D. Domestic Guidelines

Domestically, the primary guidance governing orbital debris for U.S. Government spacecraft and launches is the U.S. Government Orbital Debris Mitigation Standard Practices (USG ODMSP)

⁷ Al Anzaldúa and Dave Dunlap, *Overcoming Non-Technical Challenges to Cleaning up Orbital Debris*, The Space Review, November 9, 2015, <http://www.thespacereview.com/article/2863/1>. Presumably a high number of small (low mass) pieces of debris in LEO are attributable to China.

⁸ Thanks to Darren McKnight for pointing this out.

⁹ J. C. Liou, *The Top Ten Questions for Active Debris Removal* presentation at the European Workshop on Active Debris Removal, Paris, June 22, 2010, (<http://ntrs.nasa.gov/archive/nasa/casi.ntrs.nasa.gov/20100025507.pdf>), p. 23. A cascade effect, in which an on-orbit collision would create more pieces of debris, which in turn would create more collisions, is commonly known as the Kessler effect (after Donald Kessler, an early pioneer in the orbital debris field). Passive, rather than active, debris remediation is also a possibility, although not often discussed. Thanks to Darren McKnight for making this last point.

¹⁰ Wade Pulliam, *Catcher’s Mitt Final Report* Tactical Technology Office, Defense Advanced Research Projects Agency, May 2011, <http://www.dtic.mil/dtic/tr/fulltext/u2/1016641.pdf>.

¹¹ *Id.* at 3.

document from February 2001. The USG ODMSP have figuratively and literally set the standards for international debris mitigation guidelines, in that other orbital debris guidelines and standards have followed and been based on this approach. These mitigation guidelines cover four primary areas: controlling release of debris during normal operations (no debris larger than 5 mm should remain in orbit for more than 25 years); minimizing accidental explosions (through passivation of stored energy); avoiding collisions (by using a safe flight profile); and ensuring safe post-mission disposal (through atmospheric reentry, maneuvering to a higher “graveyard orbit” or direct retrieval).¹²

For NASA launch vehicles and spacecraft, NASA Technical Standard 8719.14 currently is the governing document for debris. This Technical Standard was first enacted in 2007, when it superseded an older NASA Safety Standard on orbital debris (upon which the USG ODMSP were based), and was updated most recently in 2011.¹³ It is similar to the USG ODMSP, although more stringent in certain areas. For example, NASA-STD 8719.14 calls for limiting the size, number, and lifetime of both small (defined as larger than 1 mm) and large (greater than 10 cm) debris while the USG ODMSP refers only to debris larger than 5 mm.¹⁴

For military spacecraft and launch vehicles, Department of Defense (DoD) Instruction 3100.12 (Space Support) includes a section on orbital debris that basically mirrors the USG ODMSP.¹⁵ While over 15 years old (dating back to September 2000), this DoD Instruction is still in force and scheduled to be updated at some point in the future. The relevant DoD directive simply refers to the

¹² The USG ODMSP are available from http://www.orbitaldebris.jsc.nasa.gov/library/USG_OD_Standard_Practices.pdf online.

¹³ NASA Safety Standard (NSS) 1740.14, Guidelines and Assessment Procedures of Limiting Orbital Debris, was released in Aug. 1995. The foreword of the NASA STD notes that it is consistent with the USG ODMSP and other relevant national and international documents such as the IADC and UN guidelines (see below in this paper).

¹⁴ This is available from <https://standards.nasa.gov/standard/nasa/nasa-std-871914> online. See p. 19, 31, and 37 for these details. [In February 2017](#), a revised NASA Procedural Requirement (NPR) for Limiting Orbital Debris was issued (available from https://nodis3.gsfc.nasa.gov/npg_img/N_PR_8715_006B_/N_PR_8715_006B_.pdf).

¹⁵ DoD Instruction 3100.12 dates from Sept. 14, 2000 and is available from <http://www.esd.whs.mil/Portals/54/Documents/DD/issuances/dodi/310012p.pdf> online.

USG ODMSP in stating that DoD “will promote the responsible, peaceful, and safe use of space.”¹⁶

E. International Guidelines

Internationally, the Inter-Agency Space Debris Coordination Committee (IADC) was established in 1993. The IADC currently has 13 space agency members: Italy, France, China, Canada, Germany, India, Japan, South Korea, the United States, Russia, Ukraine, the United Kingdom, and the European Space Agency (ESA). Following the adoption of the USG ODMSP in 2001, the IADC adopted the first international set of guidelines in 2002.¹⁷

In December 2007, the United Nations General Assembly endorsed the mitigation guidelines crafted by the UN Committee on the Peaceful Uses of Outer Space (COPUOS)’s Scientific and Technical Subcommittee. The UN guidelines build upon the IADC guidelines but are organized slightly differently and have some subtle, technical differences. Unlike the USG ODMSP or the IADC guidelines, the UN guidelines do not specify the 25-year time limit for post-mission disposal nor do they specify numerical parameters for appropriate graveyard orbits.¹⁸ Overall, IADC and UN guidelines were designed to help individual nations craft their own mitigation standards and hence these guidelines are not legally binding.

In addition to the United States, four other spacefaring countries have adopted national mitigation guidelines. Japan did so in 1996, France in 1999, and Russia in 2000. In a high irony, the Chinese adopted mitigation guidelines in 2006 before ignoring them with their January 2007 destructive antisatellite test, which in turn led to the cancellation of the spring 2007 IADC meeting in Beijing. Some spacefaring nations and organizations do not yet have

¹⁶ DoD Directive 3100.10 for Space Policy, Oct. 18, 2012, available from http://www.defenseinnovationmarketplace.mil/resources/DoD3100-10_dtd12Oct2012.pdf online.

¹⁷ See <http://www.iadc-online.org/> online. NASA leads the U.S. Government delegation to the IADC. The IADC Space Debris Mitigation Guidelines are available from <http://www.spacelaw.olemiss.edu/library/space/IntOrg/IADC/IADC-%2002-01%20-%20IADC%20Space%20Debris%20Mitigation%20Guidelines.pdf> and other sources online.

¹⁸ The UN Mitigation Guidelines are available from <http://www.iadc-online.org/index.cgi?item=documents> online.

orbital debris standards that are consistent with the UN and IADC guidelines.¹⁹

II. ADMINISTRATIVE ISSUES

A. *Mitigation Waiver Issues*

The NASA Administrator and Secretary of Defense are responsible, per the 2010 National Space Policy,²⁰ for granting waivers to upcoming launches from their own organizations that are expected not to comply with their agencies' standards or the USG ODMSP. While this arrangement is not necessarily a conflict of interest, it does raise the perception of a potential conflict of interest, an issue that seldom has been discussed publicly.

This is not to say that either NASA or DoD is self-serving in granting itself waivers. Both organizations have established processes to consider various extenuating factors that reflect common sense. NASA's Tropical Rainfall Measurement Mission (TRMM), for example, was extended because it could help provide tracking data about hurricanes that likely would save more lives than would be endangered by debris from the spacecraft's uncontrolled reentry.²¹ Nevertheless, having an organization grant itself waivers to rules is an inherent structural administrative issue.

Both NASA and DoD incorporate the concept of independent technical authority. NASA's governance model separates program-

¹⁹ Preface, *Space Debris Mitigation Guidelines of the Committee on the Peaceful Uses of Outer Space*, quoted in Nicholas Johnson, *Current Issues in Orbital Debris*, First Canadian Workshop on Orbital Debris, St.-Hubert, Quebec, Canada, June 21-22, 2011, (<http://ntrs.nasa.gov/archive/nasa/casi.ntrs.nasa.gov/20110012005.pdf>), p. 3; Nicholas Johnson, "Space Debris Mitigation Guidelines" presentation at the Symposium on Small Satellite Programmes for Sustainable Development, Graz, Austria, Sept. 13-16, 2011 (<http://ntrs.nasa.gov/archive/nasa/casi.ntrs.nasa.gov/20110014989.pdf>); China's national industry standard was developed in 2005 and put into effect in 2006 – its content apparently is similar to the UN and IADC orbital debris guidelines; (See Zizheng Gong, *CASC [China Aerospace Science and Technology Corporation] Efforts on Dealing with Space Debris toward Space Long Term Sustainability*, presentation to COPUOS Scientific and Technical Committee, Vienna, Feb. 11-22, 2013, (<http://www.unoosa.org/pdf/pres/stsc2013/2013lts-03E.pdf>), pp. 24 – 26).

²⁰ National Space Policy, June 28, 2010, (http://history.nasa.gov/national_space_policy_6-28-10.pdf) p. 8.

²¹ See <http://www.nasa.gov/content/goddard/the-trmm-rainfall-mission-comes-to-an-end-after-17-years>.

matic and technical authority. This means that the Associate Administrator for Safety and Mission Assurance is given an independent voice on programmatic safety issues, rather than, for example, giving the Associate Administrator for the Science Mission Directorate the sole ability to make final decisions about the safety of robotic spacecraft. After the *Columbia* Space Shuttle accident in 2003, NASA officials implemented formal Independent Technical Authority. Previously, NASA personnel had been looking at the Navy's SUBSAFE program in 2002 and other NASA-DoD "benchmarking" efforts based on this concept in the Navy had been done even earlier.²²

By the time a spacecraft is almost ready for launch, however, it is by definition much too late to change its construction or reconfigure it for an alternate launch vehicle that might produce less debris. Such factors need to be considered when spacecraft are being designed, not prepared for launch. It would be rather expensive to redesign a spacecraft or even potentially to provide it with additional fuel to maneuver for post-mission disposal. Thus in many cases, the Secretary of Defense and NASA Administrator effectively have had little choice but to approve exceptions to the rules, especially when critical national security spacecraft are involved (which includes virtually all DoD missions).

Calendar year 2017 appears to be the first year in which the Air Force did not request any waivers from the Secretary of Defense. This notable achievement may be due to the fact that for several years, the Secretary of Defense has directed the Air Force to reach compliance by including the USG ODMSP requirements into future space launch acquisitions strategies and contracts.²³

NASA and DoD compliance rate data (i.e.: how many waivers are granted to the USG ODMSP per year) typically are not widely

²² See, NASA, Office of the Chief Engineer, "Technical Authorities," http://www.nasa.gov/offices/oc/ce/functions/tech_auth.html; *Columbia Accident Investigation Board Report*, volume 1 (August 2003), p. 227; Rear Admiral Paul E. Sullivan, testimony before the House Science Committee on the SUBSAFE Program, in *NASA's Organizational and Management Challenges in the Wake of the Columbia Disaster*, Hearing before U.S. House of Representatives Science Committee (Oct. 29, 2003).

²³ See Robert Work, Memorandum for Secretary of the Air Force regarding Compliance with U.S. Orbital Debris Mitigation Standard Practices (ODMSP) (Feb. 6, 2017) (on file with author).

available (they are unclassified, however). In terms of reporting requirements, the 2010 National Space Policy calls for the Secretary of Defense and NASA Administrator to notify the Secretary of State of their waivers. Typically, however, the State Department does not forward this information to any international bodies such as the UN COPOUS or the IADC, or even compile the data in a systematic way. Sharing this domestic compliance data internationally would bolster the U.S. Government's deserved reputation as an international leader in debris mitigation and encourage other nations such as China and Russia to collect such data and report them internationally.²⁴

Additionally, there are some, albeit more minor, gaps and inconsistencies in regulatory coverage of commercial satellites that are launched domestically. The Federal Aviation Administration (FAA) regulates launch vehicles, while the Federal Communications Commission (FCC) and the National Oceanic and Atmospheric Administration (NOAA) regulate communications and remote sensing spacecraft, respectively. The FAA currently holds commercial launch operators only to the first three sections of the USG ODMSP and not the fourth section on post-mission disposal of launch vehicles. As part of their licensing processes, NOAA and the FCC include stipulations about post-mission disposal of spacecraft in conjunction with the USG ODMSP.²⁵ Unfortunately, there is no significant enforcement mechanism short of the government not granting a license (it is not clear whether this has ever occurred) so there is little to no overt incentive to comply with the regulations.

The FCC has regulatory authority over commercial spacecraft because even if a spacecraft is not designed for a telecommunications mission *per se*, ground operators usually still need to communicate with the spacecraft. Thus, the FCC typically regulates the

²⁴ See, the National Space Policy, June 28, 2010, http://history.nasa.gov/national_space_policy_6-28-10.pdf p. 8 (p. 12 of the pdf) for the notification language. In the context of orbital debris, page 2 (p. 6 of the pdf version) of this National Space Policy notes that "As the leading space-faring nation, the United States is committed to addressing these challenges."

²⁵ See NOAA, "About the Licensing of Private Remote Sensing Space Systems," <http://www.nesdis.noaa.gov/CRSRA/licenseHome.html> and *Disclosure of Orbital Debris Mitigation Plans, Including Amendment of Pending Applications*, Oct. 13, 2005, http://hraunfoss.fcc.gov/edocs_public/attachmatch/DA-05-2698A1.pdf.

use of that portion of the electromagnetic spectrum if it is communicating with a ground station within the United States, whether or not the spacecraft is a domestic or foreign one. However, a potential policy gap exists in cases involving spacecraft that are not directly controlled from the ground such as the experimental Polar Orbiting Passive Atmospheric Calibration Sphere (POPACS) spacecraft, which lacks maneuverability to avoid collisions.²⁶

B. Remediation Issues – Who is Leading?

While the 2010 National Space Policy calls for NASA and DoD to research and develop ADR technologies and techniques, thus far this has been, figuratively speaking, an “unfunded mandate” and so very little work has been done.²⁷ In recent years, the Naval Research Laboratory (NRL) funded three ADR technology demonstration projects as Small Business Innovative Research (SBIR) efforts and has also cosponsored a small ADR effort with NASA. The Air Force Research Laboratory has sponsored another ADR project with SBIR funding. Researchers at NASA’s Ames Research Center have also developed a ground-based technology concept for orbital ADR that is being staffed minimally. All of these efforts involve relatively small amounts of funding (approximately \$3 million or less total for each project) and are for cutting-edge concepts that are low

²⁶ Regarding the FCC’s rules on mitigation of orbital debris; See https://apps.fcc.gov/edocs_public/attachmatch/FCC-04-130A1.pdf and K. Kensinger, S. Duall & S. Persaud, *The United States Federal Communications Commission’s Regulations Concerning Mitigation of Orbital Debris*, Proceedings of the 4th European Conference on Space Debris, April 18-20, 2005 (ESA Publication SP-587, Aug. 2005). For more information about POPACS, see, for example, Jeff Foust, *CubeSats Get Big*, Sept. 10, 2012 at <http://www.thespacereview.com/article/2155/1> online.

²⁷ See *National Space Policy of the United States of America*, June 10, 2010, http://history.nasa.gov/national_space_policy_6-28-10.pdf, p. 7.

in terms of their Technology Readiness Levels.²⁸ As the NASA Administrator conceded in 2015, “Not a lot of countries are putting money into debris removal development and more of us need to.”²⁹

Should we look to the private sector or international actors to conduct ADR research? The European Space Agency (ESA) is moving forward with a mission called e.deorbit, which would use either a robotic arm or a net to capture an old ESA spacecraft in LEO and safely destroy it through a controlled atmospheric reentry.³⁰ The Swiss Clean Space One ADR effort has gained some attention, although its technical ambitions are somewhat modest and its budget is relatively small.³¹

The United States is rightly viewed as a leader in dealing with orbital debris because domestic technical experts developed the mitigation standards that are used internationally but little has been done domestically on remediation. For various political and economic reasons, it is unlikely that China or Russia, the other two main contributors to the debris problem, will provide much leadership in developing remediation technologies.³² Because of the nature of this economic externality problem, it is unrealistic to expect private companies to invest significantly in ADR research without government support. On the other hand, one commercial space company manager recently said that the IADC guidelines are actually too lenient and that his company is voluntarily planning to add ex-

²⁸ The NRL ADR efforts are Elimination of Space Debris Through Induced Drag Enhancement, Tether Electrodynamics Propulsion CubeSat Experiment (TEPCE), and Enabling Technologies for an Electrodynamics Service Vehicle. The joint NRL/NASA ADR project is Navigation for Electrodynamics Delivery Express (EDDE) and the AFRLL ADR effort is the Orbital Debris Remover (ORDER) + Satellite on Umbilical Line (SOUL) concept. NASA Ames’ ADR effort is called Project Lightforce.

²⁹ Michael Casey, *NASA Chief: Time to clean up all that space junk*, Fox News, Nov. 14, 2015, <http://www.foxnews.com/science/2015/11/14/nasa-chief-time-to-cleanup-all-that-space-junk.html>.

³⁰ See *DeoOrbit*, United Space in Europe, April 12, 2016, http://www.esa.int/Our_Activities/Space_Engineering_Technology/Clean_Space/e.Deorbit/%28print%29 and *The Clean Space Blog*, October 18, 2017, <http://blogs.esa.int/cleanspace/category/e-deorbit/>.

³¹ *Clean Space One*, September 28, 2017, https://espace.epfl.ch/CleanSpaceOne_1 and *Cleaning up Earth’s Orbit: A Swiss Satellite to Tackle Space Debris*, Sept. 3, 2012, <http://actu.epfl.ch/news/cleaning-up-earth-s-orbit-a-swiss-satellite-to-tac/>.

³² Darren McKnight points out at least one Russian ADR proposal; See Ju. Makarov, Ja. Shatrov, Trushlyakov, L. Anselmo, and C. Pardini, *Proposals for a Flight Experiment on Active Removal of a Spent Rocket Stage*, 4th European Workshop on Active Debris Removal, Paris, CNES HQ, June 6-8, 2016.

tra fuel to deorbit his company's satellite fleet and also adding fixtures to grapple them easily in case they fail.³³ Industry personnel are also proactively discussing the fairness of the 25-year rule. If, for example, the predicted lifetime of a satellite is much shorter (even days, not years), would it be fair to other operators to allow such a satellite to remain on orbit that long?³⁴

III. POLICY OPTIONS

A. *Potential New Ways to Deal with Mitigation Waivers*

To start, it could be helpful for NASA and DoD to publicly report waivers either to Congress or to the White House. Making such data public would go a long way towards validating the United States' role as a leader in debris mitigation, without changing the administrative process of how waivers are reviewed. Even without a formal reporting requirement, the data could be posted on public NASA and DoD Web sites.

It might also be helpful to reexamine the administrative process. One of various potential options would be to have an executive branch organization outside of NASA and DoD make such waiver decisions. Setting up a standing interagency body or perhaps just granting authority to the White House Office of Science and Technology Policy (OSTP) to review debris waiver requests would enable NASA and DoD to weigh in on such requests, while not giving the NASA Administrator and Secretary of Defense authority to grant waivers to their own organizations.

Two engineers, Thomas Percy and Brian Landrum, have proposed creating a domestic interagency "Central Space Licensure Board." Percy and Landrum suggested that agencies such as NASA, DoD, NOAA, FAA, and the FCC be granted membership on such a Board. Such an interagency panel would have the advantage of having key Governmental stakeholders represented at the figurative table, again without giving the NASA Administrator and Secretary of Defense authority or responsibility to grant waivers to their own

³³ See, Peter B. de Selding, *OneWeb Pledges Vigilance on Orbital Debris Mitigation Issue*, Space News 5, Oct. 19, 2015; See also Peter B. de Selding, *OneWeb is Looking Proactive on Debris Question*, Space News 18, Oct. 26, 2015.

³⁴ Thanks to Josef Koller for making this salient point.

organizations.³⁵ If this worked well, it even could be a model for an international regulatory board that could grant waivers.

Another option conceivably could be to have some sort of standing outside body deal with waivers, but usually outside bodies such as National Research Council (NRC) committees can only advise, not regulate. NASA does have a NASA Advisory Committee with a number of subcommittees but again, this structure is designed to provide outside advice to NASA, not regulate it.³⁶ The Defense Science Board is charged with advising the Department of Defense of promising new technical areas of weapons research so this advisory board would not seem like an ideal fit.³⁷ Thus it is difficult to think of an historical precedent for such an arrangement.

The Aerospace Safety Advisory Panel (ASAP) has overseen NASA's safety procedures and been recommending ways to improve its safety since 1968. Its charter includes broad language calling for the ASAP to "advise the NASA Administrator and the Congress with respect to the hazards of proposed or existing facilities and proposed operations," conceivably giving it latitude to include debris waivers.³⁸ Potentially expanding the ASAP's purview to include dealing with debris waivers would certainly be a major organizational shift of responsibilities.

Another option is to encourage international industry standards such as the International Standards Organization (ISO) for debris mitigation. In theory, if the Government required its launch providers and spacecraft manufacturers to observe ISO 9000 standards, then these would become *de facto* industry standards because of the Federal Government's significant role in space launches.³⁹

The above examples comprise a non-exhaustive list of policy options, identifying just some of the pros and cons of each. If analysts and policymakers more fully considered the default process for

³⁵ Thomas K. Percy and D. Brian Landrum, *Investigation of National Policy Shifts to Impact Orbital Debris Environments*, 30 SPACE POLICY 23, 33 (2014).

³⁶ See "NASA Advisory Council," <http://www.nasa.gov/offices/nac/home/index.html>.

³⁷ See *Charter and Membership Balance Plan*, Defense Science Board, <http://www.acq.osd.mil/dsb/charter.html>.

³⁸ See *Aerospace Safety Advisory Panel*, National Aeronautics and Space Administration, Aug. 26, 2015, http://oair.hq.nasa.gov/asap/documents/ASAP_Charter_2015_Signed.pdf.

³⁹ Percy and Landrum, *supra* note 35 at 30.

granting debris mitigation waivers, other solutions might well surface. Hopefully, outlining some of the most obvious solutions above stimulates debate on this point.

B. Potential New Financial Incentives

In addition to adopting a new process for granting debris mitigation waivers, potential economic incentives comprise another set of possible levers for encouraging operators not to create more orbital debris. The Federal Government could, for example, use at least three different kinds of levers: levy fines for debris-generating satellites, initiate a deposit system in which a company could get a refund once a space mission was safely concluded, or issue permits for debris generation (perhaps similar to the cap-and-trade system for atmospheric pollution).⁴⁰

As in the second option (a deposit system), the federal government could levy an “orbital use” tax on domestic space launches. The tax proceeds then could be pooled for remediation technology research and development. An analogy would be to maintaining terrestrial infrastructure such as highways. Such a model thus would have dual purposes: creating a financial disincentive to create new debris and creating a funding stream to clean it up eventually.⁴¹ Any kind of financial system that provided money to federal agencies outside the usual appropriations process certainly would require congressional approval.

One space industry analyst fleshed out this idea based on the obscure Universal Service Administrative Company, a nonprofit corporation that administers taxes on consumers’ telecommunications bills and distributes the proceeds to providers in rural or low-income areas.⁴² If such an analogous company were established for

⁴⁰ Molly Macauley, *Regulation on the Final Frontier*, Regulation, Summer 2003, at 40-41, (<https://www.law.upenn.edu/institutes/regulation/papers/MacauleySpaceRegulation.pdf>).

⁴¹ Elizabeth Evans and Scott Arakawa, *Time for a Solution to the Orbital Debris Problem*, 24.3 THE AIR AND SPACE LAWYER 9-13, 23 (2012); Natalie Pusey, *The Case for Preserving Nothing: The Need for a Global Response to the Space Debris Problem*, 21 COL. J. OF INT’L ENVIR. L. POL’Y 448-449 (2010); and Mark Williamson, *Space: The Fragile Frontier* (Reston, VA: American Institute of Aeronautics and Astronautics, 2006), p. 270 citing B.C.M. Reijnen, *The Pollution of Outer Space*, 4/5 ENVIR. L. REV. 117, 121 (1993).

⁴² Jeff Foust, *Putting a Bounty on Orbital Debris*, THE SPACE REVIEW, July 27, 2009, <http://www.thespacereview.com/article/1427/1> discusses space attorney Jim Dunstan’s ideas regarding the Universal Service Administrative Company analogy.

space debris, it conceivably could tax all domestic space launches or at least those that do not comply with the USG ODMSP and then use the proceeds to fund ADR research. However, such a tax arrangement would likely be seen as an unfair burden on U.S. launch providers that would encourage the use of foreign launch vehicles.⁴³ Such a company could even place “bounties” on specific pieces of debris based on their size and/or risk. Such a nonprofit company or perhaps, a future government space traffic management agency, could then ensure that the bounty hunters operated safely in space and indemnify them for losses not covered by their insurance (akin to launch insurance requirements and indemnification).⁴⁴ Somewhat similarly, on the remediation side, one option could be a tax credit as a reward for an operator that safely removed a large piece of debris from orbit, as a way to stimulate private-sector investment in ADR technology.⁴⁵ A parallel might be to the established maritime law concept of salvage and reward.⁴⁶

While such financial incentive and disincentive systems have an inherent appeal, they also raise a number of significant questions. With any potential tax system for debris mitigation, how would the federal government, the major launcher of spacecraft domestically, tax itself? Even if a suitable tax could be devised, this would presumably only apply to the commercial sector. Perhaps there is a precedent with military bases that pollute the land or water nearby, such as with an Environmental Protection Agency-mandated cleanup after a Base Realignment and Closure commission base closure. Regardless, the idea of the government taxing itself certainly raises some thorny issues.

Moreover, what about foreign space operators, such as the Russian and Chinese governments, who have created large amounts of orbital debris? International cap and trade systems for air pollution might well be analogous and at least one author has

⁴³ Thanks to Scott Pace for making this salient point.

⁴⁴ Foust, *Putting a Bounty on Orbital Debris*. Establishing a Governmental entity to oversee space traffic management is obviously a much larger subject than can be fully addressed here. At a minimum, it would have significant national security implications – thanks to Dana Johnson for making this point.

⁴⁵ Taylor, *supra* note 1 at 276.

⁴⁶ See, Geoffrey Brice, *Maritime Law of Salvage*, third edition (London: Sweet and Maxwell, 1999).

argued for the cost efficiency of “tradable allowances.”⁴⁷ Of course, such multilateral negotiations tend to be very complex and difficult.

Even if a domestic tax system were implemented, which government agency would administer it? Neither NASA nor DoD is a regulatory agency. One option could be the FAA. Another could be a new federal space traffic management organization, a subject beyond the scope of this article.⁴⁸

C. *International Diplomacy*

The 1967 Outer Space Treaty only addresses orbital debris indirectly by calling for “free access” to space and Treaty signatories are to explore space “so as to avoid ... harmful contamination.”⁴⁹ One option in theory could be to create an international treaty to impose fees on spacefaring nations or organizations based on market share liability. Similarly, the United Nations or some other international body could conceivably establish an international tribunal for space law to adjudicate disputes.⁵⁰ Often the United Nations has lacked the political authority to enforce such treaties, however, the political appetite for such actions in the foreseeable future seems quite minimal, to say the least.

Internationally, there is no space analog to the 1972 maritime London Dumping Convention nor does the 1972 space “Liability Convention” directly address debris.⁵¹ Thus, diplomatic tools other than legally binding treaties, such as non-legally binding guidelines and voluntary Transparency and Confidence-Building Measures (TCBMs), increase in importance.

The Department of State already takes the lead in international fora and other forms of diplomacy short of a legally binding treaty. Separate bilateral diplomatic discussions, particularly re-

⁴⁷ Taylor, *supra* note 1 at 279.

⁴⁸ See, Mike Gruss, *Washington Weighs an FAA Role in Managing Space Traffic*, Space News, December 3, 2015, <http://spacenews.com/might-the-faa-inherit-the-space-traffic-management-role/>; Jeff Foust, *Filling in the Details*, The Space Review, February 8, 2016, <http://www.thespacereview.com/article/2920/1>.

⁴⁹ See, <http://history.nasa.gov/1967treaty.html>.

⁵⁰ Joseph Imburgia, *Space Debris and Its Threat to National Security: A Proposal for a Binding International Agreement to Clean Up the Junk*, 44 VAND. J. TRANSNAT'L L. 616, 618 (2011).

⁵¹ *Id.* at 629-630, 633.

garding mitigation compliance rates, with Russia and China are potential options. However, due to Russia's annexation of Crimea in 2014, Obama Administration policy prohibited most bilateral negotiations with Russia, except within the context of larger, multilateral fora such as COPUOS and the IADC.⁵² While both nations are IADC members, larger geopolitical concerns dim the prospects of gaining consensus on debris. A 2011 congressional amendment bars NASA and OSTP from holding bilateral discussions with China, but other U.S. Departments and agencies are not affected by this restriction. Certainly, overall political U.S.-Russia relations have been strained over such geographic hotspots as Ukraine, Crimea, and Syria, among other issues.⁵³

One voluntary approach is a "code of conduct." The Europeans (the European Space Agency and the French, German, Italian, and British national space agencies) established a Code of Conduct for Space Debris Mitigation in 2004; this voluntary Code is designed to help mission designers and is closely related to the IADC guidelines. Language on orbital debris was also included in a broader draft European Union-proposed International Code of Conduct for Outer Space Activities.⁵⁴ The Hague Code of Conduct against Ballistic Missile Proliferation (HCoC), the only multilateral TCBM regarding ballistic missiles, is another potential model for limiting orbital debris. Negotiated outside of the UN, the HCoC was signed and entered into force in 2002 and since then the number of nations

⁵² Thanks to Dana Johnson for clarifying this point.

⁵³ Despite these tensions with Russia, NASA continues to cooperate fully with the Russian space agency on the International Space Station program. This points out that specific political-military tensions can be divorced from other issues when doing so is in both sides' common interest.

⁵⁴ The European Code of Conduct for Space Debris Mitigation is available from <http://www.unoosa.org/documents/pdf/spacelaw/sd/2004-B5-10.pdf>. See also the draft EU ICoC is available from http://www.eeas.europa.eu/non-proliferation-and-disarmament/pdf/space_code_conduct_draft_vers_31-march-2014_en.pdf online. For two opposing views on the EU ICoC, see Michael J. Listner, *The International Code of Conduct: Comments on Changes in the Latest Draft and Post-Mortem Thoughts*, Oct. 26, 2015, <http://www.thespacereview.com/article/2851/1>; See also Akshan de Alwis, *New Tensions on How to Regulate Outer Space*, *The Diplomatic Courier*, August 10, 2015, <http://www.diplomaticcourier.com/new-tensions-on-how-to-regulate-outer-space/>; For more on codes of conduct, also see Gregory Schulte and Audrey Schaffer, *Encouraging Security by Promoting Responsible Behavior in Space*, *Strategic Studies Quarterly* 9, 17, (Spring 2012).

joining as signatories has increased from 93 to 138.⁵⁵ Such codes of conduct are designed to encourage responsible behavior by space-faring nations and organizations, rather than be enforceable or impose penalties against violators, whether or not they are parties to a code of conduct.

It seems likely that the Chinese would have conducted the 2007 ASAT test even if they had previously agreed to a code of conduct (after all, they had just voluntarily adopted their own national mitigation guidelines before ignoring them less than a year later). So might there be other diplomatic options less stringent than a treaty but more formal than a code of conduct? One possibility would be TCBMs, a voluntary, practical, faster approach to dealing with near-term problems rather than taking years to negotiate and ratify formal treaties.⁵⁶ The previously-discussed International Code of Conduct is an example of a set of TCBMs. Another option simply would be encouraging the broader use of “norms of customary international law” or standards of “best practices,” which typically evolve over time.⁵⁷ Over ten years ago, one attorney grouped options into three categories: a voluntary regime modeled after the Missile Technology Control Regime (MTCR), an approach centered around the United Nations, and a voluntary code of conduct.⁵⁸

IV. SUMMARY/CONCLUSIONS

First, it is important to recognize that orbital debris is a negative economic externality. It is a truism that we must all share space, especially the increasingly congested LEO area. Debris from any operator can disable any other operator’s or his or her own spacecraft. As major nation-states (e.g.: current/former superpowers such as the United States, Russia, and China) generally wield

⁵⁵ See, *The Hague Code of Conduct against Ballistic Missile Proliferation*, The Hague Code of Conduct, Oct. 26, 2016, <http://www.hcoc.at>. Thanks to Dana Johnson for suggesting this example.

⁵⁶ For more on TCBMs, see, for examples, Jana Robinson, *Transparency and Confidence-Building Measures for Space Security*, 27 SPACE POLICY 27, 37 (2011); United Nations Office for Disarmament Affairs, <https://www.un.org/disarmament/topics/outer-space/>; And remarks by Frank Rose, Deputy Assistant Secretary for Arms Control, Verification, and Compliance, ASEAN Regional Forum Space Security Workshop, Dec. 6, 2012, <https://2009-2017.state.gov/t/avc/rls/201625.html>.

⁵⁷ Thanks to Dana Johnson for making the distinction between TCBMs and norms.

⁵⁸ Steven J. Mirmina, *Reducing the Proliferation of Orbital Debris: Alternatives to a Legally Binding Instrument*, 99 AM. J. INT’L L. 649, 662 (2005) for an interesting analysis.

more political power than international bodies (e.g.: UN COPUOS and the IADC), perhaps we should start by looking at potential domestic solutions that if successful, might then be adopted internationally.

In terms of mitigation then, are current U.S. policies adequate? There is no reason to question the technical sufficiency of the USG ODMSP (and the IADC guidelines that were based on them). There is inconsistent adherence to these guidelines, which is based on the fact that these are guidelines rather than regulations with significant consequences for noncompliance. Currently, solid data on domestic waiver rates are not widely available and the Chinese and Russians likely do not even compile such data for their own launches, let alone share it internationally.

Thus, the United States should start by proactively making its mitigation waiver data more publicly accessible by publishing it online, reporting it routinely to the UN or IADC, or the like to encourage Russia and China to take similar action. It's not even clear whether the Chinese or Russians have formal domestic waiver review processes. Since the IADC already has its own guidelines (somewhat more lenient versions of NASA's and the US ODMSP), perhaps someday the IADC could even encourage reporting of national data on launches that don't comply with its guidelines for more accurate, "apples to apples" comparisons.

A second place to start is with the waiver arrangement for NASA and DoD launches, a subject that has received very little public attention. Policymakers should consider revisiting the NASA Administrator and Secretary of Defense having the responsibility to grant waivers to the USG ODMSP for upcoming launches of their own organizations' spacecraft. Section three above outlined some potential options for tackling this problem and perhaps other solutions would be possible. Without advocating for a particular solution, probably some sort of interagency option or Central Licensure Board within the Executive branch would be preferable for NASA and DoD (rather than having, for examples, a Congressional panel or an outside quasi-Governmental body weigh in). Examining the administrative waiver process might also stimulate helpful discussion about whether the patchwork quilt of FCC, FAA, and NOAA oversight of debris mitigation for private sector launches is adequate.

Another important issue to address is financial incentives for not increasing orbital debris. For the private sector, perhaps an orbital use tax could be employed, initially at the national level. Pooling the proceeds to begin to fund ADR research, as with the Universal Service Administrative Company and highway infrastructure analogies, is an interesting potential option. On the government side, would additional congressional appropriations be needed to redesign legacy spacecraft templates or launch vehicles to comply with mitigation guidelines? Both of these ideas are attractive, but may not be politically viable in an era when politicians are wary of introducing new taxes and Federal budgets are lean.

In addition, a multilateral code of conduct, such as that proposed by the Europeans, could be useful in spreading voluntary "best practices" for mitigation. The IADC guidelines are sufficiently strict so the rub will be to get more nations to agree in principle to these existing mitigation guidelines. Then, more importantly, there need to be enforcement mechanisms behind an international set of mitigation guidelines, which will be difficult politically to implement. A devil's advocate might suggest that orbital debris is a relatively minor issue compared to the other military, economic, cyber, and diplomatic challenges facing U.S. relations with Russia and China. Optimistically, perhaps if a suitable agreement could be reached on orbital debris, then that could even improve the atmosphere for agreements in other areas.

Ideally it would also be good for the U.S. Government to get started now with basic research on remediation technologies (the 2010 National Space Policy called for this but very little funding has been spent thus far on remediation research). A number of ADR technologies are just in the early conceptual stages so it will take some time to develop good options. It is unlikely that the Russians or Chinese will fund such work on their own initiative (except perhaps for military rendezvous and proximity operations) and currently there is little economic incentive for the commercial sector to do so either. Even removing five large rocket bodies per year from LEO, as indicated earlier, would go a long way towards creating a safer operating environment there by reducing the risk of a cascade effect.

Overall, a more comprehensive approach to regulating the mitigation of orbital debris is needed domestically before dealing with

international mitigation and remediation. Orbital debris is truly a global problem that will require global solutions. The United States has an opportunity to exercise leadership by devising and implementing more effective orbital debris policies domestically first.

THE INTERSECTION OF U.S SPACE POLICY GOALS AND NATIONAL SECURITY NEEDS: AN ARGUMENT FOR A REGULATORY REGIME OVERSIGHT COMMISSION THAT BALANCES SPACE- RELATED POLICY INTERESTS

*Rebekah Rounds**

I. INTRODUCTION

In May 2014, Space Exploration Systems (SpaceX) filed an injunction in federal court to force a review of Department of Defense (DoD) procurement practices that awarded non-competitive contract monopolies to agency-favored, space-industry entities.¹ In the filing, SpaceX protested DoD conferment of non-competitive, sole-bid launch contracts to United Launch Alliance (ULA), a company

* Rebekah Rounds is an attorney at Telecom Law Firm, P.C. in Los Angeles. Before graduating from Mississippi College School of Law in 2014, Rebekah served as a legal fellow for the Chairman of the Space Subcommittee in the U.S. House of Representatives, Rep. Steven Palazzo. Rebekah is a member of the ABA Space Law Committee and the Newsletter Editorial Board of the ABA's SciTech Space Law Committee. In 2018, Rebekah will graduate with her LL.M. in Air and Space Law through the University of Mississippi. She is licensed to practice law in the State of Maryland. Rebekah thanks her family, friends, and colleagues for their never-ending encouragement; Megan Mitchell for spurring her interests in space law; and Dr. P.J. Blount for the insight and guidance he provided to Rebekah for this commentary.

¹ Bid Protest at 2, *Space Exploration Techs. Corp. v. U.S. and United Launch Sys.*, No. 14-354C, (Fed. Cl. Apr. 30, 2014) [hereinafter Bid Protest]; *see also* Bruce Gietzen, *SpaceX Goes to Court, Wins Injunction to Bid on DoD Launches* (Apr. 25, 2014), <http://www.kxxv.com/story/25347249/spacex-goes-to-court-for-right-to-bid-on-dod-launches>; *see also* Charles Poladian, *SpaceX Files Lawsuit Over U.S. Air Force Spy Satellite Launch Contract; Elon Musk Says Deal Cost Taxpayers Billions* (Apr. 26, 2014), <http://www.ibtimes.com/spacex-files-lawsuit-over-us-air-force-spy-satellite-launch-contract-elon-musk-says-deal-1576822>.

that knowingly-used Russian engines for its launch capabilities.² According to SpaceX, the award of ULA sole-bid contracts ignored national space policy,³ defied federal procurement regulations,⁴ and supported Russia during a time of heightened conflict.⁵

The DoD argued its legal prerogative to award expendable launch vehicle (EELV)⁶ block bids to ULV because such bids 1) correspond to important national security interests⁷ and 2) create dependable, reduced-cost contracts over an extended period of time.⁸ It further argued that the EELV awards neither violated U.S. sanctions against Russia, nor put national security interests at risk in the process.⁹

The issues raised by SpaceX highlight the particularly problematic tension that occurs between some space-related national security interests and various portions of national space policy and calls attention to the fact that the President, Congress, and numerous other regulatory actors, have implemented security and space policies that have the potential to impede progress in both national security and national space initiatives. This paper examines the natural, balance-driven tension that regularly arises when space-related national security needs diverge with U.S. space policy goals, and recommends that Congress curb that tension by forming a regulatory commission that balances divergent space-related interests where national security needs intersect with space policy goals. Part II narrates the development of early policy-convergent and pol-

² Bid Protest at 1, *Space Exploration Techs. Corp. v. U.S. and United Launch Sys.*, No. 14-354C, (Fed. Cl. Apr. 30, 2014); see also Jeff Foust, *SpaceX escalates the EELV Debate* (Apr. 28, 2014), <http://www.thespacereview.com/article/2502/1>.

³ Bid Protest at 1, 8, 9.

⁴ *Id.* at 9.

⁵ *Id.* at 8.

⁶ Defendant's Motion to Dismiss Portions of Plaintiff's Complaint Related to Contract No. FA8811-13-C-0003, *Space Exploration Techs. Corp. v. U.S. and United Launch Sys.*, No. 14-354C, (Fed. Cl. Apr. 30, 2014).

⁷ Stew Magnuson, *Launch Contract Pits SpaceX Against Air Force, ULA* (July 1, 2014), <http://www.nationaldefensemagazine.org/archive/2014/July/Pages/LaunchContractDisputePitsSpaceXAgainstAirForceULA.aspx>.

⁸ *Id.*; see also *Space Exploration Techs. Corp. v. U.S. and United Launch Sys.* No. 14-354C, (Fed. Cl. Apr. 30, 2014).

⁹ Defendant's Motion to Dismiss Portions of Plaintiff's Complaint Related to Contract No. FA8811-13-C-0003, *Space Exploration Techs. Corp. v. U.S. and United Launch Sys.* No. 14-354C, (Fed. Cl. Apr. 30, 2014).

icy-divergent departure points in U.S. civil space and national security space initiatives, while Part III defines and describes the intersection of actors and ideals in the modern space policy and national security space regimes. Part IV identifies space actors who affect the development, implementation, and use of national commercial space and national security space policy and explains how the intersection of space-related national security needs and commercial space policy goals creates a balance-driven tension. This paper concludes by recommending the creation of a Congressionally mandated, permanent, multi-resource uniform space policy and oversight commission that balances space-related national security needs with space policy goals, and in turn reduces unnecessary inefficiencies and frictions within divergent space policy and national security realms.

II. EARLY DEVELOPMENT OF UNITED STATES SPACE AND NATIONAL SECURITY SPACE POLICY

The United States (U.S.) rose to world power following the aftermath of World War II (WWII), due in part to its involvement in the Pacific and European campaigns;¹⁰ its ability to help countries reorganize, restructure, and rebuild in the aftermath of the War;¹¹ and its immediate and continued access to valuable resources and personnel.¹² It maintained that power much in part to national space-related¹³ military and intelligence objectives.¹⁴

A. Early Military, Intelligence, and Civilian Space Objectives

Since its inception, national space policy has sought to protect U.S. citizens, borders, and interests through the use of space and space technology capabilities.¹⁵ Until recently however, little was

¹⁰ Gabor Steingart, *A Super Power in Decline: America's Middle Class Has Become Globalization Loser* (Oct. 24, 2006), <http://www.spiegel.de/international/a-superpower-in-decline-america-s-middle-class-has-become-globalization-s-loser-a-439766.html>.

¹¹ *Id.*

¹² *Id.*

¹³ “Space” for this purpose, refers to the general and combined military, intelligence, and civilian space initiatives. Generally, this paper will indicate when policy ideals diverge by indicating the separation.

¹⁴ Hall, *supra* note 1 at 1.

¹⁵ *Id.*

known about early U.S. military and intelligence space policy objectives—or their development as a whole—due to the classified nature of the National Security Council’s (NSC) national security space policy under President Dwight D. Eisenhower.¹⁶

1. Prioritization of National Security Council Space Directives and the Resulting Federal Policy Divergence

Following WWII, Eisenhower entered office focused on protecting the U.S. from foreign threat.¹⁷ He established a top secret National Security Council (NSC) to monitor Russian military activities and their potential threats against the U.S.¹⁸ With the support of the NSC, Eisenhower sought clandestine high-altitude military overflight of Russian territory.¹⁹ This changed when Russia launched the Sputnik satellite in 1957,²⁰ and illuminated the legal and diplomatic potential of satellite overflight.²¹ As a result, President Eisenhower authorized the launch of the *Explorer I* satellite

¹⁶ *Id.* at 6. It should be noted that that the convergence and divergence of the various branches of U.S. space policy existing are a direct result of earlier U.S. space policy, as will be described throughout this paper.

¹⁷ *Id.*

¹⁸ *Id.* The National Security Council under the Eisenhower administration had classified such directives as top-secret in order to preclude enemy nations from gaining insight into U.S. national security strategy. This classification allowed “military leaders planning space operations and formulating military space doctrine . . . [to operate] . . . at cross-purposes to official policy.” *Id.* at 3.

¹⁹ *Id.* at 8; see also Peter Pindjak, *The Eisenhower’s Administration’s Road to Space Militarization*, University of Pittsburgh (2011) available at http://d-scholarship.pitt.edu/7698/1/Thesis_PindjakPeter2011Updated.pdf.

²⁰ Jason S. Sharp, *The 2010 NASA Authorization Act: Legislators As Rocket Scientists and Other Implications for America’s Human Spaceflight Program*, 76 J. AIR L. & COM. 596, 600 (2011).

²¹ Hall, *supra* note 1 at 8; According to Hall, “[A]n earth satellite operating at altitudes above a nation’s ‘air space’ would transit numerous states as it circuted the globe. If these states did not protest its passage overhead . . . free access to and unimpeded passage through outer space might be established in international law . . .” *Id.*

soon thereafter.²² In doing so, he 1) changed the way the U.S. protected its interests²³ and 2) produced a basis of policy divergence between military, intelligence, and civilian space policy goals.²⁴

2. Presidential Attempts at Space Policy Convergence when Addressing New and Developing Space Policy Concerns

Eisenhower's use of space technology for national security reconnaissance efforts created a policy shift that left military, civilian, and intelligence interests at odds.²⁵ Prior to this policy shift, the military had developed space programs with the intent to neutralize enemy threats with space technology when the need arose.²⁶ Following the shift, "military space flight . . . [was confined to] . . . non-aggressive communications or reconnaissance satellites that lodged firmly within a realm . . . [of] . . . 'peaceful purposes . . .'"²⁷ Subsequent administrations followed suit, even when military and civilian space initiatives knowingly diverged with national security space policy.²⁸

This intentional - and covert - segregation of space policy continued until the 1970s when the Carter Administration required intelligence gathering agencies to support military space objectives

²² Sharp, *supra* note 25 at 601; see also Barton Beebe, *Law's Empire and the Final Frontier: Legalizing the Future in the Early Corpus Juris Spatialis*, 108 YALE L.J., 1737, 1765 (1999); see David S. Weitzel, *Where No Lawyer Has Gone Before? What A Cyberspace Attorney Can Learn from Space Law's Legacy*, 10 COMM. LAW CONSPECTUS 191, 199 (2002).

²³ Hall, *supra* note 1, at 9.

²⁴ *Id.* at 8. Prior to Eisenhower's policy shift, the Department of Defense had begun developing military space programs that focused on national security planning and defense. *Id.*

²⁵ *Id.* at 8, 9.

²⁶ *Id.* at 9.

²⁷ *Id.* at 8. In fact, the Administration deemed space intelligence-gathering so valuable to national security interests that it eliminated two existing DoD space initiatives that had the potential to harm space surveillance priorities when they appeared to weaponize space. According to Hall, "[I]n the 1960s, military space planning was at such a variance with national space policy that . . . [at the behest of President Kennedy the] . . . Secretary of Defense . . . terminated two Air Force space programs that the service's military leaders considered vital to national security." *Id.* at 4.

²⁸ *Id.* at 9. In fact, due to the classified nature of space policy directives, the DoD was not informed of National Security Council rationale for halting the programs, and simply saw the dissemination of the programs as a financial and strategic waste. *Id.*

with their facilities and satellites,²⁹ and it then later facilitated further interagency cooperation when it 1) mandated that NASA's Space Shuttle Program would launch military and intelligence space satellites,³⁰ 2) pushed for an increase in private space innovation,³¹ and 3) called for the "encourage[ment of] domestic commercial exploitation of space capabilities and systems for economic benefit and to promote the technological position of the United States . . ."³²

The Reagan Administration continued Carter's trend of endorsing military space activity while promoting commercial space enterprises.³³ Reagan signed both the Commercial Space Launch Act and the 1988 amendments, into law,³⁴ and "authorized deployment of offensive weapons in space."³⁵ Incidentally, President Reagan promoted a Congressionally endorsed, commercial friendly space policy agenda that "encourag[ed] and facilitat[ed] commercial' [expendable launch vehicle] 'activities by the United States private sector' [for Government activities],"³⁶ while enacting military and foreign intelligence space policy that focused on prioritization of national security concerns.³⁷ In doing so, Reagan seemed to have contradictorily emphasized and elevated competing space policies, which has created a modern-day battleground between national space policy goals and national space security needs.

²⁹ Hall, *supra* note 1 at 33-39.

³⁰ *Id.* at 34, 40.

³¹ *Id.* at 33.

³² *Id.* at 37.

³³ *Id.* at 45.

³⁴ *Id.* at 43, 44; *see also* Tracy Knutson, *What is "Informed Consent" for Space-Flight Participants in the Soon-to-Launch Space Tourism Industry*, 33 J. SPACE L. VOL. 1, 105 (2007).

³⁵ Hall, *supra* note 1, at 45; *see also* W.D. Kay, *Space Policy Redefined: The Reagan Administration and the Commercialization of Space*, 27 BUS. & ECON. HISTORY, NO. 1 (1988).

³⁶ Clayton Stallbaumer, *From Longitude to Altitude: Inducement Prize Contests As Instruments of Public Policy in Science and Technology*, U. ILL. J.L. TECH. & POL'Y, 117, 158 (Spring 2006) (citing Reagan's 2/24/84 National Space Policy Presidential Directive).

³⁷ Hall, *supra* note 1, at 64-69 (discussing Reagan's National Space Policy of 1988, which "adopted nomenclature for military space activities[, including] . . . 'Force Enhancement[.]' . . . 'Space Control[.]' . . . and 'Force Application' . . . [implemented to] support [the U.S.s'] . . . right to self-defense." *Id.* at 62, 64.

III. PRESIDENTIAL AND POST-09/11 IMPACTS ON THE CONVERGENCE AND DIVERGENCE OF MODERN, SPACE POLICY GOALS AND NATIONAL SECURITY NEEDS

While in office, President Ronald Reagan spent much of his efforts and energy promoting democratic and capitalistic ideologies.³⁸ As a result, Reagan's emphasis on the promotion and protection of American ideals heavily influenced his national space and national security policies.³⁹ Among other things, he championed the innovative and economic benefits of federally endorsed commercial space industry⁴⁰ and called for the use of space capabilities in national security efforts.⁴¹ Though unintentional, Reagan's application of American ideologies to national space and national security concerns created a benchmark of policy divergence that pitted national security and national commercial space concerns against each other by elevating national security above economy-enhancing space policy initiatives.⁴²

³⁸ Nancy Snow, *International Exchanges and the U.S. Image*, 616 ANNALS AM. ACAD. POL. & SOC. SCI. 198, 215-16 (2008); see also David B. Kopel, *Evolving Christian Attitudes Towards Personal and National Self-Defense*, 45 CONN. L. REV. 1709, 1758-59 (2013); see Sumeet H. Chugani & Xingjian Zhao, *Making Capitalism More Creative: The Tempestuous Marriage of Sentiment and Self-Interest*, 22 PAC. MCGEORGE GLOBAL BUS. & DEV. L.J. 333, 336-37 (2010).

³⁹ Scott J. Shackelford, *Governing the Final Frontier: A Polycentric Approach to Managing Space Weaponization and Debris*, 51 AM. BUS. L.J. 429, 486 (2014); see also Dan L. Burk, *Protection of Trade Secrets in Outer Space Activity: A Study in Federal Preemption*, 23 SETON HALL L. REV. 560, 563-64 (1993).

⁴⁰ Hall, *supra* note 1, at 43, 45, 52; see Thomas Brannen, *Private Commercial Space Transportation's Dependence on Space Tourism and NASA's Responsibility to Both*, 75 J. AIR L. & COM. 639, 649 (2010).

⁴¹ Hall, *supra* note 1, at 56; Kay, *supra* note 40, at 241.

⁴² Though national security issues should understandably take precedence in certain situations, not all situations require an "either/or" solution. Section IV of this paper addresses situations in which national security issues have taken unjustifiably, or unevenly, take precedent over economy-enhancing space policy initiatives.

The aforementioned policy divergence continues today due in part to the changing nature of presidential issue-emphasis and policy prioritization;⁴³ the evolving nature of U.S. national security;⁴⁴ and the overall “checks and balances” organizational structure of the U.S. government.⁴⁵ This section addresses the development of national security space and commercial space policy over the last thirty years by identifying Reagan-era and post-9/11 national security space and national commercial space policies that have impacted subsequent policies.

A. Space Technology and the Mitigation of Post-9/11 National Security Threats

During the Cold War, the United States used space related capabilities to display its dominance as a super power.⁴⁶ Following the fall of western communism, the U.S. maintained this international dominance through its economic, strategic, and military policies;⁴⁷

⁴³ Because the President of the United States has authority to set space policy under the NASA Act, the president may change established presidential policy upon entering office. 51 U.S.C. 20102 (2017). Consequently, presidents tend to change policy from administration to administration. For example, during his presidency, President George W. Bush focused on space policy that intended to send astronauts back to the moon, while President Obama abandoned further moon exploration in favor of unmanned, deep space exploration.

⁴⁴ See COMM’N TO ASSESS U.S. NAT’L SEC. SPACE MGMT. AND ORG., Report of the Commission to Assess United States National Security Space Management and Organization, (2001), available at <http://www.dod.gov/pubs/space20010111.html> [hereinafter the Rumsfeld Commission Report]; see also INDEP. ASSESSMENT PANEL ON THE ORG. AND MGMT. OF NAT’L SPACE POLICY, Report to Congress on the Independent Assessment Panel on the Organization on Management of National Security Space, (2008), available at https://spacepolicyonline.com/pages/images/stories/Allard_Commission_Report.pdf [hereinafter the Allard Commission Report].

⁴⁵ Peter Margulies, *True Believers at Law: National Security Agendas, the Regulation of Lawyers, and the Separation of Powers*, 68 MD. L. REV. 1, 21-22 (2008).

⁴⁶ 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, 423-24 (2008).

⁴⁷ *Id.*; see also Daniel R. Williams, *After the Gold Rush-Part II: Hamdi, the Jury Trial, and Our Degraded Public Sphere*, 113 PENN ST. L. REV. 55, 60-61 (2008); see Jeffrey F. Addicott, *The United States of America, Champion of the Rule of Law or the New World Order?*, 6 FLA. J. INT’L L. 63, 64-65 (1990).

its continued access to resources;⁴⁸ and its relative economic stability.⁴⁹ Since that time, power dynamics throughout the world have actively shifted as various power structures have gained access to new technologies,⁵⁰ improved their economic well-being,⁵¹ and jockeyed for,⁵² or sought a reemergence of, dominance in the world scene.⁵³ Reemerging conflict with Russia;⁵⁴ anti-American sentiment related to U.S. involvement in the Middle-East,⁵⁵ Africa,⁵⁶ and South America;⁵⁷ direct cyber-intelligence attacks from China and other antagonist nations;⁵⁸ and the continuous threat of at-home terrorism raise endless calls for greater national security efforts.⁵⁹

⁴⁸ James Thuo Gathii, *Retelling Good Governance Narratives on Africa's Economic and Political Predicaments: Continuities and Discontinuities in Legal Outcomes Between Markets and States*, 45 VILL. L. REV. 971, 1029 (2000); see also Ruth Gordon, *Saving Failed States: Sometimes A Neocolonialist Notion*, 12 AM. U. J. INT'L L. & POL'Y 903, 961 (1997).

⁴⁹ Margaret MacMillan, *Rebuilding the World After the Second World War*, The Guardian, (Sept. 11, 2009), <http://www.theguardian.com/world/2009/sep/11/second-world-war-rebuilding>.

⁵⁰ COMM. SAT. SERV. AND NAT'L SEC.: *We Are Not Alone*. at 14, (Nov. 12, 2014), http://csis.org/files/media/csis/pubs/030325_commercial_sat_services.pdf.

⁵¹ *Id.*

⁵² *Id.*

⁵³ Allison Smale, *Setting Usual Caution Aside, Merkel Issues a Stern Rebuke to Russia*, New York Times (Nov. 17, 2014), http://www.nytimes.com/2014/11/18/world/europe/russia-deports-german-polish-diplomats-retaliation.html?_r=0. One need only to look Russia's recent activity in Ukraine and attendance at the November 2014 G20 summit in Australia and China's hacking of American intelligence and agencies to understand that both countries intentionally and actively assert their dominance with little concern. *Id.*; see also Darlene Storm, *List of hacked government agencies grows: State Department, White House, NOAA & USPS*, (Nov. 17, 2014), <http://www.computer-world.com/article/2848779/list-of-hacked-government-agencies-grows-state-department-white-house-noaa-and-usps.html>.

⁵⁴ Dr. Eric Engle, *A New Cold War? Cold Peace. Russia, Ukraine, and Nato*, 59 ST. LOUIS U. L.J. 97, 172-73 (2014).

⁵⁵ Derrick Howard, *Twenty-First Century Slavery: Reconciling Diplomatic Immunity and the Rule of Law in the Obama Era*, 3 ALA. C.R. & C.L.L. REV. 121, 139-40 (2012); see also Joseph Bui, *Recycled Hate: Tyler Clementi, Dharun Ravi, and Those in the Crossfire*, 21 ASIAN AM. L.J. 145, 175 (2014).

⁵⁶ Bui, *supra* note 60, at 173.

⁵⁷ Noah Asa Phillips, *Mercosur: Venezuela's New Vehicle for Resistance to American Political and Economic Hegemony*, 38 HASTINGS INT'L & COMP. L. REV. 169, 189 (2015).

⁵⁸ Alexander Melnitzky, *Defending America Against Chinese Cyber Espionage Through the Use of Active Defenses*, 20 CARDOZO J. INT'L & COMP. L. 537, 552-53 (2012).

⁵⁹ Robert M. Chesney, *The Sleeper Scenario, Terrorism-Support Laws and the Demands of Prevention*, 42 HARV. J. ON LEGIS. 1 (Winter 2007).

Consequently, the U.S. must not only acknowledge and actively address the constant and ever-evolving threat against her borders, people, and assets, but must also contend with the long-term economic and corporeal impact national security policy has on convergent peripheral policies.

1. National Security Policy

a. 9/11: An Instantaneous and Unanticipated Impetus for National Security Change

Between the close of WWII and the 1990's, U.S. national security policy focused on Cold-War related nuclear threats and other miscellaneous threats against American interests abroad.⁶⁰ During this time, America seemed near impenetrable to modern, large-scale aggression within and against its borders due to its military and technical might, and its relative distance from enemy nations.⁶¹ This changed on September 11, 2001 (9/11), however, when twenty terrorists hijacked American planes and turned them into massive weapons, killing over three thousand persons on American soil.⁶²

Following the 9/11 terrorist attacks, national security policy sharply changed as President George W. Bush focused national security policy⁶³ on terrorism and counter-terrorism both here and

⁶⁰ Michigan Journal of International Law, Post-Cold War International Security Threats: Terrorism, Drugs, and Organized Crime Symposium Transcript, 21 MICH. J. INT'L L. 527, 534 (2000), available at <http://repository.law.umich.edu/mjil/vol21/iss3/6>.

⁶¹ Tung Yin, *The Impact of the 9/11 Attacks on National Security Law Casebooks*, 19 ST. THOMAS L. REV. 157, 159 (2006). Other than a few isolated incidents, such as the attempted bombing of the World Trade Center in 1993, the Oklahoma City Bombing in 1995, and aggression against American interests overseas, peace in the United States remained relatively stable.

⁶² David Schultz, *Democracy on Trial: Terrorism, Crime, and National Security Policy in A Post 9-11 World*, 38 GOLDEN GATE U. L. REV. 195, 205 (2008).

⁶³ Arija Flowers, *National Security in the 21st Century: How the National Security Council Can Solve the President's Climate Change Problem*, 11 SUSTAINABLE DEV. L. & POL'Y 50, 52 (2011). Under the National Security Act of 1947 the president determines the focus, means, and path of national security policy. He does this with the help of the National Security Council, his national security advisor, and other high-ranking agency actors, according to his preferences. *Id.*; see also Schultz, *supra* note 67, at 205. It should be noted that National security policy is derived by Presidential mandate and implemented through presidentially and congressionally-appointed actors and agencies; see also Alan G. Whitaker, *The National Security Policy Process: The National Security*

abroad⁶⁴ and sought out regimes and groups bent on destroying freedom, liberty, and the American way of life.⁶⁵ As such, Bush's post-9/11 national security policy focused on anti-terrorism and counter-terrorism activities, which included military campaigns in Iraq and Afghanistan,⁶⁶ and where for the first time, the U.S. used large-scale space capabilities to track enemy movement and implement strategic attacks against opposing forces.⁶⁷

Council and Interagency System, available at <http://issat.dcaf.ch/download/17619/205945/icafe-nsc-policy-process-report-08-2011.pdf>. When formulating national security policy, the president communicates and coordinates with 1) members of the National Security Council, 2) his National Security Advisor, and 3) other high-ranking agency personnel. *Id.* at 6. Though the president ultimately decides national security policy, it is the National Security Council that informs him of the on-going issues, dilemmas, and points of concern that could both directly and indirectly affect national security. *Id.* The Department of Defense concerns itself with the physical military protection of the nation and its assets and the Department of Homeland Security concerns itself with border protection, intelligence and asset management, and terrorism and counter-terrorism matters. *Id.* While the Department of State concerns itself with the diplomatic support and implementation of presidential foreign policy while promoting the ideals of freedom and liberty throughout the world. *See* <http://careers.state.gov/learn/what-we-do>; National Security institutions have many moving parts, and must be appropriately managed so as to protect the U.S. from internal and external attacks, and intelligence breaches. *Id.*; *see also* The Rumsfeld Commission Report, *supra* note 49. Incidentally, recent history shows that agencies that do not appropriately manage their employees, assets, and information allow unfriendly actors to chip away and reveal weaknesses in U.S. national security, and leave room for attack against the nation, its people, and ideals; *see also* Paul R. Gupta, *Living in a Post-Breach World: What Regulators, the Courts, the Executive Branch, and Congress are Doing About Cybersecurity*, 17 No. 1 FINTECH L. REP. 1 (2014).

⁶⁴ Schultz, *supra* note 67, at 205 (including Bush's identification of nations that formed an "axis of evil," including North Korea, Iran, and Iraq); *see also* Louis Fisher, *Lost Constitutional Moorings: Recovering the War Power*, 81 IND. L.J. 1199, 1231 (2006).

⁶⁵ THE NATIONAL SECURITY POLICY OF THE UNITED STATES OF AMERICA MARCH 2006, *available at* <https://www.state.gov/documents/organization/64884.pdf>. Post-9/11 national security policy focused on anti and counter-terrorism activities, and included the invasion of Iraq and Afghanistan to inhibit Iraq's alleged nuclear proliferation by Iraq and Al-Qaida activity in Afghanistan. *Id.*; *see also* Samuel R. Berger, *Obama's National Security Policy: A little George Bush, lots of Bill Clinton*, *The Washington Post* (May 30, 2010), <http://www.washingtonpost.com/wp-dyn/content/article/2010/05/28/AR2010052804466.html>.

⁶⁶ Matthew Lippman, *Aerial Attacks on Civilians and the Humanitarian Law of War: Technology and Terror from World War I to Afghanistan*, 33 CAL. W. INT'L L.J. 1, 57 (2002).

⁶⁷ *Id.*

President Barack Obama took a somewhat different approach to national security⁶⁸ when he emphasized “whole-of-government”⁶⁹ security measures that reiterated a need to dismantle Al Qaeda through counter-terrorism measures, but rejected a “global war on terror.”⁷⁰

b. Post-9/11 National Security Concerns and the Development of a “Code Red” Security Policy

Post-9/11 security concerns have significantly and systematically changed the national security landscape, as presidential policy,⁷¹ congressional legislation,⁷² and agency activity⁷³ have worked to increase U.S. defense capabilities against threats from enemy actors at home and abroad.⁷⁴ Incidentally, U.S. national security actors have reinforced an unrelenting “code-red” security climate that endorses the surveillance, tracking, and dispatch of alleged enemy actors (that has arguably crossed the line of acceptable

⁶⁸ See Berger, *supra* note 70.

⁶⁹ Neil Munro, *Obama Will Deliver Second-Term National Security Strategy in Spring 2014*, The Daily Caller (Nov. 2, 2013), <http://dailycaller.com/2013/11/29/obama-will-deliver-second-term-national-security-strategy-in-spring-2014/>.

⁷⁰ Berger, *supra* note 70. Despite these express policy changes, some argue that President Obama’s national security policy become more invasive than the Bush Doctrine, as the Obama Doctrine promotes the use of drone counter-terrorism military strikes, used covert cyber-monitoring on U.S. citizens, and commenced on-call military airstrikes, as needed.

⁷¹ See NATIONAL SECURITY POLICY OF THE UNITED STATES OF AMERICA SEPTEMBER 2002, available at <http://www.state.gov/documents/organization/63562.pdf>; see also NATIONAL SECURITY STRATEGY MAY 2010, available at <http://nssarchive.us/NSSR/2010.pdf>; see also NATIONAL SECURITY STRATEGY FEBRUARY 2015, available at <http://nssarchive.us/wp-content/uploads/2015/02/2015.pdf>.

⁷² Darren W. Stanhouse, *Ambition and Abdication: Congress, the Presidency, and the Evolution of the Department of Homeland Security*, 29 N.C. J. INT’L L. & COM. REG. 691, 692-93 (2004) (describing the creation of the Department of Homeland Security following the 9/11 terrorist attacks); see also Rebecca A. Copeland, *War on Terrorism or War on Constitutional Rights? Blurring the Lines of Intelligence Gathering in Post-September 11 America*, 35 TEX. TECH L. REV. 1, 2-4 (2004) (explaining how use of the Foreign Intelligence Surveillance Act and the passing of the Patriot Act in Post-9/11 world by Congress has overstepped fundamental rights in lieu of national security needs).

⁷³ Shirin Sinnar, *Protecting Rights from Within? Inspectors General and National Security Oversight*, 65 STAN. L. REV. 1027, 1028-30 (2013) (explaining how national security Inspector General may be used to curb agency overreach by the Department of Defense, Central Intelligence Agency, and National Security Agency when pursuing national security efforts).

⁷⁴ *Id.*

action⁷⁵) and now includes the use death drones,⁷⁶ remote sensing,⁷⁷ data mining,⁷⁸ and cyber-surveillance,⁷⁹ as well as the encouraged, and sometimes required, use of private actors and commercial entities in national security efforts.⁸⁰

2. Evolving U.S. National Space Policy and a New National Security Space Policy

Like national security policy, national space policy has evolved over the last sixty years in accordance with congressional authority,⁸¹ presidential prerogative,⁸² and a changing political and global landscape.⁸³ Though established to prove ideological superiority

⁷⁵ *Id.*

⁷⁶ *A National Security Symposium: The Constitutionality and Consequences of America's Use of Drones and the NSA Spying Program*, 41 W. ST. U. L. REV. 535, 548 (2014).

⁷⁷ Ricky J. Lee & Sarah L. Steele, *Military Use of Satellite Communications, Remote Sensing, and Global Positioning Systems in the War on Terror*, 79 J. AIR L. & COM. 69, 80-81 (2014).

⁷⁸ Anita Ramasastry, *Lost in Translation? Data Mining, National Security and the "Adverse Inference" Problem*, 22 SANTA CLARA COMPUTER & HIGH TECH. L.J. 757, 757-58 (2006).

⁷⁹ David F. Kelley, *Taking Terabytes Out of the Constitution: Can We Fight Terrorism Without Big Brother?*, VT. B.J., 16 (Spring 2014).

⁸⁰ Jon D. Michaels, *Privatization's Pretensions*, 77 U. CHI. L. REV. 717, 719 (2010); see also Commercial Space Launch Act of 1984, Pub.L. 98-575, 98 Stat. 3055 (1984); NATIONAL SPACE POLICY OF THE UNITED STATES OF AMERICA (June 28, 2010), available at https://www.nasa.gov/sites/default/files/national_space_policy_6-28-10.pdf.

⁸¹ See National Aeronautics Space Act of 1958, Pub.L. 85-568, 72 Stat. 426. (1958) and Amendments; Commercial Space Launch Act of 1984, Pub.L. 98-575, 98 Stat. 3055 (1984); Commercial Space Launch Act of 1988, Pub.L. 100-657, 102 Stat. 3900 (1988); Commercial Space Launch Act of 2004, Pub.L. 108-492, 118 Stat. 3974 (2004); see also National Aeronautics Space Act of 2008, Pub.L. 110-422, 122 Stat. 4779 (2008); National Aeronautics Space Act of 2010, Pub.L. 111-267, 124 Stat. 2805 (2010); National Aeronautics Space Act of 2014, H.R. 4412, 113th Cong. (2nd Sess. 2014).

⁸² Hall, *supra* note 1, at 10, 19, 22, 27, 30, 33, 43, 70, 79; see also U.S. NATIONAL SPACE POLICY (Aug. 31, 2006), available at <https://fas.org/irp/offdocs/nspd/space.pdf>; NATIONAL SPACE POLICY OF THE UNITED STATES OF AMERICA, *supra* note 85; National Security Space Policy of 2010, *supra* note 85.

⁸³ Joanne Irene Gabrynowicz (FNd1), *One Half Century and Counting: The Evolution of U.S. National Space Law and Three Long-Term Emerging Issues*, 4 HARV. L. & POL'Y REV. 405 (2010).

over Russia,⁸⁴ promote national pride,⁸⁵ and provide for “the exploration of space⁸⁶ . . . for peaceful purposes . . . [.]”⁸⁷ it eventually openly encompassed commercial space and national security space concerns.⁸⁸ This open and acceptable promotion of commercial space goals and national space security needs has flowed down from Reagan to every subsequent presidential administration since.⁸⁹

a. National Space Policy and the “Reagan Impact”

i. Reagan Era National Security Space Policy

During the Reagan era, national security space concerns rose to the forefront of national space policy with President Reagan’s Strategic Defense Initiative (SDI or “Star Wars”), which envisioned the use of a missile defense system that “intercept[ed] and destroy[ed] strategic ballistic missiles before they reached . . . [American] . . . soil or that of . . . [its] . . . allies.”⁹⁰ The impact of Reagan’s public incorporation of space capabilities for national security efforts “were . . . far-reaching[, as] Department of Defense spending for satellite surveillance, communications, and navigation increased significantly throughout the 1980’s [, and] . . . by 1988 . . . [had produced a DoD space budget that outpaced NASA’s].”⁹¹

⁸⁴ *Id.*

⁸⁵ *Id.*

⁸⁶ *Id.*

⁸⁷ National Aeronautics and Space Act of 1958, *supra* note 86 (Now, 51 U.S.C. § 20102 (2017)). As mentioned above, space policy also covertly included reconnaissance and intelligence initiatives, but the government kept such activities classified. Hall, *supra* note 1, at 8.

⁸⁸ Hall, *supra* note 1, at 8, 43. Whereas national space policy once appeared to focus on NASA-based initiatives of scientific inquiry and exploration, over the last thirty years it has grown to progressively and publicly encompass commercial space and national security space policy endeavors; *see also* Kay, *supra* note 40; Commercial Space Launch Act of 1984, Pub.L. 98-575, 98 Stat. 3055 (1984); NATIONAL SPACE POLICY OF THE UNITED STATES OF AMERICA, *supra* note 85.

⁸⁹ Hall, *supra* note 1, at 70, 75, 86; *see also* U.S. NATIONAL SPACE POLICY, *supra* note ; NATIONAL SPACE POLICY OF THE UNITED STATES OF AMERICA, *supra* note 85; *see* National Security Space Policy, unclassified summary (January 2011).

⁹⁰ Kevin C. Kennedy, *Treaty Interpretation by the Executive Branch: The Abm Treaty and “Star Wars” Testing and Development*, 80 AM. J. INT’L L. 854, 855 (1986) (quoting and discussing President Ronald Reagan’s Address to the Nation on Defense and National Security 19 WEEKLY COMP. PRES. DOC. 437 (Mar. 28, 1983)).

⁹¹ Kay, *supra* note 40, at 239-240.

ii. Reagan Era Commercial Space Policy

While extolling the virtues of national security space initiatives, Reagan “actively sought out business leaders[,] . . . corporate contacts[, and]. . . new organizations dedicated to space privatization⁹² . . . [, and looked] . . . to ease . . . regulatory burden[s in order to] . . . help pave the way for development of a new . . . [commercial space] . . . industry”⁹³ Reagan succeeded; he helped establish permanent national commercial space policy by signing the Commercial Space Launch Act of 1984 and “designating [the Department of Transportation] . . . as the ‘single point of contact’ to ‘expedite the processing of private sector requests to obtain licenses’ . . . [and to] . . . operate . . . launch vehicles.”⁹⁴

iii. Balance for Reagan-Era Space Policies

To align and balance national security and commercial space interests, President Reagan initiated the creation and implementation of a Senior Interagency Group (SIG) on space, which he used “to provide a forum to all Federal agencies for their policy views, to review and advise on proposed changes to national space policy, and to provide for orderly and rapid referral of space policy issues to the President for decisions as necessary. . . .”⁹⁵ Reagan’s SIG initiative arguably balanced national security space policy and commercial space policy initiatives during his administration.⁹⁶ This initiative created long-term effects within the national space policy realm by facilitating various national security space and commercial space endeavors⁹⁷ but also potentially hindered such efforts at various points of policy divergence.

⁹² *Id.* at 240.

⁹³ *Id.* To this point, private actors interested in commercial space interests faced numerous regulatory hurdles that made commercial space activity expensive and nearly impossible to achieve. Reagan sought to streamline the private sector process for commercial actors while ensuring that the government maintained appropriate government oversight. *Id.*

⁹⁴ *Id.*

⁹⁵ *Fact Sheet Outlining United States Space Policy*, (July 4, 1982), available at <http://www.presidency.ucsb.edu/ws/?pid=42705>.

⁹⁶ Kay, *supra* note 40, at 241 (explaining that SIG was implemented in 1983 and essentially helped facilitate enactment of the Commercial Space Launch of 1984).

⁹⁷ *Id.*

b. National Space Policy Initiatives in the Post-Reagan Age

Following Reagan's departure from office, ensuing administrations addressed national space policy, and their correlating issues, in different ways.⁹⁸ President George H.W. Bush continued in Reagan's footsteps by balancing space policy concerns through a National Security Council⁹⁹ and by continuing Reagan-based space policy initiatives throughout his presidency.¹⁰⁰ Presidents Clinton, George W. Bush, and Obama, on the other hand, deviated in many ways from Reagan's space initiatives¹⁰¹ when devising their own space, national security, and national security space policies.¹⁰² This has debatably influenced the current climate of policy divergence in the national security space and national commercial space policy realms.

President Clinton avoided using a national space council or interagency group to balance national security space needs and commercial space policy goals.¹⁰³ Additionally, he "separate[d] civil space activities and national security space activities . . . [with] national security activities . . . 'overseen by the Secretary of Defense and the Director of Central Intelligence (DCI)'"¹⁰⁴

President George W. Bush and President Obama both implemented space policies void of national space councils and/or inter-

⁹⁸ Hall, *supra* note, at 70, 79; *see also* U.S. NATIONAL SPACE POLICY, *supra* note 87; NATIONAL SPACE POLICY OF THE UNITED STATES OF AMERICA, *supra* note 85; National Security Space Policy of 2011, *supra* note 89.

⁹⁹ Hall, *supra* note 1, at 70; Kay, *supra* note 40, at 243.

¹⁰⁰ Hall, *supra* note 1, at 79; Kay, *supra* note 40, at 243; *see* U.S. NATIONAL SPACE POLICY, *supra* note 87; NATIONAL SPACE POLICY OF THE UNITED STATES OF AMERICA, *supra* note 85; National Security Space Policy of 2011, *supra* note 89; *see also* Todd Barnett, *United States National Space Policy, 2006 & 2010*, 23 FLA. J. INT'L L. 277 (2011).

¹⁰¹ Please note that President Reagan's national security space policies fell under the auspices of national space policy. Kay, *supra* note 40, at 239; It was not until much later that national security space policy became a subset of national security policy. *see also* William G. Schmidt, *Aviation and Aerospace Law*, 31 INT'L LAW. 571, 577-78 (1997).

¹⁰² Barnett, *supra* note 105, at 23.

¹⁰³ Kay, *supra* note 40, at 243.

¹⁰⁴ William G. Schmidt, *Aviation and Aerospace Law*, 31 INT'L LAW. 571, 577-78 (1997). It should be noted that like Reagan, President Clinton encouraged the use of commercial space technologies in national space initiatives and called for "a national missile defense deployment readiness program as a hedge against the emergence of long-range missile threat against the U.S." *Id.*

agency groups capable of balancing varied and potentially conflicting space policy interests.¹⁰⁵ Furthermore, due to heightened post 9/11 security concerns, both Bush¹⁰⁶ and Obama¹⁰⁷ contrived space policy that, though containing commercial space goals reminiscent of prior administrations,¹⁰⁸ additionally emphasized and prioritized national space security needs.¹⁰⁹ Bush's 2006 national space policy included a "space control" provision that enabled the U.S. to "maintain capability to deter and . . . defeat efforts . . . [that] . . . interfere with U.S. Space Capabilities,"¹¹⁰ which essentially "authorized the United States to unilaterally determine which nations should be barred from space, for what reason, and when."¹¹¹ President Obama's space policy followed the same vein by "allowing the United States to protect its national interests in space . . . [,]"¹¹² but also reins in the earlier Bush space doctrine by "call[ing] for cooperation and transparency"¹¹³ with other nations.¹¹⁴

¹⁰⁵ NASA's Strategic Direction and the Need for a National Consensus, Committee on NASA's Strategic Direction; Division on Engineering and Physical Sciences; National Research Council (2012) available at [https://oig.nasa.gov/Special-Review/SpecialReview\(12-5-12\).pdf](https://oig.nasa.gov/Special-Review/SpecialReview(12-5-12).pdf)

¹⁰⁶ U.S. NATIONAL SPACE POLICY, *supra* note 87.

¹⁰⁷ NATIONAL SPACE POLICY OF THE UNITED STATES OF AMERICA, *supra* note 85.

¹⁰⁸ Jeff Kueter, *Evaluating the Obama National Space Policy: Continuity and New Priorities*, George C. Marshall Institute (July 2010); *see also* Barnet, *supra* note 105, at 278.

¹⁰⁹ Barnet, *supra* note 105, at 278.

¹¹⁰ David A. Koplow, *An Inference About Interference: A Surprising Application of Existing International Law to Inhibit Anti-Satellite Weapons*, 35 U. PA. J. INT'L L. 737, 827 (2014); *see also*, *What Do You Leave Behind? Evaluating the Bush Administration's National Security Space Policy*, George C. Marshall Institute (December 2006).

¹¹¹ Barnet, *supra* note 105.

¹¹² NATIONAL SPACE POLICY OF THE UNITED STATES OF AMERICA, *supra* note 85; *see also* Scott J. Shackelford, *Governing the Final Frontier: A Polycentric Approach to Managing Space Weaponization and Debris*, 51 AM. BUS. L.J. 429, 470-71 (2014); *see What Do You Leave Behind? Evaluating the Bush Administration's National Security Space Policy*, George C. Marshall Institute (December 2006); Jeff Kueter, *Evaluating the Obama National Space Policy: Continuity and New Priorities*, George C. Marshall Institute (July 2010).

¹¹³ NATIONAL SPACE POLICY OF THE UNITED STATES OF AMERICA, *supra* note 85; *see also*, Jeff Kueter, *Evaluating the Obama National Space Policy: Continuity and New Priorities*, George C. Marshall Institute (July 2010).

¹¹⁴ Kueter, *supra* note 118.

Though recent presidential policy has reiterated the importance of a national security space program that diligently protects U.S. interests through space capabilities;¹¹⁵ and a commercial space policy that promotes the economic and innovative benefits of a thriving commercial space industry,¹¹⁶ such presidential policy initiatives have at times conflicted with other proposed and/or established presidential,¹¹⁷ congressional,¹¹⁸ and agency-based¹¹⁹ policy initiatives.¹²⁰ This in turn has created an atmosphere of competing and counter-productive policy ideologies.¹²¹

The next section discusses various policy divergent departure points within the national security space and national commercial space realms and explains why Congress should implement a permanent, multi-resource uniform space policy & oversight commission tasked with balancing the economic and innovative goals of commercial space policy with the interest-protecting importance of national security space initiatives.

IV. CONVERGENCE, DIVERGENCE, AND A BALANCE-DRIVEN TENSION AT THE INTERSECTION OF NATIONAL COMMERCIAL SPACE POLICY GOALS AND NATIONAL SPACE SECURITY NEEDS.

To this point, much of this paper has focused on the development of, and presidential influence upon, National Security Policy (NSEC) and National Space Policy (NSPP) (and assorted subsets) and the various policy-convergent and policy-divergent departure points between NSEC and NSPP.¹²²

¹¹⁵ U.S. NATIONAL SPACE POLICY, *supra* note 87; NATIONAL SPACE POLICY OF THE UNITED STATES OF AMERICA, *supra* note 85.

¹¹⁶ U.S. NATIONAL SPACE POLICY, *supra* note 87; NATIONAL SPACE POLICY OF THE UNITED STATES OF AMERICA, *supra* note 85.

¹¹⁷ For example, the Bush Space Doctrine called for a Commercial Crew program that would return man to the moon, whereas the Obama Space Doctrine dropped that goal to focus on unmanned space exploration.

¹¹⁸ Blount, *supra* note 5, at 705-06.

¹¹⁹ Captain Michael R. Hoverstein, *U.S. National Security and Government Regulation of Commercial Remote Sensing from Outer Space*, 50 A.F. L. REV. 253, 254 (2001); Major Elizabeth Seebode Waldrop, *Integration of Military and Civilian Space Assets: Legal and National Security Implications*, 55 A.F. L. REV. 157, 157 (2004).

¹²⁰ *Id.*

¹²¹ *Id.*

¹²²

It is the opinion of the author that a discussion of policy-convergent and policy-divergent departure-points within space policy must include an overall depiction of such departure

The remainder of this paper will: 1) address the conflict between presidential, congressional, and agency actors and initiatives related to National Security Space Policy (NSSP) and Commercial Space Policy (CSP); 2) describe various policy divergent departure points between NSSP and CSP initiatives;¹²³ and 3) recommend a permanent, multi-resource uniform space policy oversight commission to be used for facilitating vital balance between and adherence to NSEC and NSPP.

A. *Convergence and Divergence of National Security Space and Commercial Space Policy*

1. Actors Affecting, and Effected by, National Security Space and Commercial Space Policy Divergence

As discussed throughout this paper, both the Executive and Legislative Branches have had a hand in developing national security and national space policy.¹²⁴ The President sets NSEC¹²⁵ and

points throughout the development of space policy to ensure that the reader has an understanding that policy divergence between national space and national security space policy is not a new phenomenon, but an ongoing issue. Much focus was placed on President Ronald Reagan within this paper due to the fact that President Reagan had a large influence upon the development of both commercial space and national security space policy, which he managed by using an interagency group to monitor the needs and national security space, national commercial space, and national civil space initiatives. See *supra* notes 99, 100, 101 and accompanying text.

¹²³ Though there are other areas of divergence within the National Security and National Space realms, this section will focus on problems that arise between National Security Space and National Commercial Space initiatives because that is that place of divergence in *Space Exploration Techs. Corp. v. U.S. and United Launch Sys.*, No. 14-354C, (Fed. Cl. Apr. 30, 2014), and the place in which space policy divergence is most easily observed.

¹²⁴ Hall, *supra* note 1, at 6-10, 19, 22, 24, 27, 33, 43, 70, 79; see also Kay, *supra* note 40, at 239-241; U.S. NATIONAL SPACE POLICY, *supra* note 87; NATIONAL SPACE POLICY OF THE UNITED STATES OF AMERICA, *supra* note 85; National Security Space Strategy 2011 available at <https://www.hsdl.org/?view&did=10828>; see also NATIONAL SECURITY SPACE POLICY UNCLASSIFIED SUMMARY (Jan. 2011), available at, file:///Users/HaleyGrantham28/Downloads/nps51-020711-02.pdf; National Aeronautics Space Act of 1958, Pub.L. 85-568, 72 Stat. 426. (1958); Commercial Space Launch Act of 1984, Pub.L. 98-575, 98 Stat. 3055 (1984); National Aeronautics and Space Administration Authorization Act of 2010, Pub. L. No. 111-267, 124 Stat. 2805.

¹²⁵ Roy E. Brownell II, *The Coexistence of United States v. Curtiss-Wright and Youngstown Sheet & Tube v. Sawyer in National Security Jurisprudence*, 16 J.L. & POL. 1, 21 (2000) (explaining that the president's "plenary" foreign affairs power authorizes the president to set national security policy); see also H. Jefferson Powell, *The President's*

NSPP;¹²⁶ while Congress provides legislative authority¹²⁷ to agency entities tasked with implementing such policies.¹²⁸ Currently, the President,¹²⁹ the Congress,¹³⁰ the DoD,¹³¹ the Intelligence Community,¹³² and the FAA¹³³ all contribute to the development, implementation, monitoring, and/or application of NSEC and or NSPP for various national initiatives. However, these organizations and entities often work against—rather than with—each other when implementing policy because the focus and goals of each organization and entity varies according to its mission.¹³⁴

Incidentally, policy divergence between policy actors has produced problems for both national security space¹³⁵ and private

Authority over Foreign Affairs: An Executive Branch Perspective, 67 GEO. WASH. L. REV. 527, 529 (1999).

¹²⁶ 51 U.S.C. § 20102 (2017).

¹²⁷ A. Michael Froomkin, *In Defense of Administrative Agency Autonomy*, 96 YALE L.J. 787, 813-14 (1987); *see also* Larry Alexander & Saikrishna Prakash, *Delegation Really Running Riot*, 93 VA. L. REV. 1035, 1037 (2007).

¹²⁸ *Froomkin*, *supra* note 127.

¹²⁹ Powell, *supra* note 130, at 529; 51 U.S.C. § 20102 (2017).

¹³⁰ Alexander & Prakash, *supra* note 132, at 1037.

¹³¹ *See* NATIONAL SECURITY SPACE POLICY UNCLASSIFIED SUMMARY, *supra* note 129; Department of Defense space initiatives center around the launching and monitoring of satellites for troop tracking and deployment, on-ground enemy combatant positioning, and intelligence tracking and interception, as well as EELV satellite launches for intelligence and military-tracking technology. *Id.*; *see also* The Rumsfeld Commission Report, *supra* note 49; The Allard Commission Report, *supra* note 49.

¹³² The intelligence community uses NSSP to monitor and track potential terrorist action against the U.S. through a myriad of cyber, signal, and remote sensing technology. Lee and Steele, *supra* note 82, at 80-81; *see also* David A. Koplow, *Back to the Future and Up to the Sky: Legal Implications of "Open Skies" Inspection for Arms Control*, 79 CAL. L. REV. 421, 496 (1991); *see* Walter Gary Sharp, Sr., *Balancing Our Civil Liberties with Our National Security Interests in Cyberspace*, 4 TEX. REV. L. & POL. 69, 69-70 (1999); Winn and Wright, § 18A.14 *Counter-Cyberterrorism Initiatives*, Law of Electronic Commerce, 2014 WL 6814375.

¹³³ Under NSPP authority, the FAA controls licensing, launch, and reentry of space vehicles, but could affect both national and commercial actors, when dealing with private actors intent on providing products and services to national state actors. Michael C. Mineiro, *Law and Regulation Governing U.S. Commercial Spaceports: Licensing, Liability, and Legal Challenges*, 73 J. AIR L. & COM. 759, 759-60 (2008).

¹³⁴ Waldrop, *supra* note 124, at 191-92; *see also* J. David Grizzle et. al., *Navigating the Turbulence of Competing Interests: Principles and Practice of the Federal Aviation Administration*, 75 J. AIR L. & COM. 777, 779-80 (2010).

¹³⁵ Justin Levine, *Reevaluating ITAR: A Holistic Approach to Regaining Critical Market Share While Simultaneously Attaining Robust National Security*, 2 U. MIAMI NAT'L SEC. & ARMED CONFLICT L. REV. 150 (2012).

space initiatives,¹³⁶ and in turn has caused adverse, long-term effects on national security, the U.S. economy, civil and commercial space policy initiatives—as seen in the ITAR-governance of commercial space technologies and in *SpaceX v. U.S.*¹³⁷

a. ITAR

Over the last twenty years, and especially since 9/11, there have been several policy divergent departure points between national security space and commercial space policy initiatives.¹³⁸ While U.S. space policy has outwardly promoted the use of private industry for U.S. space interests,¹³⁹ not all actors have been open to such relationships.¹⁴⁰ In fact, there seems at times to be an inherent tension between commercial and national security space interests.¹⁴¹

Since enactment of the Commercial Space Launch Act, national space policy¹⁴² has encouraged competition and innovation in the space industry by encouraging national security space procurement through private industry.¹⁴³ However, not all government policy, nor government actors, have encouraged such competition or open use.¹⁴⁴ This is especially true when considering government

¹³⁶ *Id.*

¹³⁷ *Id.*

¹³⁸ *Id.*; see also *Space Exploration Techs. Corp. v. U.S. and United Launch Sys.*, No. 14-354C, (Fed. Cl. Apr. 30, 2014)

¹³⁹ Hall, *supra* note 1, at 43, 51-52; Kay, *supra* note 40, at 240-24; see also U.S. Commercial Space Launch Competitiveness Act, Pub.L. 114-90, 129 Stat. 704 (2015); U.S. NATIONAL SPACE POLICY, *supra* note 87; NATIONAL SPACE POLICY OF THE UNITED STATES OF AMERICA, *supra* note 85.

¹⁴⁰ *Space Exploration Techs. Corp. v. U.S. and United Launch Sys.*, No. 14-354C, (Fed. Cl. Apr. 30, 2014)

¹⁴¹ David Damast, *Export Control Reform and the Space Industry*, 42 GEO. J. INT'L L. 211 (2010); see also Waldrop, *supra* note 124, at 191-92; Grizzle, *supra* note 139, at 779-80; *Space Exploration Techs. Corp. v. U.S. and United Launch Sys.*, No. 14-354C, (Fed. Cl. Apr. 30, 2014).

¹⁴² Hall, *supra* note 1, at 45, 61, 75, 86; see also Kay, *supra* note 40, at 239-241; see also U.S. NATIONAL SPACE POLICY, *supra* note 87; NATIONAL SPACE POLICY OF THE UNITED STATES OF AMERICA, *supra* note 85

¹⁴³ Glenn Harlan Reynolds, *The Omnibus Space Commercialization Act of 1993*, 20 RUTGERS COMPUTER & TECH. L.J. 581, 596 (1994).

¹⁴⁴ Michael S. Straubel, *The Commercial Space Launch Act: The Regulation of Private Space Transportation*, 52 J. AIR L. & COM. 941, 948 (1987).

tasked national security objectives.¹⁴⁵ For instance, after being confronted with various foreign, dual-use-technology security breaches,¹⁴⁶ military and civilian security agencies argued for greater regulations of space technology in order to promote and protect national security interests.¹⁴⁷ To combat the potential misappropriation and use of U.S. defense and intelligence information by foreign actors against U.S. interests, Congress called for the application of the International Traffic in Arms Regulations (ITAR) export regulations to dual-use space technologies.¹⁴⁸ These export regulations placed space technologies on the United States Munitions List (USML)—under the jurisdiction of the Department of State—prohibiting the exportation of such technologies,¹⁴⁹ thereby severely limiting the types of technology and services the commercial space industry could export and the type of space actors that could be used in the commercial space industry.^{150 151}

Not only did ITAR restrict the export of dual-use space technologies that affected national security interests, but it also “placed *all* space-related equipment and hardware on the USML, bringing space technology exclusively under the auspices of the ITAR”¹⁵² Incidentally, this Congressional reactionaryism prompted an “overly broad implementation of . . . ITAR . . . [and caused] . . . substantial damage to the nation’s economy”¹⁵³ by disregarding commercial space policy interests, thus countermanding Congressionally sanctioned commercial space policy intended to facilitate growth in the private sector.¹⁵⁴

¹⁴⁵ *Id.*; see also Levine, *supra* note 140.

¹⁴⁶ David Damast, *Export Control Reform and the Space Industry*, 42 GEO. J. INT’L L. 211 (2010).

¹⁴⁷ Major Matthew D. Burris, *Tilting at Windmills? The Counterposing Policy Interests Driving the U.S. Commercial Satellite Export Control Reform Debate*, 66 A.F. L. REV. 255, 262-63 (2010).

¹⁴⁸ Levine, *supra* note 140.

¹⁴⁹ *Id.*

¹⁵⁰ *Id.*

¹⁵¹ *Id.*

¹⁵² 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, 631 (2009).

¹⁵³ *Id.*

¹⁵⁴ *Id.*

Though Congress managed to revise ITAR regulations in 2013¹⁵⁵ by “loosen[ing] export controls,”¹⁵⁶ the damage had already been done to the U.S. commercial space industry, as companies and countries sought out ITAR free technologies from non-U.S. space-faring nations, which caused the U.S. to lose upwards of a third of the space industry market share.¹⁵⁷

The administration of ITAR governance to commercial space endeavors ironically also harmed national security space efforts “by emasculating America’s domestic satellite manufacturing market, thereby sending billions of dollars and thousands of jobs overseas . . . [consequently] . . . encouraging, and in some instances forcing, other nations to develop native capabilities . . . [and thereby] . . . fueling proliferation.”¹⁵⁸

If there had been a uniform space policy oversight commission that weighed national security needs with commercial space policy goals when applying “overly broad” ITAR guidance to commercial space endeavors—rather than leaving the issue to a reactionary Congress—then the U.S. may have balanced the needs of NSEC and NSPP and maintained a larger market share in the commercial space industry while bolstering its national security efforts. Instead, U.S. policy-makers made small view decisions that had long-term effects upon both NSSP and CSP, and promulgated far-reaching policy divergence between national security space policy needs and commercial space policy goals.

¹⁵⁵ *Amendment to the International Traffic in Arms Regulations: Initial Implementation of Export Control Reform*, A Rule by the State Department (April 16, 2013) at <https://www.federalregister.gov/documents/2013/04/16/2013-08351/amendment-to-the-international-traffic-in-arms-regulations-initial-implementation-of-export-control>

¹⁵⁶ Marcia Smith, *Senate Debating NDAA, Including ITAR, INKSNA, Launch Liability, and SLS/Orion Funding Amendments*, SpacePolicyOnline.com (November 29, 2012) at <https://spacepolicyonline.com/news/senate-debating-ndaa-including-itar-inksna-launch-liability-and-sls-orion-funding-amendments/>

¹⁵⁷ *Id.*; see also, Mike 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 Cleveland St. L. Rev. 629, 633, 640 stating “[o]verly broad” ITAR regulation harmed not only commercial space endeavors, but ironically also harmed national security space efforts “by emasculating America’s domestic satellite manufacturing market, thereby sending billions of dollars and thousand of jobs overseas . . . [thereby] . . . encouraging, and in some instances forcing, other nations to develop native capabilities . . . [and thus] . . . fueling proliferation. Gold, *supra* note 157 at 633.

¹⁵⁸ Gold, *supra* note 157 at 633.

b. Space X v. U.S.

Over-application of ITAR to commercial space ventures is just one area in which NSEC and NSPP have caused longstanding issues between national security space and commercial space policy initiatives. Divergence has also occurred in instances where national actors have ignored national procurement procedures that encourage and/or require national actors to use and acquire commercial space products and services for national security space initiatives through competitive bidding processes, and instead, such actors have provided non-competitive bid awards to single parties.¹⁵⁹ Such is the case with *Space Expl. Techs. Corp. v. United States*, 68 Fed. Cl. 1, 1-2 (2005).

In *Space Expl. Techs. Corp.*, national security policy diverged with national space policy when the DoD violated national procurement policy initiatives when denying SpaceX the opportunity to compete for EELV launch awards, and in turn awarded non-competitive, multi-billion dollar block bids to ULA for multi-year EELV launch opportunities.¹⁶⁰ In its bid protest, SpaceX contended that the ULA award “concluded outside of public scrutiny, funnel[ed] hundreds of millions of . . . dollars to Russia’s military-industrial base . . . [and] . . . include[ed] monies that [could] flow to individuals on the U.S. sanctions list.”¹⁶¹

In its response, the DoD justified the ULA award by stating “that ULA was the only “responsible source” and “only launch provider” that could meet [Air Force] requirements from Fiscal Year 2012 until Fiscal Year 2017 . . . [based on the information received in’ the Air Force’s 2011 EELV Request for Information].”¹⁶² It further contended that SpaceX had the opportunity to contest this determination, but failed to do so in a timely manner, thus depriving SpaceX of any right to contest the block-bid awards.¹⁶³

¹⁵⁹ Bid Protest at ¶ 9.

¹⁶⁰ *Id.*

¹⁶¹ *Id.* at 2; see also Gietzen, *supra* note 6; SpaceX also criticized “Skyrocketing” EELV costs related to non-competitive procurement practices that had “been criticized by external auditors like the Government accountability Office (“GAO”) for its strategic use of complex contractual structures that eliminate[d] transparency.” *Id.* at 9.

¹⁶² Defendant’s Motion to Dismiss at ¶ 5, *Space Exploration Techs. Corp. v. U.S. and United Launch Sys.*, No. 14-354C, (Fed. Cl. Apr. 30, 2014).

¹⁶³ *Id.*; SpaceX preemptively answered these contentions in its original motion by explaining that in “2005 . . . the Air Force committed to solicit interest from new entrants

The court sided with SpaceX, citing an Executive Order from March 2014 that prohibited U.S. government entities from paying for or trading in Russian space technologies, and ordered a preliminary injunction of ULA's sole-bid awards.¹⁶⁴ As of January 2015, this matter settled behind closed-door, sealed mediation.¹⁶⁵

2. Divergence-Driving Need for a Permanent, Uniform Space Policy and Oversight Commission

The policy divergence bolstered by Congress in the over application of ITAR and by the DoD in *Space Expl. Techs. Corp. v. United States* shows—at the very least—the depth to which policy divergence occurs between national security space policy and commercial space policy interests in the absence of a permanent, uniform space policy oversight commission, and illustrates the cost this policy divergence has had upon both the United States and the commercial space industry.¹⁶⁶ Interestingly, there have been pre and post-09/11 calls for a permanent, uniform space policy oversight commission to balance competing space interests.¹⁶⁷ Most notably, in 2001, Donald Rumsfeld recommended the implementation of a uniform space commission that would coordinate inter-agency communication efforts.¹⁶⁸ The Allard Commission of 2008 reiterated the need for a uniform space commission in light of the government's failure

on an annual basis and only award sole source launches for each year in which there was no new qualified competition,” and thus the multi-billion dollar block bid award directly contradicted the Air Force's earlier statements, and thus should be nullified. *Id.* at ¶ 34.

¹⁶⁴ *Id.*

¹⁶⁵ Mike Gruss, *SpaceX, Air Force Settle Lawsuit over ULA Blockbuy*, (Jan. 23, 2015), <http://spacenews.com/spacex-air-force-reach-agreement/>.

¹⁶⁶ Aside from assumed astronomical legal fees in *Space Exploration Technologies Corp. v. U.S. and United Launch Systems, LLC*, ITAR and DoD sole-source block bid awards have the potential of costing commercial entities and taxpayers billions of dollars.

¹⁶⁷ See The Rumsfeld Commission Report, *supra* note 49; The Allard Commission Report, *supra* note 49; see also, Joan Johnson-Freese, *An Allard Commission Postmortem and the Need for a National Space Council*, Joint Forces Quarterly, issue 60, 1st Quarter 2011, 54-60 (January 2011).

¹⁶⁸ See The Rumsfeld Commission Report, *supra* note 49; According to Mr. Rumsfeld, unless the U.S. took steps to coordinate inter-agency communication efforts and make space security a top priority, the U.S. could face a veritable “Space Pearl Harbor.” *Id.* He explained that though it might be considered “improbable [...] . . . history is replete with instances in which warning signs were ignored and change resisted until an external ‘improbable’ event forced . . . action,” and as the largest user of space technology, the U.S. was ripe for attack in the space realm. *Id.*

to follow through on the Rumsfeld recommendations.¹⁶⁹ According to the Allard Commission, the “[lack of] an effective national-level leadership mechanism . . . [harms national space programs because it creates] . . . an inability to resolve interagency differences in setting achievable requirements and resource priorities.”¹⁷⁰

Interestingly, both the Executive and Legislative Branches have ignored the economic and national security costs of NSPP and CSP divergence, despite the recommendations of noteworthy NSPP and CSP players.¹⁷¹ Consequently, unless Congress acts to ensure balance between NSPP and CSP, the U.S. will continue to expose itself to national security and economic risks, and will inevitably harm the future of the United States.

V. CONCLUSION: MOVING FORWARD

As access to space and space technology becomes more attainable and the United States becomes both more reliant on space technology, and more susceptible to foreign attacks, the United States must do what it can to balance its differing economic and security interests.

Although these interests are not diametrically opposed, there will be a natural tension between policy interests when national security space and commercial space policies diverge because on some levels, each policy promotes a distinctly important mission. However, these competing goals could—and should—be balanced; neither goal should be denied nor oversimplified. The United States should maintain economic stability within its borders while maintaining security at its borders.

To balance policy priorities, and ensure various policy actors cooperate with existing and evolving NSPP and CSP, Congress should enact a permanent, uniform space policy oversight commission, staffed by advisement councils from the national security,¹⁷² commercial space,¹⁷³ and civil space¹⁷⁴ arenas. As seen with Reagan space policy, and with the Rumsfeld Report and Allard Commission

¹⁶⁹ See generally The Allard Commission Report.

¹⁷⁰ *Id.* at 13.

¹⁷¹ Johnson-Freese, *supra* note 171.

¹⁷² Staffed by representatives from the current presidential administration.

¹⁷³ Staffed by members of the commercial space industry.

¹⁷⁴ Staffed by NASA, NOAA, and Congressional committee members.

suggestions, a uniform space policy oversight commission would benefit NSSP and CSP actors alike. It would provide a forum for various national security space and commercial space actors to present their issues, concerns, and complaints, and it would provide much needed oversight and organization to space issues that touch many different agencies and issues. In a day when the U.S. extensively relies upon space capabilities to protect itself from internal and external threat, and fights to maintain and stabilize its economy, a multi-resource space policy oversight commission (MR SPOC) would provide much-needed balance and consistency in NSSP and CSP matters.

STUDENT ARTICLE

STAKEOUT FROM SPACE: FOURTH AMENDMENT CONCERNS RESULTING FROM THE ONSET OF SATELLITE VIDEO

Blake Knight

I. INTRODUCTION

In 2014 a company called Skybox Imaging released video of a Beijing airport taken from Earth orbit using its satellite, the *Sky-sat-1*.¹ The resolution of the video was such that viewers were able to identify the exact flight number of the flights recorded landing.² Just months prior, the same company released video of a slightly lower spatial resolution³ showing clips of the Earth's surface.⁴ After amassing considerable investment revenue, and a name change and acquisition by Google⁵, Terra Bella (formerly Skybox Imaging) was announced to be acquired by the larger Planet Labs (now known simply as "Planet"⁶), another operator of remote sensing satellites.⁷ All the foregoing is to suggest that high definition video

¹ Betsy Mason, *Incredible HD Video from Space Brings Maps to Life*, (Mar. 4, 2014), <https://www.wired.com/2014/03/skybox-video-earth-from-space/>.

² *Id.*

³ Spatial resolution refers to the smallest object that can be discerned from the image. See <http://www.nrcan.gc.ca/node/9407> for a more detailed explanation.

⁴ David Wogan, *High-definition video from space is available for purchase. Finally.*, (Dec. 30, 2013), <https://blogs.scientificamerican.com/plugged-in/high-definition-video-from-space-is-available-for-purchase-finally/>.

⁵ Google, *Google and Skybox Imaging Sign Acquisition Agreement*, (Jun 10, 2014), <https://abc.xyz/investor/news/releases/2014/0609.html>

⁶ Tony Campitelli, *A Changing Planet: Meet Our New Brand*, (Jun 12, 2016), <https://www.planet.com/pulse/meet-our-new-brand/>.

⁷ Will Marshall, *Planet to Acquire Terra Bella from Google, Sign Multi-Year Data Contract*, (Fed. 3, 2017), <https://www.planet.com/pulse/planet-to-acquire-terra-bella-from-google/>.

from satellites in orbit of the earth is soon to be commercially available and the technology is being pursued with considerable material investment.

The privacy concerns of observing earth by satellite is a debate that has been discussed by scholars for decades,⁸ but video surveillance by satellite is a capability that has existed within the realms of speculation regarding the government's ability and Hollywood dramatization.⁹ Today's environment for commercial remote sensing services is distinctly different than the one envisioned by legal scholars decades ago.¹⁰ We stand near in time to an era in which law enforcement (or a private citizen, perhaps) could conceivably purchase video from satellites capable of tracking the movements of an individual person. Certainly this presents legal issues different than those that may currently exist from the ability to view still images from satellite that are potentially years old- as is already possible with a service such as Google Maps.¹¹ This article intends to address some distinct concerns related to the Fourth Amendment that potentially arise with the use of video from space by analyzing hypothetical space video surveillance scenarios in light of older and more recent Supreme Court cases. In addition, this Article attempts to address the question of whether or not the commercial ubiquity of satellite video changes the debate of what constitutes a "reasonable expectation of privacy." Finally, this Article will propose that the Congress of the United States preemptively nullify much of the concern by legislating privacy rights as it relates to space video in a manner similar to the regulation of other law enforcement technologies.

⁸ See generally Krysten C. Kelly, *Warrantless Satellite Surveillance: Will Our 4th Amendment Privacy Rights Be Lost in Space*, 13 J. MARSHALL J. COMPUTER & INFO. L. 729, ii (1995), and Lisa J. Steele, *The View from on High: Satellite Remote Sensing Technology and the Fourth Amendment*, 6 HIGH TECH. L.J. 317, 334 (1991) (discussing the concerns of satellite remote sensing in the early Nineties).

⁹ See *BEHIND ENEMY LINES* (20th Century Fox, 2001) (As part of the plot, the military uses live video feed from a satellite to track the movements of a downed Naval pilot).

¹⁰ Steele, *supra* note 8, at 319-320.

¹¹ See generally <https://www.google.com/maps> (It is important to note that Google Maps and Google Earth are in fact two different services with similar satellite imagery).

II. EXAMINING SPACE VIDEO SURVEILLANCE UNDER RELATED SUPREME COURT CASES

a. Katz v. United States

*Katz v. United States*¹² is a 1967 Supreme Court case that expanded the definition of a “search” under the Fourth Amendment of the Constitution. In the case, a man was speaking on the phone to convey illegal wagering information while inside a public, but closed, phone booth.¹³ The FBI placed a listening device on the exterior of the phone booth and was able to listen in on the conversation.¹⁴ The defendant sought to argue that the phone booth was a constitutionally protected place and therefore, for the FBI to conduct the surveillance without a warrant was an unreasonable search. Arguably, then, the resulting recorded phone call should have been excluded from evidence under the exclusionary rule.¹⁵ The FBI argued that because no physical intrusion had occurred, there could not have been a “search.”¹⁶ In writing the opinion of the Court, Justice Stewart claimed that both sides missed the mark in formulating the argument by focusing on the status of the phone booth,¹⁷ and that, instead, what is protected from searches by the Fourth Amendment is what the person “seeks to preserve as private.”¹⁸

From *Katz* we gather two important holdings: first, what may be searched depends somewhat on the subjective expectation of the person that the place or information will remain private, and second, that physical intrusion is not necessary to constitute a search, that is a search is entirely possible by remote, technological means. In his concurrence in *Katz*, Justice Harlan proffers a test for determining when a person has a reasonable expectation of privacy.¹⁹ The test first requires that the person exhibited an actual and subjective expectation to withhold something as private, and secondly,

¹² *Katz v. United States*, 389 U.S. 347 (1967).

¹³ *Id.* at 348.

¹⁴ *Id.*

¹⁵ *Id.* at 350.

¹⁶ *Id.* at 352.

¹⁷ *Id.* at 351.

¹⁸ *Id.* at 352.

¹⁹ *Id.* at 361.

that this is an expectation that “society is prepared to recognize as reasonable.”²⁰

Although it cannot be done, due to later Fourth Amendment cases related specifically to aerial surveillance (which will be discussed later in the Article), it is helpful to examine video surveillance from space as if the *Katz* holding existed in a vacuum. Hypothetically, assume someone were to have a house on a busy public street in the center of Manhattan. Assume further that they were to do some activity by an open window of that home. If a government agency were to record that activity from the street outside one could argue that it would be admissible evidence because, while that person may have satisfied the first prong of the reasonable expectation of privacy test, the court would likely hold that society would not find that expectation as reasonable. Now imagine someone who lives in a house in a small acre clearing of a forest (the forest also being owned by the person), far from any public road, and with the entirety of that clearing obscured from the road. That person could reasonably expect that his or her actions within the home or clearing are private, and society would most likely find that expectation reasonable. Which would conceivably mean for any law enforcement to observe anything in the home or the clearing would require a warrant to enter and search.

When you add in the prospect of aerial surveillance, by satellite or otherwise, this hypothetical becomes considerably more difficult to analyze. May a person reasonably expect privacy when airplanes overhead could photograph or record his or her activities in the clearing? If so, would society deem that expectation reasonable? Later Supreme Court cases have held that, society does not find such expectations to be reasonable.²¹ In general, if law enforcement uses aerial (by plane or helicopter) surveillance, even without a warrant, it is not a violation of a person’s Fourth Amendment rights.²² These forms of aerial surveillance are reasonably detectable by the one under surveillance, at least to some extent. Would a

²⁰ *Id.* (This test was later adopted by the Supreme Court in *Smith v. Maryland*, 442 U.S. 735, at 740.)

²¹ See generally *Florida v. Riley*, 488 U.S. 445 (1989) and *California v. Ciraolo*, 476 U.S. 207 (1986) (both cases involving aerial surveillance) and *Dow Chemical v. United States*, 106 S. Ct. 1819 (1986) (Also involving aerial surveillance, although somewhat limited to a commercial context.)

²² *Id.*

pure *Katz* analysis change when the method of surveillance on our hypothetical house in the clearing is silent and undetectable, as would be the case with satellite video? One may instinctively begin to ask questions about the frequency and altitude of the flights over the clearing. If there are any flights at all, one may question whether society would reasonably expect privacy in the clearing - perhaps certainly in the walls of the home, but less reasonable in the open of the clearing. If the method of surveillance is silent and effectively invisible, it is hard to expect any rational person (devoid of any other knowledge) to assume that someone might witness their actions in the clearing. Suppose that a satellite video service exists in a manner similar to and nearly as ubiquitous as Google Maps; will the Supreme Court then interpret society as generally being aware that satellite video surveillance is available, and therefore society *would not* hold an expectation of privacy in the clearing reasonable? As one can see, *Katz* conceivably raises more questions than answers for the future law enforcement application of space video.

Cases after *Katz*, such as *Oliver v. United States*, seemingly affirm this return to the pre-*Katz* distinction of *where* the location the “search” occurred being the defining factor in whether a constitutional search has actually occurred.²³ Although, the same case appears to reserve some constitutional respect for the privacy of one’s “curtilage,” that is, the land directly adjacent, or considered part of, the home.²⁴

b. Aerial Surveillance in Ciraolo and Riley

The largest blows to those wanting protection from law enforcement’s eventual use of satellite video may have already been dealt. The summation of the cases *California v. Ciraolo*, *Florida v. Riley*, and *Dow Chemical v. United States* give rise to the “Plain View Doctrine.”²⁵ Although *Oliver* seemed to protect the curtilage

²³ See *Oliver v. United States*, 466 U.S. 170, at 179 (1984) (holding that “Only the curtilage, not the neighboring open fields warrants the Fourth Amendment protections that attach to the home.”)

²⁴ *Id* at 180.

²⁵ Kelly, *supra* note 8, at 754 ii.

of one's home, these three cases apparently destroy that protection.²⁶ In *Ciraolo*, a defendant was convicted of growing marijuana in his yard after local law enforcement received an anonymous tip, flew an airplane overhead at 1000 feet, and photographed the marijuana plants without a warrant.²⁷ In the majority opinion Justice Burger writes:

That the area is within the curtilage does not itself bar all police observation ... The observations by Officers Shutz and Rodriguez in this case took place within public navigable airspace ... in a physically nonintrusive manner; from this point they were able to observe plants readily discernible to the naked eye as marijuana.²⁸

In what many now refer to as the "naked-eye" test, *Ciraolo* has removed the curtilage of one's home from the undeniable need for law enforcement to obtain a warrant to search. In effect, *Ciraolo* deemed the "public navigable airspace" to be a location from which a person cannot expect privacy, even within his curtilage.²⁹ Which begs the question: is the orbit of our earth a proper extension of "public navigable airspace"? If yes, the result does not bode well for those wanting warrants in order for law enforcement to utilize video gathered from satellites. Some authors are inclined to believe that this warrantless use of satellite imagery will be the norm, because the altitude at which the flight occurs seems unimportant if the technology required to photograph in detail at that altitude is irrelevant.³⁰

As an additional note, the California Court of Appeal (from which the case was granted *certiorari*) noted that the flight from which the plants were photographed was undertaken specifically for the purpose of surveilling the defendant's particular home and was distinct from a civilian flight overhead, which would have merely happened to observe the plants.³¹ The Supreme Court's

²⁶ *Id.* at 753. See also: Daniel W. Johnson, *Aerial Surveillance: A Birds-Eye View of Katz v. United States*, 22 Gonz. L. Rev. 393, at (1986)

²⁷ *Ciraolo*, 476 U.S. at 209.

²⁸ *Id.* at 213.

²⁹ *Id.*

³⁰ Kelly, *supra* note 8, at 753 (Quoting *Dow* in which the Court held that "the mere fact that vision is enhanced somewhat... does not give rise to constitutional problems).

³¹ *Ciraolo*, 476 U.S. at 211.

holding renders this distinction irrelevant.³² *Florida v. Riley* reaffirmed this holding three years later when a person growing marijuana in their greenhouse had that marijuana photographed by law enforcement in a helicopter at an altitude of 400 feet.³³

c. Does the Technology used Matter? – Dow Chemical

Dow Chemical v. United States sheds uncertainty on the “naked-eye” test we derive from *Ciraolo* and *Riley*. In *Dow Chemical*, the EPA used an airplane to observe and perform an unconsented inspection of a Dow Chemical plant in Midland Michigan.³⁴ The record states that the aircraft contained a “standard floor-mounted, precision aerial mapping camera.”³⁵ *Dow Chemical* is invaluable to the present analysis because it offers considerable discussion to the type of technology used. *Ciraolo* was clear: the surveillance of defendant’s backyard was constitutional because it was done from public airspace and involved material visible by “the naked-eye.”³⁶ This stands in stark contrast to *Dow Chemical* where the “search” was conducted with a “precision aerial mapping camera” capable of discerning objects a half inch in size.³⁷ This discrepancy between the two holdings is seemingly only mendable by concluding that the Court intends advanced technology to stand as the “naked-eye.” Consequently, there does not seem to be a situation in which the technology used to surveil would ever matter.³⁸ So, it, perhaps unfortunately, follows that use of satellite video could easily become an extension of “navigable airspace” and the highly refined, expensive telescopic video cameras onboard these satellites are, inexplicably, an extension of the “naked eye.”

The *Dow Chemical* opinion mentions that the Government concedes that there could be a cut-off in terms of technology (offering satellites as an example) that would be considered outside the

³² *Id.* at 215.

³³ *Riley*, 488 U.S. at 446.

³⁴ *Dow Chemical*, 476 U.S. at 229.

³⁵ *Id.*

³⁶ *Ciraolo*, 476 U.S. at 209.

³⁷ *Dow Chemical*, 476 U.S. at 238.

³⁸ Daniel W. Johnson, *Aerial Surveillance: A Birds-Eye View of Katz v. United States*, 22 Gonz. L. Rev. 393 (1986), at 403.

“naked-eye” and thereby require a warrant.³⁹ Although the Supreme Court is merely restating the government’s argument, it does seem interesting that it would even mention the Government’s reference. It is almost as if the Court does not wish to outright hold that all forms of enhanced vision will be considered the “naked-eye” and would like to reserve some maneuvering room for the future. The *Dow Chemical* opinion does, however, seem to take the general availability to the public of the surveillance method into consideration when determining if an unreasonable search occurred.⁴⁰ As some commenters have noted, it is almost incredulous the court would find a nearly “\$22,000 aerial mapping camera” generally available to the public, as if “any Joe Sixpack with an airplane and [the camera] could readily duplicate these photos.”⁴¹ Nevertheless, such an interpretation invites the question of whether or not the same court would hold a satellite to be a similar piece of “generally available” technology. If satellite video were to exist for some time as a relatively unknown (to the general public) technology, then perhaps the same court would find its warrantless use by law enforcement an unreasonable search. But if satellite video were to become as ubiquitous as Google Maps, as this author imagines it might, then would the availability of the technology erode the protection the Fourth Amendment offers against it? So, while this Article intends to focus on law enforcement’s potential use of satellite video, *Dow Chemical* seems to suggest that the general public’s use of the technology involved plays a role in determining whether or not a Fourth Amendment search has occurred.

d. Using Satellite Video to Invade the Home – analogous to Kyllo?

Although satellites obviously exist outside of homes and would provide video from an overhead view, the fact that it is video rather than still imagery may allow one to deduce the contents inside of the house. Consider our earlier home in the clearing hypothetical. If law enforcement wished to surveil the owner using Google Maps, they would not be able to determine much. If something illegal was

³⁹ *Dow Chemical*, 476 U.S. at 238.

⁴⁰ *Dow Chemical*, 476 U.S. at 234.

⁴¹ Johnson, 22 GONZ. L. REV. 393, at 403 (quoting Professor Yale Kamisar.)

conspicuously located in the clearing the moment the satellite took the still image, then perhaps law enforcement would have a case to investigate or prosecute. But even then, the still image may be old and therefore inconclusive. On the other hand, if the law enforcement had video at its disposal it could possibly record a vehicle leaving every day at 8:00 a.m. that does not return until 5:00 p.m., thereby allowing them to deduce that in between those two times, at least one person *is not* in the home. Or, suppose satellite video captures a van arriving at the home every day at a certain time and captures the driver carrying some object from the van into the home. If law enforcement uses the video to track the van as it goes to and from a known marijuana growing operation, then they can deduce with reasonable effectiveness that there is marijuana inside the home. Again, we see how satellite video is distinct from other forms of satellite surveillance and requires its own consideration.

In *Kyllo v. United States*, law enforcement suspected a man of growing marijuana within his house.⁴² Knowing that high powered lamps are often used to grow marijuana indoors, the law enforcement used (without a warrant) a thermal imaging camera to see if there were unusual heat concentrations emanating from the house.⁴³ There were heat concentrations, and law enforcement subsequently were issued a warrant to enter the home where they found marijuana growing.⁴⁴ The defendant in the case was arrested and sought to have the evidence suppressed because the thermal scan of the home was an unreasonable search under the Fourth Amendment.⁴⁵ The syllabus from the case gives us the clearest interpretation of the holding:

Where, as here, the Government uses a device that is not in general public use, to explore details of a private home that would previously have been unknowable without physical intrusion, the surveillance is a Fourth Amendment ‘search,’ and is presumptively unreasonable without a warrant.⁴⁶

⁴² *Kyllo v. United States*, 533 U.S. 27, at 29 (2001).

⁴³ *Id.*

⁴⁴ *Id.* at 30.

⁴⁵ *Id.*

⁴⁶ *Id.* at 29.

Such a holding applied to satellite video seems workable in its favor. Satellite video is certainly a device that is not currently in general public use, and in a situation like our home in the clearing hypothetical, it could certainly be used to deduce the details of the home in the clearing; details which would otherwise be unknowable without physically entering the property. In addition, this holding seems to support the holding of *Dow Chemical* in that the reasonableness of the expectation of privacy depends, at least to some extent, on the general availability of the technology used to conduct the surveillance.⁴⁷ One of the criticisms of those in the dissent was that the majority provided no guidelines as to what constitutes “general use.”⁴⁸ This gives citizens and law enforcement no guidance on how video gathered from satellites may be utilized. At what point will satellite video cross the line into “general use” of the public, and thereby society find the expectation that activities in the clearing is unreasonable? I argue that point will come whenever the average citizen can go to a service and order video from a specific time and specific location; especially given that surveillance requiring a \$22,000 camera and an airplane was once held to be “generally available to the public.”⁴⁹

Even if satellite video does become generally available to the public and useful to make deductions about the contents inside the home, should society still legislatively proscribe its warrantless use? The opinion of *Kyllo* suggests this may not be necessary, as Fourth Amendment jurisprudence would suffice. The *Kyllo* opinion states that the Fourth Amendment “draws a firm line at the entrance to the house.”⁵⁰ The obvious counter to this would be that police evidence has long been gathered by staking out homes and deducing their contents by the traffic that comes and goes from them.⁵¹ If the positioning of the video satellite is considered a public area, “navigable airspace,” remaining consistent with *Ciraolo* and

⁴⁷ Thomas D. Colbridge, *Kyllo v. United States: Technology versus Individual Privacy*, 70 FBI L. Enforcement Bull. 25, 28 (2001).

⁴⁸ *Id.*

⁴⁹ Johnson, 22 GONZ. L. REV. 393, at 403.

⁵⁰ *Kyllo*, 533 U.S., at 40 (quoting *Payton*, 445 U.S., at 590).

⁵¹ See *Horton v. California*, 496 U.S. 128, at 137 (1990) (the court upheld warrantless seizure when “...the officer [is] lawfully located in a place from which the object can be plainly seen...” demonstrating an emphasis on searches being lawful without warrant when conducted by an officer who is located in a place where he has a lawful right to be).

Riley, and it's "generally available to the public," remaining consistent with *Dow* and *Kyllo*, then it's hard to imagine how our federal courts *would not* hold the use of satellite video to be any different from a police vehicle staking out a home. The distinction in *Kyllo* seems to be that using a generally *unavailable* technology to determine what is *inside* the home constitutes a warrant-requiring search. This author's envisioned use of satellite video (prior to its general availability, at least) fits that bill rather nicely. Yet in light of *Ciraolo*, one can just as easily envision the warrantless use of satellite video being upheld as not a search. This conundrum may lead to considerable unpredictability for law enforcement when the day comes that they are in a position to utilize satellite video when investigating a suspect.

Further indicative of the mess that is Fourth Amendment jurisprudence is the fact that *Kyllo* was heard by the Ninth Circuit Court of Appeals four times, decided on the third, and then the Ninth Circuit reversed itself on the fourth hearing, holding that the search *was* constitutional.⁵² It's difficult even for the highest levels of our federal courts to come to a consensus as to what factors make a search unreasonable.

e. Using Satellite Video to Track Movements – analogous to Jones?

One of the additional uses the reader must envision satellite video providing is the tracking of individuals. Suppose law enforcement had sufficient information to suspect a person of committing a crime, but not enough to give them probable cause or a warrant. So, they set out to track the person's vehicle, on the public roadways, where generally one does not have a reasonable expectation of privacy,⁵³ all in the hope of gathering information about the suspect's activities. Satellite video, even in its current form (as detailed in the introduction of this Article), is capable of distinguishing individual vehicles. If there were enough satellites so that they could "hand-off" the video when one passes out of range, and the other into range, then law enforcement could conceivably track an individual's car silently, undetectably, and without needing to touch the

⁵² *Id.*

⁵³ See generally, *United States v. Knotts*, 460 U.S. 276 (1983).

car to place a tracking device or recover or intercept its on-board location data. This ability could be particularly useful to law enforcement, and in some instances where other methods of aerial surveillance are not feasible or the law enforcement has a particular need to remain undetected, satellite video could even be chosen over airplane, helicopter, or drone surveillance.

In 2012, the Supreme Court decided *United States v. Jones*.⁵⁴ *Jones* involved law enforcement tracking a suspect via a Global Positioning System (GPS) device attached to his car for a four week period.⁵⁵ The defendant sought to have the evidence gathered by the GPS tracking suppressed, and initially the District Court would only suppress the data from when the car was parked at the defendant's home.⁵⁶ For all the other data, the Court claimed while on public thoroughfares the defendant had no reasonable expectation of privacy.⁵⁷ Ultimately, the case made its way to the Supreme Court where the Court held that the attachment of the device to the car constituted a search for the purposes of the Fourth Amendment.⁵⁸

Interestingly, the case was not decided on a reasonable expectation of privacy grounds, but instead, on the theory that placing the GPS tracker on the car constituted a trespass to chattel and therefore a search.⁵⁹ Justice Scalia in the majority opinion, specifically mentions *Katz* and decides to sidestep its "reasonable expectation of privacy" test, instead choosing to return to pre-*Katz* jurisprudence related to trespass.⁶⁰ To apply satellite video directly to *Jones* leads one to few conclusions. Because *Jones* was decided solely on the issue of trespass, it does not answer whether or not constant and long-term 24/7 tracking is actually unconstitutional without a warrant.⁶¹ And, because satellite video surveillance certainly would not involve a physical trespass, the jury is still out, so

⁵⁴ 565 U.S. 400 (2012).

⁵⁵ *Id.* at 403.

⁵⁶ *Id.*

⁵⁷ *Id.*

⁵⁸ *Id.* at 402.

⁵⁹ *Id.* at 404.

⁶⁰ *Id.* at 406-7.

⁶¹ See, Heather Phillips, *The Big Brother Effect: The Implications of the Unanswered Question in United States v. Jones*, 48 MCGEORGE L. REV. 395, 422 (2017) (Noting that the majority opinion in *Jones* did not address at what point warrantless police surveillance or tracking becomes a warrant-requiring search).

to say, on whether or not satellite video tracking would be *per se* unconstitutional without a warrant.

Those who may be worried about a future of satellite video in the hands of law enforcement may find relief in the concurrences of *Jones*. The *Jones* case spawned two concurrences, each generally more favorable to addressing long term individual tracking by means of a post-*Katz* reasonable expectation of privacy test, rather than simply traditional trespass means.⁶² If satellite video ultimately is capable of tracking the individual, physical trespass doctrines will do nothing to stop it. Justice Sotomayor is distinctly aware of this fact, noting in her concurrence that other forms of individual tracking will not require physical trespass at all.⁶³ Justice Alito also considers that non-physical trespass (even assisted by aerial surveillance) is afforded no protection at all by the majority in *Jones*.⁶⁴ Justice Alito, in his concurrence, which four other justices joined, wishes to do away entirely with pre-*Katz* physical trespass as a test of when one's right to privacy has been abridged, instead relying on a reasonable expectation of privacy test.⁶⁵ Sotomayor, alone in her concurrence, would still like to recognize physical trespass as constituting a search, but thinks the pervasive individual tracking should have been subject to the reasonable expectation of privacy test.⁶⁶ The issue for her, is that when the government is able to collect a "comprehensive record of a person's public movements that reflects a wealth of detail about her familial, political, professional, religious, and sexual associations" it is ripe for abuse.⁶⁷ Further, it could change the way the government and its citizens interact: "Awareness that the Government may be

⁶² See generally David Gray; Danielle Keats Citron; Liz Clark Rinehart, *Fighting Cybercrime after United States v. Jones*, 103 J. CRIM. L. & CRIMINOLOGY 745, 762-764 (2013) (noting that both Justice Sotomayor's and Justice Alito's concurrences are both sympathetic to modifying 4th Amendment privacy doctrine in the digital age.)

⁶³ *U.S. v. Jones*, 565 U.S. at 414.

⁶⁴ *Id.* at 425.

⁶⁵ See *Id.* at 422-23 (Alito notes that *Katz* "did away with" the old doctrine, and notes several cases pointing to the abandonment of physical trespass-based tests for unreasonable searches; quotes *United States v. Karo*, 468 U.S. 705, 713 (1984) in which the court held "an actual trespass is neither necessary nor sufficient to establish a constitutional trespass").

⁶⁶ *Id.* at 414.

⁶⁷ Gray et al., *supra* note 62, at 763.

watching chills associational and expressive freedoms.”⁶⁸ Some of Justice Sotomayor’s concurrence might suggest a willingness to even abandon the public-observation doctrine.⁶⁹ Justice Alito also questions the public view doctrine’s survival in the modern age of law enforcement surveillance.⁷⁰ Abandoning this doctrine would be beneficial to protecting against unreasonable searches conducted via satellite. It would allow for a reasonable expectation of privacy to exist against some forms of surveillance, even if the person is acting in public view, if the surveillance and individual tracking is constant and ongoing. If satellite video surveillance can be conducted constantly and conducted of a person in public view, then there is little to suggest that their Fourth Amendment right has been violated. But, if the court adopts a mosaic theory of privacy, as Justices Sotomayor and Alito suggest,⁷¹ then perhaps in the future Fourth Amendment jurisprudence will be more favorable to satellite video surveillance protections.

Although this is not position of the Supreme Court at the time, the fact that both concurrences address the issue of constant tracking and surveillance being the “unreasonable search” seems to suggest that, going forward, the Court is in position to accept that constant surveillance can be a search even done in public areas.

Regardless, this author reasons that GPS tracking and potential satellite video tracking are not perfect analogues. Satellite video would suffer from numerous limitations: inability to penetrate cloud cover,⁷² losing vehicles in tunnels or other covered areas, gaps in swath coverage,⁷³ overall lack of satellites, etc. Part of the reasoning behind the *Jones* decision (at least by the concurring Jus-

⁶⁸ *US v. Jones*, 565 U.S. at 416.

⁶⁹ *Id.*

⁷⁰ *Id.* at 764.

⁷¹ *Id.* at 762.

⁷² See NASA Earth Observatory, <https://earthobservatory.nasa.gov/IOTD/view.php?id=79233> (last visited April 9, 2017) (Demonstrating that when imaging in the visible spectrum, NASA’s EO-1 satellite cannot image the ground through smoke; imaging through it requires using more than the visible spectrum).

⁷³ See Allan Brimicombe, *GIS, Environmental Modeling and Engineering Second Edition*, at 40 (CRC Press, 2009) (Describes generally what swath width is and, as an example, describes how the IKONOS satellite would require multiple passes over London in order to image its entirety).

tices) was the completeness, almost omnipotent nature of the tracking that the GPS provided.⁷⁴ In that sense, satellite video would most likely be lacking, relative to GPS. It is easy to imagine law enforcement knowing the unlawful nature of warrantless GPS tracking (if the police placed a tracker on the car, that is) and thus seek satellite video tracking as an alternative. It is just as easy to imagine a day in the future when, by technological advancement, satellite video has largely overcome some of the deficiencies posited above; bringing it just as, or nearly as, effective at tracking an individual's movements as GPS. This is simply another reason to suggest that legislative bodies address the situation rather than wait for the higher levels of our federal and state courts to inevitably weigh in on the matter.

III. LEGISLATING LAW ENFORCEMENT'S USE OF SATELLITE VIDEO

As one can see from examination of the relevant Fourth Amendment Supreme Court Cases, we are left with little certainty as to how the law will eventually apply law enforcement's use of satellite video to Fourth Amendment cases. This has been the case with other technologies, and, in response, state legislatures and the federal legislature have enacted legislation and regulation governing the use of certain technologies in relation to their use by law enforcement.⁷⁵ This author suggests the same should be done with satellite video. In order to examine how this might take place, this section of the Article will examine some technological analogues and how their use has been addressed in legislation.

There is debate as to whether or not legislatures should regulate what would normally be Fourth Amendment protections at all.⁷⁶ On one side (and the side to which this author is partial) schol-

⁷⁴ See *Jones*, 565 U.S. at 415 (Justice Sotomayor, in concurring noting the litany of personal information that be gathered about someone from the constant, long term tracking of their vehicle) and also, *Id.* at 430 (Justice Alito, in his concurrence noting that "longer term GPS monitoring in investigations of most offenses impinges on expectations of privacy").

⁷⁵ David E. Steinberg, *Sense-Enhanced Searches and the Irrelevance of the Fourth Amendment*, 16 WM. & MARY BILL RTS. J. 465, 472 (2007)

⁷⁶ *Id.* at 473.

ars disfavor the unpredictability of the Fourth Amendment jurisprudence.⁷⁷ As Fourth Amendment scholar David Steinberg notes, there is an inability to predict how the Supreme Court will address a new technology; prior to the handing down of the *Kyllo* decision he predicted the court would not require a warrant, but ultimately the court did.⁷⁸ Steinberg asks the question that if he, who has spent years studying the Fourth Amendment, cannot predict how the Court will address a technology “then why should we expect police officers to make accurate predictions?”⁷⁹ Therein lies the crux of this author’s argument: in leaving satellite video to the Supreme Court, we make the everyday law enforcement officer the “judge” as to what is a reasonable search, at least until the courts have ruled conclusively on the new technology. To leave that determination in such hands is to subject it to decision-making with considerable bias. Further, the judicial system is inherently slow, and by the time the satellite video evidence reaches the bench, the searched person’s right may have already been violated.

Conversely, some scholars suggest that new technology under the Fourth Amendment should be left to the courts.⁸⁰ Steinberg points out that those in this camp tend to disfavor the complexity that arises from legislative actions. Instead, they prefer that the basic Fourth Amendment principles are relatively accessible and concepts such as “reasonable expectation of privacy, probable cause, and reasonable suspicion are easily understood.”⁸¹ This author would argue that those with this position are possibly overestimating the average person’s grasp of these concepts. In other words, they *can* be easily understood by the average person, but are they *actually* understood by the average person?

If that supposition is correct, that the average person may not truly understand what a reasonable expectation of privacy is (along with other Fourth Amendment concepts), then it makes it all the more important that we find a legislative solution to law enforcement’s use of satellite video. At the Federal level, wiretapping was

⁷⁷ *Id.*

⁷⁸ *Id.*

⁷⁹ *Id.*

⁸⁰ *Id.* at 475.

⁸¹ *Id.*

regulated in the aftermath of *Katz*.⁸² Wiretapping gives the law enforcement the ability to listen or record the content of a phone call. Congress passed the Omnibus Crime Control and Safe Streets Act of 1968 which dictated that law enforcement's use of wiretaps would require a warrant.⁸³ In 1986, Congress enacted roughly the same requirements for pen registers (devices that capture to whom, and from where a phone call was made).⁸⁴

Drones are a more relevant and recent example of a technology undergoing some legislation and regulation. At the Federal level there has been a push to regulate law enforcement's use of drones, with a few failed acts having warrant provisions.⁸⁵ At the state level, there has been some legislation successfully passed to require warrants for their use by law enforcement. In 2013, Illinois, Florida, Idaho, Montana, Oregon, Tennessee, and Texas all passed drone legislation that included some form of warrant-requiring provision.⁸⁶ The requirement is not always absolute; the states' legislation provides exceptions for emergencies, "exigent circumstances," and to forestall the escape of a suspect, among other exceptions.⁸⁷ There is a trend among the states to allow the legislature to more clearly define, for citizens, what exactly constitutes their reasonable expectation of privacy in relation to drones.

This author proposes that Congress follows the lead of states' action related to drones and define for the entirety of the United States what constitutes a reasonable expectation of privacy in relation to law enforcement's use of satellite video. In fact if you were to take 18 U.S.C. § 2518 (the warrant requirements for wiretapping) and replace every instance of "the interception of a wire, oral, or electronic communication" with "surveillance of an individual or individuals by means of recorded video from an orbiting satellite" you would be very near to an acceptable warrant-requiring provision for satellite video. Whatever Congress decides, it is best to do

⁸² *Id* at 471.

⁸³ *Id.* (for the current version of the law see 18 U.S.C. § 2518).

⁸⁴ *Id* at 472.

⁸⁵ Thomas A. Bryan, *State v. Brossart: Adapting the Fourth Amendment for a Future with Drones*, 63 CATH. U. L. REV. 465, at 494 (2014).

⁸⁶ Taly Matiteyahu, *Drone Regulations and Fourth Amendment Rights: The Interaction of State Drone Statutes and the Reasonable Expectation of Privacy*, 48 COLUM. J.L. & SOC. PROBS. 265, 285 n.145 (2015).

⁸⁷ *Id* at 285-286.

so before the technology matures in order to prevent the infringement of constitutional protections prior to the issue being dealt with by the courts.

IV. CONCLUSION

The concerns addressed in this Article may be more distant than they are near. Regardless, satellite video is a currently existing technology (even if only in its infancy), the further development of which is being pursued with considerable investment. Once it is developed to maturity, it could serve as a useful tool for law enforcement to conduct searches, track individuals and groups, and otherwise conduct investigations. Like any technology, it is a tool at law enforcement's disposal. However, law enforcement often will rush in to using the new technology without sufficient regard for Fourth Amendment principles. Perhaps rightfully so, law enforcement's mission is generally to pursue criminal suspects and protect the public, not to debate the minutiae of how each and every technology fits into Fourth Amendment jurisprudence.

Examining how satellite video surveillance fits into Fourth Amendment concepts and jurisprudence would not only serve the public's interest in being protected against unreasonable searches, but also benefit law enforcement by clearly defining their role and minimizing losses of evidence due to the exclusionary rule. When one attempts this, however, they are left with more questions than answers. *Katz* gave birth to the reasonable expectation of privacy test as well as confirming that an unreasonable search can be conducted via remote, technological means, seemingly suggesting that the fact that a satellite video is taken remotely does not preclude protection against its warrantless use. Just after arriving at that conclusion, we are faced with *Ciraolo* and *Riley*, where the warrantless use of overhead aerial surveillance was held to *not* infringe upon a constitutional protection. This leads one to inevitably ask whether or not our courts will find satellite video to be merely another form of aerial surveillance, making warrants for its use unnecessary. *Dow Chemical* expanded upon *Ciraolo* and *Riley* by finding that the use of highly specialized camera equipment to conduct the aerial surveillance did not in any way change the way the court applied the reasonable expectation of privacy test. This seemingly

allows for not only warrantless aerial surveillance, but aerial surveillance with highly specialized, sense-enhancing equipment.

Kyllo appears to offer some protection against warrantless satellite video surveillance by holding that it is an unreasonable search to use technology that is not in general public use to discern the private details of the home without a warrant. As the dissent in that case pointed out, there are no guidelines as to what constitutes general public use. How would the court determine when satellite video has reached the level of “general public use?” Further, that holding seems limited to when the technology is used to discern what is *inside* the home. Does using satellite video to watch persons coming and going from a home, and thereby deduce the contents of the home count as invading the home? Finally, in *Jones* the court held constant and long term warrantless tracking of an individual to be an unreasonable search, but only due to the physical trespass required to place the tracking device on the person’s car. Does that mean if satellite video can achieve the same result (in terms of tracking) without requiring a physical trespass that its warrantless use would be upheld under the *Jones* holding?

The courts have struggled to adapt the Fourth Amendment as technology continues to evolve and surveillance becomes easier to conduct and more pervasive. This could simply be a result of the drafters of the Fourth Amendment never intending or conceiving the technology that is available today. A definitive, legislative solution can neutralize some of the worry satellite video may present. Federal and state legislatures have enacted legislation to specifically require warrants when law enforcement wishes to use pen registers, wiretaps, drones, and other technologies. There is little reason to avoid doing the same for satellite video.

TRANSLATION

TRANSLATOR'S INTRODUCTION TO THE 1865 INTERNATIONAL TELEGRAPH CONVENTION

*Harrison Parker**

Editor's Note: The importance of the International Telecommunication Union (ITU) to international space law cannot be overstated. As the international coordinating body for electromagnetic spectrum its work touches every satellite in orbit. The ITU, though, predates satellites and even wireless transmission using electromagnetic waves. The ITU, as the oldest international organization, was first formed as the International Telegraph Union. Until now, the original convention establishing this body has only been available in French. This English translation is offered to give readers access to an important historical antecedent to the modern-day treaties that govern this important international body.

Telegraphy, like all other forms of telecommunications, was a heavily codified field. Its practice had national and international implications due to what could be conveyed across its lines, and how it should be done. Indeed, “agreement on standards is inherent in any extension of telecommunications beyond the purely local.”¹

*LL.M. in Air and Space Law, 2017, University of Mississippi School of Law; J.D., 2016, University of Mississippi School of Law; BA in English, 2012, George Mason University.

¹ M.B. Williams, *International Standards for Telecommunications*, Phil. Trans. R. Soc. Lond. A. (Eng.) 289, 185 (1978).

Like all other forms of telecommunications, telegraphy's codification was done through the International Telecommunication Union (ITU).² Utilizing ITU's voluminous documents and records produced and published from over 150 years of International Conventions, legal scholars, academics, and historians are able to explore the legal and operational histories of satellite communication, the Internet, telephonics, and radio to name a few. There is, however, one exception: telegraphy, which for historians may also be the most important. The origin of all international telecommunication and its applicable laws is inextricably tied to the origin of the ITU and its first convention, the 1865 *Convention télégraphique internationale de Paris* (the International Telegraphic Convention of Paris) and subsequent *Règlement de service international* (Rules of International Service). This document not only established the international standards and practices of telegraphy for mainland Europe, (The U.K. and other countries would be added in subsequent Conventions.) but also was the first international document to establish Morse code as the international standard alphabet of telegraphy, and it set the parameters for sending coded messages via Morse across the borders of Contracting States. The ITU's Convention, a repeated title changed only to match the technology of the age, the year, and the place, "has the status of a treaty between sovereign states in recognition of the importance of its role in international relations."³ Unfortunately, this original document is referenced sparingly in historical analyses concerning the ITU, international telecommunications, or telegraphy, in large part because there is no official English version. As such, Williams' article on the evolution of the ITU speaks only to "the catalytic role" of the 1865 convention, and then hurdles quickly to the 1871 Convention,⁴ the first produced in English. An undated internal document from ITU discussing its own history offers only half a paragraph to the 1865 Convention, which *founded* the ITU. The internal document states,

On 17 May 1865 after two and a half months of arduous negotiations, the first International Telegraph Convention was signed by the 20 participating countries and the International

² *Id.*

³ *Id.*

⁴ *Id.*

Telegraph Union was set up to enable subsequent amendments to this initial agreement to be agreed upon. This marked the birth of the ITU.⁵

Unlike the majority of ITU's Conventions, the documents produced from the 1865 Convention were only in the original French, and before now, remained untranslated. Because of this, one of the (if not *the*) most important foundational documents for International Telecommunication laws, regulations, and standardizations has been excluded from the legal repertoire of lawyers, scholars, and historians alike.

What is presented here are both the 1865 Telegraphic Convention and the Rules of International Service, translated from the original French to English. This introductory text accompanies the translation to serve as an historical introduction, and to deliver translation notes to better appreciate the nuances of the Convention's language, discuss the method of translation, and the idiosyncrasies of translating a document from 1860s French to modern academic English. This introductory text also includes a history of both the 1865 Convention and the origin of Morse Code.

A PIECE IN TIME

There is a tendency, I think, to take for granted the nature of communication and connectivity during the era of the telegraph. This Convention was created in a time when America was at one of its lowest points during the Civil War, and Europe was at a pre-WWI height. It is easy to relegate the concept of kings, queens, and royalty to fantastical ideas of Camelot, Narnia, and fairy tales, and not to the hard, tangible history of telecommunications and wires and networks. However, they are precisely who established the first international telegraphy laws. The Convention was established by the plenipotentiaries of twelve Kings, four Emperors, one Grand-Duke, one Queen, one Free City, and the Swiss Federation. It was the age of royals that led us into communications as we know it.

One of the most striking things in the 1865 Convention, not duplicated in the 1868 or 1871 Conventions, is the introduction of

⁵ ITU History, *History*, www.itu.int/itudoc/about/itu/history/history.txt (last visited Nov. 21, 2017).

Plenipotentiaries. Perhaps nothing more indicates the grandeur of the time than the honors bestowed upon those representing the Crowns. Taking as an example Napoleon III's plenipotentiary, Mr. Édouard Droyn de Lhuys, who was awarded the Grand-Cross of the Imperial Order of the Legion of Honor, an internal award, and also similar national awards from:

the Orders of Saint-Étienne of Austria, of the Danebrog of Denmark, of Charles III of Spain, of the Savior of Greece, of the Saints Maurice and Lazarus of Italy, of the Netherlands Lion, of the Seraphim of Sweden; decorated by the Imperial Order of the Medjidie First Class (Turkey).⁶

These accolades were mirrored either in whole or in part by the majority of Plenipotentiaries at the Convention, which showed both the interconnectivity of Europe, and the type of people who represented their countries in those days. While we tend to think about telecommunications in terms of a bunch of nerds sitting in dark rooms doing long division, the origin of telecommunications was founded by Kings and Queens.

ITU AND THE EXCLUSION OF ENGLAND

It is not until 1872 that an English document is suddenly generated by the ITU, the third such Convention.⁷ This is due to a sequence of events within England that led to their approval as members of the ITU. By the time of the original 1865 Convention, England had authorized the creation of telegraph services inside the United Kingdom via "the Telegraph Act, 1863."⁸ The telegraph offices born out of this act, however, were privately owned, and not under the direct control of the State.⁹ Because of the sensitive nature of telegraphy, as described in the 1865 Convention, the ITU would not allow a non-State-run telegraphy system into the Union.¹⁰ Britain, understanding the importance of being involved in

⁶ Int'l. Telecomm. Union, *Conv. Télé. Int'l. de Paris*, 3-4 (1865).

⁷ *Constitution and Convention*, ITU, <http://www.itu.int/en/history/Pages/ConstitutionAndConvention.aspx>.

⁸ The Telegraph Act 1863, 26 & 27 Vict., c. 112.

⁹ Williams, *supra*.

¹⁰ Williams, *supra* at 186.

international telegraphy, then pursued the adoption of laws that would bring telegraphy back into the fold of State-run services.

When the ITU had convened its second Convention in 1868, the U.K. had passed the “Telegraph Act, 1868,” (the Act) which acknowledged that “the Means of Communication by Electric Telegraphs within the United Kingdom of *Great Britain and Ireland* are insufficient, and many important Districts are without such Means of Communications.”¹¹ The Act made it clear that the privately-run telegraph system was inadequate for the coming age, and that all the U.K. would profit from a standardized system, and thereby “empowered [Her Majesty’s Postmaster General] to work Telegraphs in connexion with the Administration of the Post Office.”¹²

The Act gave the Postmaster a unique set of powers, including the right to purchase outright any “Undertaking...” or “Company... engaged in the United Kingdom of *Great Britain and Ireland* in transmitting or authorized to transmit, Messages for Money or other Consideration, by means of Electric or other Telegraphs, or mechanical Agencies, and each and every of those Companies,”¹³ and also to “require the Railway Company to affix Wires to Existing Posts... and the Company may have a like Power to affix Wires to the Posts belonging from Time to Time to the Postmaster General...”¹⁴ These powers allowed the U.K. to create a comprehensive telegraphy network throughout the British Islands. Finally, the “Telegraph Act, 1870” extended “the Telegraphic Acts of 1868, 1869 to the Channel Islands and the Isle of Man,” which allowed for a fully-nationalized telegraphy network across the whole of the U.K., thereby qualifying them for ITU membership,¹⁵ joining as members to the 1872 Convention. Due to the new British paradigm wherein telegraphy was owned and operated through the British Post, the United Kingdom was represented at the 1872 Rome Convention by

ALAN E. CHAMBRE, Chef (ad interim) des Lignes Télégraphique— fils privés — Administration Postes-Télégraphes Britanniques.

¹¹ The Telegraph Act 1868, 31 & 32 Vict., c. 110.

¹² *Id.*

¹³ *Id.* at 3.

¹⁴ *Id.* at 9(4).

¹⁵ Williams *supra* at 186-205.

[ALAN E. CHAMBRE, Head (ad interim) of Telegraphic Lines
— private wires — British Administration of Telegraph-
Post.]¹⁶

While the British Isles struggled to gain entry to the ITU for over seven years, they already had in-roads to the ITU through their then-colony: India. The 1868 Convention accepted *l'Inde britannique* (British India), setting the currency exchange of one French franc to 76 pice, or roughly 1.20 rupee.¹⁷ At the conclusion of the Vienna Document, Lieutenant-Colonel G. Glover signed on behalf of British India.¹⁸ Lieutenant-Colonel Thomas George Glover was an officer in the military portion of the East India Company.¹⁹ He joined in 1844, and would go on to work in the Public Works Department of the Punjab Circle, Garrison Engineer at Lahore, Executive Engineer at Bhirtpore, among other positions, before finally taking on the position of Director-General of Telegraphs in 1867, before retiring from service in India in 1870.²⁰ He continued to work in British international telegraphy, and attended both the International Telegraph Convention at Vienna in 1868 and in Rome in 1871-72. He died suddenly on September 12, 1881, at Neuenahr, Prussia.²¹ While telegraphy entered into the international sphere through the medaled, titled, and crowned, by 1868 and 1872 countries' representatives within the ITU were those whose careers were either for a time, or all their lives, telegraphy.

¹⁶ What is surprising to learn is that Mr. Chambre would go on, by at least 1880, to become the Official Manager of the London Homeopathic Hospital. There, he served a long career in his role, lauded by gentlemen and Lords, namely Lord Ebury, who said, "he did not like to speak in too strong language of [Chambre's] services, but he always went away from the Hospital with the feeling that he ought to say 'Good-bye, Mr. Chambre, for Heaven's sake, take care of yourself.'" J. Brit. Homeopathic Soc'y., Vol 9 424-25, 1882.

¹⁷ Int'l. Telecomm. Union, *Conv. Télé. Int'l à Vienne*, 17 (1868).

¹⁸ *Id.* at 34.

¹⁹ *The Late Colonel Glover*, *The Electrician*, May- Nov., 1881, at 325.

²⁰ *Id.*

²¹ *Id.*

THE MORSE ORIGINS

The history of telecommunication can be traced back to specific moments in time when innovators altered the means by which mankind communicated over vast distances. Some of the most famous examples have either spoken to us, or allowed us to speak through them. Most recently, IBM's journey into AI introduced itself in 2011 with, "Hello, my name is Watson."²² In 1984, Steve Jobs introduced the Macintosh, revolutionizing modern home computing. The Mac entered into tech lore when it introduced itself to us with the classic phrase, "Hello, I'm Macintosh. It sure is great to get out of that bag."²³ Twelve years earlier, in '72, Dennis Ritchie created C Programming Language, one of computer programming's most ubiquitous languages, and, with it, Brian Kernighan taught us to code "Hello, World."²⁴ If we venture farther back to 1876, Alexander Graham Bell gave voice to the distance, by giving us the telephone, stating "Mr. Watson. Come here. I want to see you." However, the mantle of first pioneer in telecomm goes to Samuel F. B. Morse, who perfected telegraphy and created the standard telegraphic writing system: the Morse code. In 1844, twenty-one years before the ITU's first Convention, Morse conveyed over experimental wire from the U.S. Supreme Court chambers in Washington D.C. to the railway station in Baltimore, the first telegraphic phrase, "What hath God wrought?"²⁵

Like so many origin stories, Morse and telegraphy's are fraught with hardship. Samuel Morse was born April 27, 1791.²⁶ After attending Yale at fourteen, and graduating at nineteen, Morse sailed to England to attend the Royal Academy of Arts in

²² Lauren J. Young, *What has IBM Watson Been Up to Since Winning 'Jeopardy!' 5 Years Ago?*, Inverse, April 5, 2016.

²³ David Bunnell, *The Macintosh Speaks for Itself (Literally)...*, Cult of Mac, (May 1, 2010, 6:00 AM), <https://www.cultofmac.com/40440/the-macintosh-speaks-for-itself-literally/>.

²⁴ David Cardinal, *Dennis Ritchie, creator of C, bids 'goodbye, world'*, Extreme Tech, (November 2, 2011, 11:24 AM), <https://www.extremetech.com/computing/102835-dennis-ritchie-creator-of-c-bids-goodbye-world>.

²⁵ *First telegraphic message-- 24 May 1844*, Library of Congress, <https://www.loc.gov/item/mmorse000107>.

²⁶ *Samuel F.B. Morse Papers at the Library of Congress, 1793 to 1919*, Library of Congress, <https://www.loc.gov/collections/samuel-morse-papers/articles-and-essays/timeline/1791-1839/>.

London.²⁷ After returning, he was commissioned to paint a number of portraits, including President James Monroe's, and fatefully, the Marquis de Lafayette's.²⁸

Morse was a renowned portraitist and founded the National Academy of Design, where he served as president for 20 years.²⁹ The Marquis made his last visit to the U.S. in 1825, and Morse was commissioned to paint his portrait by the City of New York.³⁰ While working on the portrait, he received a letter via horse messenger, the fastest local conveyance of the time,³¹ which would change not only his life, but also reshape communication in the modern world. The letter said that his wife had fallen ill, and while preparing to return the next day, he received another letter informing him that she had died.³² He returned to Connecticut, only to find that by the time he arrived, his wife had been buried.³³ Grief-stricken and determined, Morse set out to ensure that information could freely travel over great distance in much shorter time. He set aside his career as a painter and took up the mantle of inventor, eventually discovering telegraphy through the invention of communication wires, the telegraph key,³⁴ and his eponymous code. Morse, an old man by the time telegraphy became an international affair, lived long enough to see the formation of the ITU and its first two Conventions, but the year the United Kingdom joining the International Telegraph Convention, in 1872, Samuel Morse passed away at 80 years old.

²⁷ *Id.*

²⁸ *Id.*

²⁹ Bill Federer, *Magnificent Breakthroughs of the Morse Family*, WND, (April 1, 2017, 9:23 PM), <http://www.wnd.com/2017/04/magnificent-breakthroughs-of-the-morse-family/>.

³⁰ Aaron Jones, *Lafayette, Morse, and the March of Progress*, Crystal Bridges Museum of American Art, (April 27, 2014), <https://crystalbridges.org/blog/lafayette-morse-march-progress/>.

³¹ *Id.*

³² *Id.*

³³ *Id.*

³⁴ In English, the device used to transmit telegrams is referred to as the "telegraph key." In French, however, the telegraph key is referred to as "l'appareil Morse," literally "the Morse device." To be clear, the Morse device is so named not because it transmits Morse code, but because it was Samuel Morse who invented it. (*Dictionnaire étymologique et historique de la langue française*. "morse 2" 510 (1996).

TRANSLATOR'S NOTES

Perhaps the greatest task in translating what is, for want of a better word, a period piece, is combatting the translation of words and phrases whose meanings have shifted in the past 150 years, or that have simply fallen out of use. Researching these was both the most difficult task, and the most rewarding.

The first such word is, perhaps unsurprisingly, *dépêche*. The denotative meaning of the word *dépêche* is a “dispatch,” coming from the infinitive *dépêcher*, “to dispatch,” from Old French *despeechier*, a combination of the root *des-* (to not) and the stem *em-peechier* “to hinder,” (though sharing the same root as “to impeach.”) Therefore, the word “dispatch” traces back to the original meaning “to not hinder.” Imagining Morse’s goal of the dissemination of information across great distances with alacrity, the idea of not hindering that information makes perfect sense. This is the grammatical origin of the word, but not the path the word took once it changed from *despeechier* to *dépêche*.

The verb form, *dépêcher*, was first used in the 13th century. It first meant “to deliver (in the sense of liberate or release) from something.”³⁵ It then went on to mean “to get something over with, to hasten,” and finally by the 17th century, “to send a message with haste.”³⁶ It was not until the 17th-century definition that *dépêche* broke away from its infinitive suffix, *-er*. The earliest definition of *dépêche* meant simply, “a letter or message,” then took on the more specific, “an official letter transmitted by rapid means.”³⁷ Finally, the 19th century altered the meaning once again to “*dépêche télégraphique*,” a telegraphic dispatch, which is translated into practical English as simply, “a telegram.” That is the form of the word I adopted throughout my translation.³⁸

After a telegram is transmitted from one telegraph office to the other, something has to be *done* with it. Generally speaking, telegrams are turned into letters that were then delivered to the addressee through the local postal service. However, Article 16 of the Convention states that, “Telegrams may be addressed either to a

³⁵ *Id.*

³⁶ *Id.*

³⁷ *Id.*

³⁸ *Id.*

domicile, *poste restante*, or *bureau télégraphique restant*.” The concept of *poste restante* is neither an antiquated or defunct service, but it is a phrase that is chiefly postal *and* European.

Translating *poste restante* creates a circular reasoning loop when your translation source says that *poste restante* is still called *poste restante* in the U.K. A literal translation gives us “remainder mail,” which describes its function a bit more. In the U.S. however, it is referred to as “general delivery.” General Delivery a service requested by the sender, who marks *poste restante* in Europe or General Delivery in the U.S. The post office receives the telegram and then holds onto it (remainder mail), rather than delivering it, with the expectation that the person to whom it is addressed is expected to pick it up. Similarly, if marked *bureau télégraphique restant*, the same applies, but to the telegraph office that received the message, rather than forwarding on to a post office first.

In the vein of what must be *done* with a telegram once it arrives at the telegraph office, it can be sent on through the post to the addressee. If that addressee is not home, without further instruction, the telegram may be delivered to any adult member of their family, to employees, or hosts. There is, however, the option for the sender to put into writing that the telegram must be *entre les mains* of the addressee solely. This is not a difficult translation, but it is perhaps my favorite direct translation (which here proves to be the best). The phrase translates to “between the hands.” If marked appropriately, the telegram must literally be delivered “between the hands” of the addressee.

The most era- and occupation-specific word also had the most historic evolution. It is also the one I believe requires the most explanation to truly understand. In Section VII on “Certain Special Telegrams,” the beginning of Article 23 states, “Each sender may *affranchir* the response that they request from their correspondent.”³⁹ The word I chose for translation into English was “frank,” as in the verb, “to frank,” rather than the phrase, “to be frank” (although these share similar roots). This word, while accurate, did not clear up the meaning for me, but editorializing within the translation was outside my purview. My translated phrase reads, “Each

³⁹ Int’l. Telecomm. Union, *Conv. Tél. Int’l de Paris*, 17 (1865) [Partial translation].

sender may frank the response that they request from their correspondent." Still confusing, but the etymology clears it up.

Traveling back in time farther than any other word, we find the 3rd century European tribal people, the Franks, who conquered northern Gaul around the 6th century.⁴⁰ The Franks were so named for the Old English *franc(a)*, meaning "freeman, or noble."⁴¹ As the tribal Franks developed their land, in time they became the French, from the same root, meaning the free people.⁴² Returning to the Convention, when we look up *affranchir* in the Dictionnaire Étymologique, we are told to "see *franc*."⁴³ The word *franc* comes from the 10th century *franc/frank*, a Latinized ethnic adjective of the masculine singular of *Francus*,⁴⁴ thereby sharing the Latin root with the Franks of yore. The time gap between the 3rd century tribe and 10th century adjective form shows that the "free" denotation derives from the people, and not the other way round. Later, in the 15th century, "*Francus*" would make another appearance on what we know as the French Franc. The Franc likely got its name from the original inscription on the coin: *Francorum rex*, "King of the Franks,"⁴⁵ i.e. King of the free people. In French, the adjective form meant, "having the condition of freedom, being born free," from which the meaning "exempt from certain servitudes" comes. The sense of "one who expresses themselves openly, who says what they think" ("to be frank") appears in the 12th century. This is also the time period for the French adjective "*franchise*," which follows the evolution of *franc*. *Franchise* has persisted into Modern French (the French of the Convention) as "exemption."⁴⁶ The example given is "*franchise postal*,"⁴⁷ or "exempt mail."

Therefore, *affranchir* ultimately means to make something free, liberated, or exempt. In English, we took this word and went back to the beginning and used, "to frank," which has since fallen

⁴⁰ *Frank (n)*, Online Etymology Dictionary, <https://www.etymonline.com/search?q=frank> (last visited Nov. 21, 2017).

⁴¹ *Id.*

⁴² *Id.*

⁴³ *Dictionnaire étymologique*, *supra* at 18.

⁴⁴ *Id.* at 338.

⁴⁵ *Id.*

⁴⁶ *Id.*

⁴⁷ *Id.*

into disuse, but is still the accurate translation of *affranchir*. Finally, the editorialized version of Section VII, Article 23 reads:

“Each sender may request a response from their correspondent, and make their correspondent’s response free by paying its cost.”

While there are a handful of other translation notes, none add as much to the historical and interpretive value as these four. Given the unimaginable leaps in technology and communication, the importance of this document is rooted in history, rather than applicability. Because of that, the history of its words is integral to the document’s place in the annals of telecommunication.

1865 INTERNATIONAL TELEGRAPH CONVENTION

HIS MAJESTY THE EMPEROR OF AUSTRIA, KING OF HUNGARY AND OF BOHEMIA, HIS ROYAL HIGHNESS THE GRAND-DUKE OF BADEN, HIS MAJESTY THE KING OF BAVARIA, HIS MAJESTY THE KING OF BELGIUM, HIS MAJESTY THE KING OF DENMARK, HER MAJESTY THE QUEEN OF SPAIN, HIS MAJESTY THE EMPEROR OF FRANCE, HIS MAJESTY THE KING OF GREECE, THE FREE CITY OF HAMBURG, HIS MAJESTY THE KING OF HANOVER, HIS MAJESTY THE KING OF ITALY, HIS MAJESTY THE KING OF THE NETHERLANDS, HIS MAJESTY THE KING OF PORTUGAL AND THE ALGARVES, HIS MAJESTY THE KING OF PRUSSIA, HIS MAJESTY THE EMPEROR OF ALL RUSSIA, HIS MAJESTY THE KING OF SAXONY, HIS MAJESTY THE KING OF SWEDEN AND NORWAY, THE SWISS CONFEDERATION, HIS MAJESTY THE EMPEROR OF THE OTTOMAN EMPIRE, HIS MAJESTY THE KING OF WURTEMBERG,

Equally moved by the desire to ensure the telegraphic correspondence exchanged between their respective States have the advantages of a simple and lowered tariff, to improve the current conditions of international telegraphy, and to establish a permanent agreement between their states, while conserving their freedom of action for any measures that do not interest all of the service,

Have resolved to finalize a convention to that effect, and have named their Plenipotentiaries, namely:

HIS MAJESTY THE EMPEROR OF AUSTRIA, KING OF HUNGARY AND OF BOHEMIA, THE PRINCE RICHARD DE METTERNICH-WINNEBURG, Duke of Portella, Count of Königswart, his Chamberlain and Personal Councilor, Grandee First Class of Spain, Grand Cross of the Imperial Austrian Order of Leopold, of the Order of Albert of Saxony, Grand Officer of the Belgian Order of Leopold, Knight of the Imperial Order of the Legion of Honor, etc. etc., his Special Ambassador to his Majesty the Emperor of France;

HIS ROYAL HIGHNESS THE GRAND-DUKE OF BADEN, HIS CURRENT PERSONAL COUNCILOR, THE BARON FERDINAND ALÉSINA

OF SCHWEIZER, Grand Cross of the Zaehringen Order of the Lion, Grand Officer of the Imperial Order of the Legion of Honor, etc. etc. etc., his Special Envoy and Minister Plenipotentiary near His Majesty the Emperor of France;

HIS MAJESTY THE KING OF BAVERIA, THE BARON AUGUSTE DE WENDLAND, his Chamberlain, Grand Commander of the Order of Virtue of the Crown, Grand-Cross of his Order of St.-Michael, Grand Officer of the Imperial Order of the Legion of Honor, etc. etc. etc., his Special Envoy and Minister Plenipotentiary near His Majesty the Emperor of France;

HIS MAJESTY THE KING OF BELGIUM, THE BARON EUGÈNE BEYENS, Officer of the Order of Leopold, Commander of the Imperial Order of the Legion of Honor, Commander of the Special Number of the Order of Charles II and of Isabella the Catholic of Spain, etc. etc. etc., his Special Envoy and Minister Plenipotentiary near His Majesty Emperor of France;

HIS MAJESTY THE KING OF DENMARK, THE COUNT LÉON DE MOLTKE-HVITFELDT, his Chamberlain, Commander of the Order of the Danebrog and decorated by the Gold Cross, Grand-Cross of the Orders of the Savior of Greece, of the Conception of Villa-Viçosa of Portugal, of Isabella the Catholic of Spain, Commander of the Order of the Tour and the Épée of Portugal, Officer of the Order of Léopold of Belgium, etc. etc. etc., his Special Envoy and Minister Plenipotentiary near His Majesty the Emperor of France.

HER MAJESTY THE QUEEN OF SPAIN, MR. ALEXANDRE MON, former President of the Council of Ministers and the Chamber of Deputies, Deputy of the Courts, Grand-Cross of the Royal Order of Charles III, of the Imperial Order of the Legion of Honor, etc. etc. etc., his Special Ambassador and Plenipotentiary near his Majesty the Emperor of France;

HIS MAJESTY THE EMPEROR OF FRANCE, MR. ÉDOUARD DROYN DE LHUYS, Senator of the Empire, Grand-Cross of the Imperial Order of the Legion of Honor, of the Orders of Saint-Étienne of Austria, of the Danebrog of Denmark, of Charles III of Spain, of the Savior of Greece, of the Saints Maurice and Lazarus of Italy, of the Netherlands Lion, of the Seraphim of Sweden; decorated by the Imperial Order of the Medjidie First Class, etc. etc. etc., his Minister of Foreign Affairs;

HIS MAJESTY THE KING OF GREECE, MR. PHOCION ROQUE, his Plenipotentiary, Officer of His Royal Order of the Savior and of the Imperial Order of the Legion of Honor, etc. etc. etc.;

THE FREE CITY OF HAMBOURG, MR. JEAN-HERMANN HERREN, Doctor of Law, Resident Minister of the Free Cities of Germany near His Majesty the Emperor of France;

HIS MAJESTY THE KING OF HANOVER, THE BARON CHARLES DE LINSINGEN, his present Legation Councilor, Officer of his Royal Order of the Guelphes, Commander of the Order of the Netherlands Lion, etc. etc. etc., his Special Envoy and Minister Plenipotentiary near His Majesty the Emperor of France;

HIS MAJESTY THE KING OF ITALY, KNIGHT CONSTANTIN NIGRA, Grand-Cross of his Order of the Saints Maurice and Lazarus, Grand Officer of the Imperial Order of the Legion of Honor, etc. etc. etc. his Special Envoy and Minister Plenipotentiary near His Majesty the Emperor of France;

HIS MAJESTY THE KING OF THE NETHERLANDS, Mr. Léonard-Antoine Lightenvelt, Grand-Cross of the Order of the Netherlands Lion, Grand officer of the Imperial order of the Legion of Honor, etc. etc. etc., his Special Envoy and Minister Plenipotentiary near His Majesty the Emperor of France;

HIS MAJESTY THE KING OF PORTUGAL AND THE ALGARVES, THE VISCOUNT DE PAÏVA, Peer of the Realm, Grand-Cross of the Order of the Conception of Villa-Viçosa, Grand Officer of the Imperial Order of the Legion of Honor, etc. etc. etc., his Special Envoy and Minister Plenipotentiary near His Majesty the Emperor of France;

HIS MAJESTY THE KING OF PRUSSIA, COUNT HENRI-LOUIS-ROBERT DE GOLTZ, Knight of the Royal Order of the Red Eagle First Class and of Saint John of Jerusalem, Grand-Cross of the Order of the White Eagle of Russia, of the Imperial Order of the Medjidie of Turkey, of the Royal Order of the Savior of Greece, etc. etc. etc., his Special and Plenipotentiary Ambassador near His Majesty the Emperor of France;

HIS MAJESTY THE EMPEROR OF ALL RUSSIA, BARON ANDRÉ DE BUDBERG, his private council, Grand-Cross of the Imperial Orders of Saint Elexandre Newsky and of the White Eagle, Knight of the Order of Saint Wladimir Second Class, Grand-Cross of the Imperial Order of Sainte Anne and of the Orders of the Legion

of Honor, of the Red Eagle of Prussia, of the Iron Crown of Prussia, of the Danebrog of Denmark, of the Guelphes of Hanover, etc. etc. etc., his Special and Plenipotentiary Ambassador near His Majesty the Emperor of France;

HIS MAJESTY THE KING OF SAXONY, BARON ALBIN-LÉO DE SEEBACH, his present Concillor and Chamberlain, Grand-Cross of his Royal Order of Merit, Grand Officer of the Imperial Order of the Legion of Honor, decorated by the Order of the Iron Crown of Austria First Class, by the Order of the Red Eagle of Prussia Second Class, Grand-Cross of the Order of the Ernestine Branch of Saxony, of the Orders of the White Eagle and of Sainte Anne of Russia; decorated by the Order of the Medjidie Second Class, etc. etc. etc., his Special Envoy and Minister Plenipotentiary near His Majesty the Emperor of France;

HIS MAJESTY THE KING OF SWEDEN AND OF NORWAY, MR. GEORGES-NICOLAS BARON ADELSWÄRD, Grand-Cross of the Order of the Polar Star, Grand Cross of the Order of Saint Olaf of Norway, Grand Officer of the Imperial Order of the Legion of Honor, etc. etc. etc., his Special Envoy and Minister Plenipotentiary near His Majesty the Emperor of France;

THE SWISS CONFEDERATION, MR. KERN, Special Envoy and Minister Plenipotentiary of the aforesaid Confederation near His Majesty the Emperor of France;

HIS MAJESTY THE EMPEROR OF THE OTTOMAN EMPIRE, ESSEİD MOUHAMMED DJÉMIL-PACHA, Muchir and Member of the Grand Council of the Empire, decorated by the Imperial Orders of the Medjidie First Class, of the Osmanieh Second Class, Grand Cordon of the Imperial Order of the Legion of Honor, of the Orders of Isabella the Catholic of Spain, of the Iron Crown of Austria, of the White Eagle of Russia, of Saints Maurice and Lazarus of Italy, of the Polar Star of Sweden, of Leopold of Belgium, of the Netherlands Lion, etc. etc. etc., his Special Ambassador and Plenipotentiary near Her Majesty the Queen of Spain;

HIS MAJESTY THE KING OF WURTEMBERG, THE BARON JEAN-AUGUSTE DE WAECHTER, his State Counselor and Chamberlain, Commander of his Order of the Crown, Grand-Cross of his Royal Order of Frederic, etc. etc. etc., his Special Envoy and Minister Plenipotentiary near his Majesty the Emperor of France.

Which, after having communicated their full powers, believe in due form, agreed to enforce upon Contracting State telegraphic correspondences the following agreement:

TITLE I: ON THE INTERNATIONAL NETWORK

Art. 1.

The High Contracting Parties undertake to assign special wires to the international telegraphic service, in number sufficient to insure a rapid transmission of telegrams.

The wires will be established in the best conditions known to the practice of the service.

The cities between which exchange of the correspondences are continuous or very active will be, successively and as much as possible, connected by direct wires of superior diameter, and the service will remain open for the work of the office intermediaries.

Art. 2.

Between the important cities of the Contracting States, the service will be as often as possible permanent, day and night, without any interruption.

Ordinary offices, once daily service is completed, are open to the public:

From April 1st to September 30th, from 7:00AM to 9:00PM,

From October 1st to March 31st, from 8:00AM to 9:00PM.

The offices' open hours for limited service are fixed by the respective administrations of the Contracting States.

The hour of all the offices of a State is the standard time of the capital of that State.

Art. 3.

The Morse apparatus (telegraph key) remains adopted provisionally for international wire service.

TITLE II: ON CORRESPONDENCE.

First Section: General Conditions.

Art. 4.

The High Contracting Parties acknowledge the rights of all people to correspond by means of international telegraphs.

Art. 5.

The High Contracting Parties commit to learn of all necessary arrangements in order to make and dispatch secret correspondences.

Art. 6.

The High Contracting Parties declare however not to accept, at a rate of international telegraphy service, any responsibility.

Second Section: On Submission.

Art. 7.

Telegrams are classified into three categories:

^{1st} State Telegrams: those that come from the Head of State, from Ministers, from Commanders-in-Chief of Ground or Naval Forces, and of Diplomatic Agents or Diplomats of the Contracting Governments.

Dispatches by Consular Agents who practice commerce are only considered as State dispatches when they deal with matters of service.

^{2nd} Service Telegrams: those which come from telegraphic administrations of the Contracting States, and which are relative, either to service of international telegraphy, or to objects of public interest determined by the entente of the aforementioned administrations.

^{3rd} Private Telegrams.

Art. 8.

State Telegrams are only accepted as such, that bear the seal or stamp of the authority that sent them.

The sender of a private telegram may always be required to establish the sincerity of the signature that the telegram bears.

Art. 9.

Each telegram may be written in any of the languages used in the territory of the Contracting States.

Each State remains free to appoint, among the languages used in their territory, those that they consider suitable for telegraphic correspondence.

Private telegrams may also be composed in code or secret missives, either in total or in part.

Private telegrams may also be composed in code or in secret missives, when they are exchanged between two Contracting States that admit that mode of correspondence, and in the conditions decided upon by the rules of service that are mentioned in Article 54 hereinafter.

The reservation mentioned in the above paragraph does not to apply to transit telegrams.

Telegrams in ordinary language cannot contain combinations of words, compositions, nor uncommon abbreviations.

Art. 10.

The official record of the telegram must be legible, in characters that have their equivalent in the regulatory table of telegraphic signs in use in the country where the telegram was presented.

The text must be preceded by the address and followed by the signature.

The address must carry all the necessary indications to ensure the delivery of the telegram to its destination.

Each writing between the lines, return-to-sender marking, crossing-out, or alteration must be approved by the signature on the telegram or its representative.

Third Section: On Transmission.

Art. 11.

The transmission of telegrams have place in the following order:

- | | |
|-----------------|--------------------|
| 1 st | State Telegrams; |
| 2 nd | Service Telegrams; |
| 3 rd | Private Telegrams. |

A telegram begun may only be interrupted in order to make a place for a communication of a superior rank in case of absolute emergency.

Telegrams of the same rank are transmitted by the departure office in the order of their submission, and by intermediary offices in the order of their reception.

Between offices of direct relation, telegrams of the same rank are transmitted in alternating order.

Nevertheless, that rule may be contravened in the interest of speed of transmission on lines whose work is continuous or which lead to special telegraph keys.

Art. 12.

Offices of which the service is not permanent may not close before they have sent all their international telegrams to a permanent office.

These telegrams are immediately exchanged to their reception tower between the permanent offices of different States.

Art. 13.

Each Government remains adjudicator vis-à-vis the sender, the direction it agrees to give telegrams, while in ordinary service in case of interruption or blockage of habitual routes.

Art. 14.

As soon as an interruption in telegraphic communication occurs in the course of a telegram's transmission, from the moment when the interruption occurs, immediately dispatch the telegram by the mail, or by a means a faster transportation, if available. — Its address, following the circumstances, will be to the first telegraph office able to forward the telegraph, either a destination office, or to the same recipient. As soon as the communication is reestablished, the telegram is sent once again by telegraphic means, unless it has otherwise been previously been marked as received.

Art. 15.

If there is enough time, a sender may, in justifying its quality, stop the transmission of a telegram they have sent.

Fourth Section: On Delivery to Destination

Art. 16.

Telegraphic dispatches may be addressed to either a domicile, to *poste restante*, or telegraphic office *restant*.

They are delivered or dispatched to their destination in the order of their reception.

Telegrams addressed to domiciles or *poste restante* in the locality of the telegraphic office serves are immediately carried to their address.

Telegrams addressed to domiciles or *poste restante* outside the locality served, following the demand of the sender, are sent immediately to their destinations by post, or by a faster means, if the administration of the destination office are capable.

Art. 17.

Each Contracting State reserves to structure itself, as much as possible for localities not served by telegraph, a faster transport service than the post; and each State works with the others to let every sender be in a position to profit, by their correspondence, from the dispositions held and notified in this regard, by one of any of the other States.

Art. 18.

When a telegram is sent to a domicile and the recipient is absent, it may be delivered to adult members of their family, to their employees, tenants or hosts, unless the recipient is designated in writing, a special appointment, or that the sender did not demand that the delivery be placed in the hands of a single recipient.

When the telegram is addressed *bureau restant*, it is only delivered to the recipient or their representative.

If the telegram cannot be delivered to the destination, notice is left at the domicile of the recipient, and the telegram is returned to the office, to be delivered upon demand.

If the telegram is not claimed within six weeks, it is destroyed.
The same rule applies to telegrams addressed *bureau restant*.

Fifth Section: On Inspection.

Art. 19.

The High Contracting Parties reserve the ability to stop the transmission of all private telegrams that appear dangerous to State security, or that could be against the laws of the country, public order or good customs, at the charge of immediately notifying the sender.

This inspection is exercised by the most distant or intermediary telegraph offices, or if necessary to the Central Administration, who decide without appeal.

Art. 20.

Each Government also reserves the right to suspend international telegraphic service for an indeterminate time, if they judge it necessary, either in a general manner, or only on certain lines and for certain types of correspondence, at the charge to immediately advice each of the other Contracting Governments.

Sixth Section: On Archives.

Art. 21.

Originals and copies of telegrams, groups of signals or analogous pieces are conserved in the archives of offices for at least one year, from their date, with all the necessary precautions to keep their contents secret.

After that date, they may be destroyed.

Art. 22.

Originals and the copies of telegrams may only be communicated to their sender or their recipient after observing their identity.

Seventh Section: On Certain Special Telegrams.

Art. 23.

Each sender may frank the response that they request from their correspondent.

Each may request the response to an ordinary point in the territory of the Contracting States.

For lack of indication given in the same telegram, or by a later telegram received in due course, the response is transmitted to the office of origin, to be delivered to the destination, care of that office.

When the response is not presented in the eight days following the date of the first telegram, the destination office informs the sender by telegram, which serves as a response. Each response presented after this period is considered and treated as a new telegram.

Art. 24.

The sender of each telegram has the ability to send it *registered*.

When a telegram is sent registered, the office of the destination transmits by telegraph to the same sender, the whole reproduction of the copy sent to the addressee, followed by the double indication of the precise hour of the delivery and of the person between whose hands the delivery took place.

If the delivery could not be made, the double indication is replaced by a notice of the circumstances that obstructed the delivery and the necessary information in order for the sender to forward their telegram, if necessary.

The transmission of the *return telegram* is performed by priority of the other telegrams of the same rank.

The sender of a registered telegram address the return telegram to a point somewhere within the territories of the Contracting States by furnishing the necessary indications, as in the material on paid responses.

Art. 25.

The registration is obligatory for telegrams composed in numbers or in secret letters.

Art. 26.

When a telegram carries the phrase *forward*, without other indication, the office of the destination, after presenting it to the indicated address, forwards it immediately, when necessary, to the new address indicated that is designated as the domicile of the addressee; however, it is only bound to retransmit the telegram within the limits of the State to which it belongs, and the telegram is treated like an interior telegram.

If no indication is furnished, the telegram is kept for safekeeping. If the telegram is resent, the second office does not find the addressee at the new address, the telegram is held by that office.

If the *follow* marking is accompanied by successive addresses, the telegram is successively transmitted to each destination indicated, until the last one, if necessary, and the last office conforms to the arrangement of the preceding paragraph.

Each person may demand, by furnishing the necessary justifications, that the telegrams which arrive to a telegraphic office, for it to be delivered in the area of distribution for that office, they may resend to the address that they had indicated or in the conditions of the preceding paragraphs.

Art. 27.

Telegrams may be addressed:

To multiple addressees in the different localities;

To multiple addressees in the same locality;

Or to the same addressee in the different localities, or to many domiciles in the same locality.

In the first two cases, each copy of the telegram must only carry its own address, unless the sender asked for the contrary.

Telegrams sent to multiple States must be deposited in as many of the original copy as there are different States.

Art. 28.

In application of the preceding articles, one will combine the facilities given to the public for telegrams with paid responses, registered telegrams, and multiple telegrams.

Art. 29.

The High Contracting Parties commit to take measures that comprise delivery to destination of delivered telegrams, by sea, by the established semaphore intermediary, or as established on the coastline of any of the States who will take part in the present Convention.

TITLE III: ON TAXES.

First Section: General Conditions.

Art. 30.

The High Contracting Parties declare to take on, for the formation of international tariffs, the tenets hereinafter:

The applicable tax on all correspondences exchanged, by the same line, between the offices of any two Contracting States will be uniform. However, the same State may be subdivided, for the application of a uniform tax, into two large territorial divisions at most. The Contracting States reserve incidentally every freedom of action to the respect of their possessions or of their colonies situated outside of Europe.

The minimum of the tax applies itself to the telegram of which the length does not overrun twenty words. The tax applicable to telegrams of twenty words increases in half by indivisible series of ten words above twenty.

The franc is the monetary unit used for the composition of international tariffs.

The tariffs for correspondences exchanged between any two points of the Contracting States must be composed in such a way that the tax on the telegram of twenty words is always in multiple of half-francs.

It will be received for a franc :

In Austria, 40 kreutzer, (Austrian value);

In Spain, 0.40 crown;

In Greece, 1.11 drachma;

In Hanover, Prussia, Saxony, 8 Silbergroschen;

In the Netherlands, 50 cents;

In Portugal, 192 reais;

In Russia, 25 kopecks;
In Sweden, 72 öre;
In Norway, 22 skillings;

Art. 31.

The rate of the tax is established from State to State, in concert between the most distant Governments and the intermediary Governments.

The tariff immediately applicable to the correspondence exchanged between the Contracting States is fixed, conforming to the tables annexed to the present Convention. The taxes inscribed in the tables may always, and at any time, be reduced by a joint agreement between this and that of the interested Governments; but each general or specific modification will only be binding for at least a month after its announcement.

Second Section: On the Application of Taxes.

Art. 32.

Everything that the sender writes in the official record their telegram in order to be transmitted, goes into the calculation of the tax, except that said in paragraph 7 of the following article.

Art. 32.

The maximum length of a word is fixed at seven syllables; the excess counts as a word.

The expressions joined by a hyphen are counted for the number of words that serve to form them.

Words separated by an apostrophe are counted as isolated words.

The proper names of cities and of persons, names of sites, places, boulevards, etc.... the titles, the Christian names, aristocratic particles and qualifications, are counted for the number of words used to express them.

Numbers written in code are counted for as many words that they contain at a time of five figures, plus a word for the excess.

Each isolated character, letter or number, is counted as a word; the same applies for underlining.

The marks that the machine expresses by a single mark (punctuation marks, hyphens, apostrophes, quotation marks, parentheses, indentation) are not counted.

Always counted for a character: periods, commas, and division lines that enter into the formation of numbers.

Art. 34.

The count of words is established in the following manner for telegrams in code or in secret letters:

All characters, numbers, letters or signs employed in the coded text are added up; the total, divided by five, given for quotient the number of words they represent; the excess is counted for one word.

One adds there, in order to obtain the total number of words for the telegram, the words in the ordinary language of the address, of the signature, and of the text, as the case may be. Their count is made according to the rules of the preceding article.

Art. 35.

The name of the office of departure, the date, the hour and minute of dispatch are transmitted from the office to the addressee.

Art. 36.

Each corrective or complete telegram, and generally each communication exchanged between a telegraphic office at the time of a telegram's transmission or in the course of transmission, is taxed conforming to the rules of the present Convention, unless that communication was made necessary by an error of service.

Art. 37.

The tax is calculated according to the least costly means between the point of departure of the telegram and its point of destination.

The High Contracting Parties commit to avoid, whenever it is possible, variations of tax that could result in interruptions of service of underwater conductors.

Third Sections: On Special Taxes.

Art. 38.

The tax for registration is equal to that of the telegram.

Art. 39.

The tax for paid responses and return telegrams, to direct to a point other than the place of origin of the first telegram, is calculated according to the tariff applicable between the point of transmission of the response or of the return telegram and its point of destination.

Art. 40.

Telegrams addressed to multiple addressees or to the same addressee, in localities served by different offices, are taxed as separate telegrams.

Telegrams addressed, in the same locality, to multiple addressees, or to the same addressee at multiple domiciles, with or without resending by the post, are taxed as a single telegram; but it is collected, as a fee of copy, apart from the fees of the post, as the case may be, as much as a half franc at a time for each destination there is, minus one.

Art. 41.

For each copy delivered conforming with Article 22, a fixed fee of a half franc per copy is collected.

Art. 42.

Registered telegrams, sent by post or deposited into general delivery, are franked, like registered letters, by the telegraphic office of their arrival.

The office of origin collects the following supplemental taxes:

A half-franc per telegram deposited *general delivery* in the locality served, or sent by post, in the limits of the State that makes the dispatch;

One franc per telegram to be sent, outside of those limits, in the territory of the Contracting States;

Two and a half francs per telegram to be sent beyond that.

Non-registered telegrams are sent like ordinary letters by the telegraphic office of their arrival. The mailing costs are paid off, if there are any, by the addressee, no additional tax being collected by the office of origin.

Art. 43.

The tax on telegrams to be exchanged with ships at sea, by a semaphore intermediary, to be fixed conforming with the general rules of the present Convention, except, for those Contracting States that will have organized this mode of correspondence, the right to determine, as it will belong to them, the tax pertaining to the transmission between semaphores and ships.

Fourth Section: On Collecting.

Art. 44.

The collecting of taxes takes place at departure.

However, these are collected upon arrival to the addressee:

1st The tax on expedited telegrams, on the sea, by semaphore intermediaries;

2nd The additional tax on telegrams marked *forward*;

3rd The additional tax on paid responses of which the extent exceeds the franked length;

4th The transport costs, beyond telegraphic offices, by a means faster than the post, in the States where such a service is organized.

However, the sender of a registered telegram may frank its transport, by way of depositing a sum determined by the office of origin barring later administration. Return telegrams discloses the amount of costs spent.

In each case where it is necessary to have the tax collected at arrival, the telegram is not delivered to the addressee in exchange for the payment of the tax that is due.

Fifth Section: On Tax Exemption.

Art. 45.

Telegrams relative to the service of international telegraphs in the Contracting States are transmitted tax-free throughout the network of said States.

Sixth Section: On Tax Deduction.

Art. 46.

The tax of each telegram of which the telegraphic transmission was not effectuated is returned to the sender by the State that collected it, without recourse against the other States, if necessary.

Art. 47.

As a result of a notable delay or of grave errors in the transmission, if the telegram cannot clearly fulfill its purpose, unless the delay or error is either attributable to a State or a private company who have not accepted the provision of the present Convention, the integral tax of each registered telegram, if necessary, is reimbursed to the sender by the State that collected it.

Art. 48.

Each claim must be formed, subject to decline, within three months of the collection.

This period is carried out to six months for correspondences exchanged with countries situated outside of Europe.

TITLE IV: ON INTERNATIONAL ACCOUNTANCY.

Art. 49.

The High Contracting Parties must reciprocally tally the taxes collected by each other.

Taxes pertaining to copy and transport fees beyond the lines are reserved to the State that delivered the copies or effectuated the transport.

Each State credits the bordering State for the amount of taxes of each telegram that they transmitted, calculated from the border of the two States to the destination.

These taxes may be regulated by a simple agreement, from the number of telegrams that have crossed that border, leaving out the number of words and incidental fees. In that case, the parts of the bordering country and of each of the following States, if necessary, are determined by the means established by both parties.

Art. 50.

Taxes taken in advance for paid responses and registered telegrams are returned, between the various States, conforming to the provisions of the preceding article, the responses and the telegrams being handled, in the accounts, like some ordinary telegrams that would have been sent by the State who collected.

As soon as the transmission did not occur, the tax is given to the office that collected it, except for the sending fees.

Art. 51.

As soon as a telegram, whatever it is, was transmitted by a different means than that which served as the basis for the tax, the difference in tax is supported by the office that rerouted the telegram.

Art. 52.

The reciprocal regulation of the accounts takes place at the end of each month.

The detailed account and the administration of the balance is done at the end of each quarter.

Art. 53.

The resulting balance of the administration is paid in the common currency of the State to which the balance is established.

TITLE V: GENERAL PROVISIONS.

First Section: On Supplementary Dispositions.

Art. 54.

The provisions of the present Convention are completed, in that they concern the detailed rules of international service, by a common agreement that will be a statement of agreement between the telegraphic administrations of the Contracting States.

The provisions of this regulation will enter into power in the same time as the present Convention; the provisions may be, at any time, modified by a simple agreement by the aforesaid administrations.

Art. 55.

The administration of the State where, by virtue of article 56, below, the final conference will take place, will be charged with the relative measures of execution for the modifications to the regulations, to be carried by a common accord.

All the demands for modifications will be addressed at that administration, which consults all others, and, after having obtained their unanimous assent, will promulgate the adopted changes, in fixing the date of their application.

Second Section: On Conferences and Reciprocal Communications.

Art. 56.

The present Convention will be subjected to periodic revisions, where all the Powers who have taken part will be represented.

To that effect, these conferences will take place successively in the capital of each of the Contracting States, between the delegates of the aforementioned States.

The first reunion will take place in 1868, at Vienna.

Art. 57.

The High Contracting Parties, in order to assure, by an exchange of regular communications, the good administration of their

common service, endeavor to transmit reciprocally all the relative documents to their interior administration and to convey each improvement that they may buy or introduce.

Each one of these will be sent directly to all the others:

1st By telegraph:

The immediately notification of interruptions which may occur in their territory, or on the lines of States and private companies who will serve as intermediaries, for their connection with each of the Contracting States;

2nd By post:

The notification of all the relative measures to the opening of new lines, to the suppression of existing lines, to the openings, suppressions, and modifications of service by the offices included in the territory or in the routes of the telegraphic lines of the States and companies designated in the preceding paragraph;

At the start of each year, a statistical table of the movement of telegrams on their network, during the past year, and a map of that network, drawn up and ended on 31 December of that year;

Finally, their memorandums and service instructions, as they are published.

ART. 58.

An *Official Map of Telegraphic Relations* will be drawn up and published by the French Administration and subjected to periodic revisions.

Third Section: On Stocks.

Art. 59.

The High Contracting Parties respectively reserve the right to take separately, between one another, some particular arrangement of any nature, on all points of service that do not interest the majority of the States, namely :

On the formation of taxes;

On the adoption of devices or special vocabularies, between the points and in some defined cases;

On the application of a system of telegraph stamps;

On the collection of taxes on arrival;

On the delivery service of telegrams to their destination;

On the extension of right to make telegrams of service that concern meteorology, and all other objects of public interest, tax exempt.

Fourth Section: On Membership.

Art. 60.

The States that do not take part in the present Convention will be allowed to become a member upon their request.

That membership will be notified by diplomatic means to those Contracting States present at the last conference, by that State, to all other States.

The State will take, by right, accession to all the clauses and admission to all the advantages stipulated by the present Convention.

Art. 61.

The High Contracting Parties commit to impose, as far as possible, the rules of the present Convention upon concessionaire companies of land-based or underwater telegraphic lines, and to negotiate a reciprocal reduction of taxes with the existing companies, if necessary.

Not included, in any case, in the international tax:

1st The telegraphic offices of the States and of private companies who will not have accepted the uniform regulatory dispositions and obligations of the present Conventions;

2nd The telegraphic offices for the companies of railways or other private exploitations, situated in the continental territories of the Contracting States or adherents, and those for whom there would be a supplemental tax.

Fifth Section: On the Execution.

Art. 62.

The present Convention will be carried out from 1st January 1866, and remain in force until an undetermined time and until the end of one year from the day when the denunciation takes place.

Art. 63.

The present Convention will be ratified, and the ratifications of it will be exchanged in Paris with the least delay possible.

In witness whereof, the respective Plenipotentiaries have signed the Convention and affixed the seal of their arms.

Completed in Paris, 17th May 1865.

(L.S.) Signed : METTERNICH.

(L.S.) SCHWEIZER.

(L.S.) WENDLAND.

(L.S.) BEYENS.

(L.S.) MOLTKE-HVITFELDT.

(L.S.) MON.

(L.S.) DROUYN DE LHUYS.

(L.S.) PHOCION ROQUE.

(L.S.) HEEREN.

(L.S.) LINSINGEN.

(L.S.) NIGRA.

(L.S.) LIGHTENVELT.

(L.S.) PAÏVA.

(L.S.) GOLTZ.

(L.S.) BUDBERG.

(L.S.) SEEBACH.

(L.S.) ADELWARD.

(L.S.) KERN.

(L.S.) DJÉMIL.

(L.S.) WAECHTER.

ANNEXES OF THE INTERNATIONAL CONVENTION SIGNED IN PARIS 17TH MAY 1865

TABLES ON THE FIXED TAXES TO BE USED FOR THE FORMATION OF
INTERNATIONAL TAXES, IN EXECUTION OF ARTICLE 31 OF THE
CONVENTION SIGNED AT PARIS ON TODAY'S DATE

A. Terminal Taxes

(The terminal tax is that which returns to each State for the correspondences coming from or destined for its offices.)

DESIGNATION OF STATES	INDICATION OF CORRESPONDENCES	TAX	OBSERVATIONS
AUSTRIA	For the correspondences exchanged with each of the Contracting States...	3 ^f 00 ^c	For each telegram that traverses the State of the Austro-Germanic Union, that tax is shared with its States.
BADE	For the correspondences that traverse the States of the Austro-Germanic Union...	3 00	<i>Idem.</i>
	For all others...	1 00	
BAVARIA	For the correspondences that traverse the State of the Austro-Germanic Union...	3 00	<i>Idem.</i>
	For all others...	1 00	
BELGIUM	For the correspondences exchanged with Denmark, Norway, Russia, and Sweden...	1 50	
	For all others...	1 00	

DENMARK	For all of its correspondences...	1 ^f 50 ^c	
SPAIN	For the correspondences exchanged with Denmark, Italy, Norway, Sweden, and the States comprising the Austro Germanic Union, with the except of Prussia...	3 00	
	For all others...	2 50	
FRANCE	For the correspondences exchanged with Denmark, Greece, Norway, Russia, Sweden, Turkey, and the States comprising the Austro-Germanic Union...	3 00	
	For all the others, comprising those exchanged with Holland and Wurtemberg...	2 00	
GREECE	For all of its correspondences...	1 00	
HANOVER	For all of its correspondences...	3 00	Common tax with the other States of the Union
ITALY	For all its correspondences...	3 00	
NORWAY	For all its correspondences...	2 00	
HOLLAND	For the correspondences exchanged with Italy and Switzerland by Belgium and France...	0 50	
	For all others...	1 00	
PORTUGAL	For all its correspondences ...	1 00	
PRUSSIA	For the correspondences that traverse the State of the Union...	3 00	<i>Idem.</i>

RUSSIA	For the correspondences exchanged with each of the Contracting States, with the exception of Turkey...	5 00	The tax is raised to 8 francs for the stations of the Caucasus.
SAXONY	For all its correspondences...	3 00	Common tax with the other States of the Union
SWEDEN	For all its correspondences...	3 00	
SWITZERLAND	For all its correspondences...	1 00	
TURKEY	For the correspondences exchanged with each of the Contracting States, with the exception of Russia...	4 00	Principalities of Serbia and Moldo-Wallachia not included.
WURTEMBERG AND HOHENZOLLERS	For the correspondences that traverse the States of the Union...	3 00	Common tax with the other States of the Union.
	For the correspondences exchanged with France, Italy, and Switzerland...	1 00	The tax of 1 franc, for France, is shared with the other States of the Union.

B. Transit Taxes.

(THE TRANSIT TAX IS ONE WHICH RETURNS TO EACH STATE FOR THE CORRESPONDENCES THAT TRAVERSE ITS TERRITORY.)

DESIGNATION OF STATES	INDICATION OF CORRESPONDENCES	TAX	OBSERVATIONS
AUSTRIA	For all correspondences and in all directions...	3 ^f 00 ^c	For each telegram that traverses the State of the Austro-Germanic Union, that tax is shared with its States.

BADE	For the correspondences that traverse the States of the Austro-Germanic Union, in all directions...	3 00	<i>Idem.</i>
	For all others...	1 00	
BAVARIA	For the correspondences that traverse the State of the Austro-Germanic Union, in all directions...	3 00	<i>Idem.</i>
	For all others...	1 00	
BELGIUM	For the correspondences exchanged firstly by France between Holland, and secondly Italy and Switzerland...	0 50	
	For all other correspondences, in all directions...	1 00	
DENMARK	For all of its correspondences and in all directions (underwater lines included)...	1 50	
SPAIN	For the correspondences originated from or the destination of Denmark, Italy, Norway, Switzerland, and the States comprising the Austro Germanic Union, with the except of Prussia...	3 00	
	For the correspondences exchanged between France and Portugal...	2 50	

FRANCE	For the correspondences exchanged:		The transit of Corsica is fixed at 1 franc.
	1 st Between Italy initially, then Spain and Portugal after; 2 nd Between Holland initially, then by each of the States, by the borders of Germany, Italy, and Switzerland...	2 00	
	For all the other correspondences, in all directions...	3 00	
GREECE	#	Does not transit.
HANOVER	For all of its correspondences and in all directions...	3 00	Common tax with the other States of the Union.
ITALY	For all the correspondences exchanged between the same borders and the Ottoman border (underwater lines included)...	3 00	
NORWAY	2 00	Does not transit.
HOLLAND	For all correspondences, in all directions...	3 00	Common tax with the other States of the Union.
PORTUGAL	#	Does not transit.
PRUSSIA	For the correspondences that traverse the States of the Union...		Common tax with the other States of the Union.
	For all the other correspondences, in all directions	3 00	
RUSSIA	For all correspondences, in all directions, with the exception of Turkey...	5 00	The Convention only applies to Europe. It does not mention transit across Asia.

SAXONY	For all correspondences, in all directions...	3 00	Common tax with the other States of the Union
SWEDEN	For all correspondences, in all directions (underwater lines included)...	3 00	
SWITZERLAND	For all correspondences, in all directions...	1 00	
TURKEY	For correspondences originating or destined for Greece...	4 00	Principalities of Serbia and Moldo-Wallachia not included.
WURTEMBERG AND HOHENZOLLERS	For all correspondences, in all directions...	3 00	Common tax with the other States of the Union.

Done in Paris, 17th May Two-Thousand and Sixty-Nine

Signed: METTERNICH.

SCHWEIZER.

WENDLAND.

BEYENS.

MOLTKE-HVITFELDT.

MON.

DROUYN DE LHUYS.

PHOCION ROQUE.

HEEREN.

LINSINGEN.

NIGRA.

LIGHTENVELT.

PAÏVA.

GOLTZ.

BUDBERG.

SEEBACH.

ADELWARD.

KERN.

DJÉMIL.

WAECHTER.

II. REGULATION OF INTERNATIONAL SERVICE.

*Destined to be completed with the dispositions of the
Telegraphic Convention of Paris*

I

The wires especially assigned for international service receive a particular notation on the *Official Map*, drawn up conforming with Article 58 of the Convention.

These wires are designated under the name: *international wire from. . . . to. . . .*

They only serve, as often as possible, for relations between the two cities designated as their extreme points.

They may be detoured, from that special purpose in case of derangement of lines, but they must be remanded as soon as the derangement has ceased.

These wires are placed under the collective safeguard of the States of whose territory the wire crosses; the respective administrations plan, for each of them, the placements that make it possible to make the best of it.

The heads of service of the districts neighboring the borders speak with one another directly in order to assure, as far as they are concerned, the execution of these measures.

II

The following notations are adopted in the international taxes in order for the telegraphic offices to refer:

N. Office with permanent service (both day and night).

N. Office with day service open until midnight.

2

c. Office with service for the entire day.

l. Office with limited service (that is to say, open during a number of hours lower than the offices with service for the entire day.

- B. Office open during swimming season.
H. Office open only during Winter
L/BC. Office open with complete service during swimming season and limited during the rest of the year.
L/HC. Office open with complete service during winter and limited during the rest of the year.
E. Office open only during the sojourn of the Court.
F. Railway station open to the correspondence of private individuals.
P. Office owned by a private company.
*. Office to be opened in the near future.
S. Synonymous.
- These notations may be combined with the preceding.

III

The telegraphic administrations employ, as often as possible, the telegraph keys marking colored dashes.

IV

Each office that receives by an international wire a telegram presented as a telegram of the State or service forwards it as such.

Telegrams by Consular Agents who apply to Paragraph 3 of Article 7 of the Convention are not refused by the departure office, and instead their signal is immediately sent to the central administration.

Dispatches emanating from multiple offices, and related to transmission incidents, circulate on the international network like telegrams of service.

V

Each State designates, if it judges it reasonable, the responsible functionaries or magistrates in each city to certify the signature of senders. In that case, each of the offices of that State control the fairness of the authentications that they are presented, and they transmit, after the signature, in the following form:

Signature certified by (qualified by the functionary or magistrate).

That mention enters in the summary of the taxed words.

NUMBERS.

Figure 1 is a 10x10 grid representing the distribution of the number of non-zero elements in the product of two vectors. The rows are labeled 1 to 0 (top to bottom) and the columns are labeled 0 to 9 (left to right). The grid shows the number of pairs of vectors that result in a product with a specific number of non-zero elements. For example, the top row (1) has 10 non-zero elements in the product, and the bottom row (0) has 0 non-zero elements. The distribution is symmetric about the diagonal.

One may also use, to express numbers, the following signs, but only in compulsory practice:

Figure 1 shows a 2x4 grid of squares. The top row consists of a black square, two white squares, and a black square. The bottom row consists of a black square, a black square, a white square, and a white square. The top-left square is labeled '1' and the top-right square is labeled '2'.

3	■	■	■	■	■	■
4	■	■	■	■	■	■
5	■	■	■	■	■	■
6	■	■	■	■	■	■
7	■	■	■	■	■	■
8	■	■	■	■	■	■
9	■	■	■	■	■	■
0	■	■	■	■	■	■

PUNCTUATION.

Period	[.]	■	■	■	■	■
Semi-colon	[:]	■	■	■	■	■
Comma	[,]	■	■	■	■	■
Colon	[:]	■	■	■	■	■
Question mark, or request for repetition of a transmission not understood	[?]	■	■	■	■	■
Exclamation mark	[!]	■	■	■	■	■
Apostrophe	[']	■	■	■	■	■
Indentation	[]	■	■	■	■	■
Hyphen	[-]	■	■	■	■	■
Parentheses (Before and after the words between)	()	■	■	■	■	■
Quotation marks	[“ ”]	■	■	■	■	■
Underline (Before and after the word or the member of a phrase)	[]	■	■	■	■	■
Signed (Separating the text from the signature)	[]	■	■	■	■	■

The office called must respond immediately by giving its *code*, and, if it prevents itself from receiving, the *Wait* signal, followed by a number indicating the probable duration of the wait. If the probable duration exceeds ten minutes, the wait must be justifiable.

When the office that had just called has received, without other signal, the indication of the responding office, it telegraphs, before everything, the signal indicating *the nature* of the telegram, namely:

- S. for a Telegram of State;
- A. for a Telegram of Service;
- P. for a private telegram.

At this signal, the correspondent responds by the *Invitation to Transmit*. The office that transmit gives, in the order below, all the indications of constituting the preamble of the telegram:

- a. — Office of destination¹;
- b. — Office of origin, preceded by the word *from* (example: Paris from Bruxelles);
- c. — Number of the telegram;
- d. — Nature of the telegram (of the manner indicated above), when it is a Telegram of State or Service;
- e. — Number of words. (In coded telegrams, one indicates: 1st the number of words that serve as the base of the tax, and 2nd, if necessary, the number of words written in ordinary language);
- f. — Depot of the telegram (by three numbers, date, hour, and minute, separated by commas, with indication *m.* or *s.* [morning or evening]);
- g. — Path to follow (if necessary);
- h. — Other *potential indications*.

Any office called may only refuse to receive telegrams by announcement, when it is the destination.

One must not refuse, nor delay a telegram, if the indications of service are not regular: it must receive the telegram and then ask for regularization from the office of origin, via a Telegram of Service.

Following the preamble specified above, one successively telegraphs the address, the text, and the signature of the telegram, and

¹ When the telegram is destined for a locality not under the purview of a telegraphic office, the preamble indicates, not the residence of the addressee, but the telegraphic office under whose care the telegram must be forwarded to the destination or mailed.

it is ended by the signal of *End of Transmission*; after that is received, the correspondent give the signal *Understood*, or, if necessary, *Not Understood* (the question mark).

If the employee who transmits notices that they have made a mistake, they must interrupt by the *Error* signal, repeat the last most properly transmitted, and continue, starting from there, the fixed transmission.

Likewise, the receiving employee, if they notice a word that is not managed to be understood, must interrupt their correspondence by the same signal, and repeat the last understood word, and in doing that follow with question mark. The correspondent responds with the transmission beginning from that word, making an effort to make their signals as clear as possible.

Immediately after the telegram is transmitted, the employee who received it compares the number of words transmitted to the number sent, and, if there is a difference, signals it to their correspondent. If the latter simply erred in announcing the number of words, they respond *successful*; if not, they repeat the first letter of each word up to the omitted passage, which they reestablish.

Apart from the cases determined in concert by the separated Administrations, it is not permitted to use any abbreviation in transmitting the text of a telegram, or to modify the text in any way whatsoever. Each telegram must be transmitted such that the sender wrote it in that moment.

Each telegram produces a partial non-taxed collation, which must not be confused with the integral collation pertaining to registered telegrams.

The partial collation is made at the end of the transmission of the telegram.

After having verified the word count, the employee who has received immediately repeats the proper names, the numbers (with the exception of the year), the uncertain words or the few known and those that contain the principal meaning of the telegram.

This repetition is obligatory for all telegrams. The employee who received may, incidentally, extend the collation and repeat the telegram completely, if they judge it essential to cover their responsibility. Likewise, the employee who has transmitted may ask for an integral repetition of the telegram.

In the repetition of numbers followed by fractions, or of fractions of which the numerator is formed by two numbers of more, one must repeat, in all letters, the numerator of the fraction, in order to avoid any confusion. In this way, for $1\frac{1}{16}$, it is necessary to repeat 1 one/16, so that one does not read it as $\frac{61}{16}$; for $\frac{13}{4}$, it is necessary to repeat thirteen/4, so that one doesn't read $1\frac{3}{4}$.

The repetition may not slow or interrupt under any pretext. When it is finished, and the telegram is identified as perfectly exact, the office that received gives to that which transmitted a signal of *Reception Terminated* or *Acknowledgement of Receipt*, which is immediately by the correspondent. After that, the office that just received transmits in its turn, if it has a telegram; if not, the other continues. If neither side has anything to transmit, the two offices give the other the signal *zero*.

If sometimes, as a result of interruptions or by some other reason, one cannot receive the repetition, that circumstance does not delay the forwarding of the telegram to its destination.

IX

Between two offices of different States, communicating by a direct wire, the closure is given by the one who belongs to the State who has the westernmost capital.

That rule applies to the closure of the official reports and to the division of sessions, in the offices of permanent service.

X

Notices of service relative to a telegram previously transmitted are guided as far as possible to the offices by which the first telegram was transmitted.

When these offices each have all the necessary elements to proceed with notices of service, they take their own measures to avoid an unnecessary forwarding.

XI

Telegrams that are, in case of interruption, addressed by a post office to a telegraphic office are transported by a form.

The office that received the form registers reception of it by post, and reproduces the notice at the moment telegraphic communications are reestablished.

When a telegram is sent directly to the addressee, in the case previewed in Article 14 of the Convention, it is accompanied by a note indicating the interruption of the lines.

The office that forwarded, by telegraph, a telegram already transmitted by another means, must indicate in the preamble that this telegram was transmitted by a certified copy. This notice is carried on the mail delivery to the addressee.

The office that has sent telegrams by post may avoid redelivering them by telegraph, in cases of exceptional encumbrance, and when that redelivery would be clearly injurious to the service system.

XII

When a sender removes or stops their telegram, the enclosed tax remains collected by the interested offices.

The potential relative costs for the delivery to a domicile, the same as those which would be returned at payment for the response or for registration, are only reimbursed if the telegram was stopped in due course.

If the telegram was not entirely transmitted by the relaying office at the moment the sender removed it, the sender requests the cancellation in writing. That request is appended to the original, which remains at the office.

If the telegram was transmitted, the sender may only ask for the annulation by a telegram addressed to the chief of the arrival office, and of which the tax is settled; the sender equally pays for the response, if they desire to be informed by telegraphic means on the development of their request.

The delivery office gives telegrams of this nature the form indicating hereafter, § XXIII.

XIII

The telegraphic office of arrival has the right to utilize the post:

1st With an error in instruction, within the telegram, in the method of transport requested by the sender;

2nd When the method indicated differs from the adopted mode and notified by the State of arrival, conforming to Article 17 of the Convention;

3rd When there is a question of payment by an addressee who has previously refused to pay for the costs of the same nature.

When a telegram sent by registered letter cannot be immediately conformed to the formality of the charge, each may take advantage by a postal delivery, it is first placed by post by ordinary letter; a certified copy is addressed by a registered letter, as soon as possible.

Telegrams addressed to passengers of a ship that docks in a port are delivered to them, as often as possible, before disembarkment.

XIV

When the sender desires that the delivery be only between the hands of the addressee, they must mention it in the address.

At the arrival office, that notice is carefully reproduced on the envelope of the telegram, and the postman receives the necessary indications to conform to it.

When one cannot find the addressee of a telegram, and the arrival office has reason to suspect that an alteration was committed in the transmission of the address, it sends to the originating office a notice of service in the following form:

N^o. from addressed to street (indication of the city). *Addressee unknown.*

The address given in this notice of service must be a verbatim reproduction of the address received.

The departure office verifies the exactness of the address and only respond to the arrival office if there is an error of service to correct.

Each Administration retains control to authorize offices to communicate these notices to senders. In this case, the senders may only complete, rectify, or confirm the address by paid telegram, in the form indicated hereafter, § XXIII.

XV

The transmissions of Telegrams of State have the right. Telegraphic offices have no control to exercise over them.

When a private telegram is stopped after acceptance, the sender is informed of it by telegraph or by post, depending on what each Administration finds convenient.

XVI

The telegraphic Administrations are only bound to give communication or copy of pieces designated by Article 22 of the Convention, if the sender or the addressees furnish the exact date of the telegrams to which they relate.

XVII

In the case of a telegram requesting a paid response, the sender must write after the text, and before the signature, the indication: *paid response*.

The tax of a simple response is collected.

The sender may incidentally complete the notice by putting: *paid* (number of words) *response*, at paying off the corresponding tax.

The sender may also request an unlimited response. In this case, the telegram carries the notice: *unlimited paid response*, and the State of origin remains responsible for the tax due.

The starting telegram must reproduce, in the preamble, the notice indicative of a paid response.

The response must equally contain, in the preamble, the indication: *paid response to N^o . . from* (office of origin). This indication does not contribute to the count of taxed words.

The response made by the office, after eight days, by the originating office is given in the following form:

Paris by Berlin. — N^o . . . — Date.

Office Response to N^o . . from . . .

Mr

The addressee has not left a response.

XVIII

When the departure office identifies some alteration in the text that they have returned regarding the return telegram, it must immediately bring about a rectification.

It transmits to this effect:

The preamble and the ordinary address of the service telegrams;

The number and complete address of the registered telegram;

The number of words or groups to be fixed.

Then it successively repeats each word, group, or altered passage, doing so from beginning to end, if necessary, of the last words or groups correctly transmitted; each passage repeated in this way is separated from the following by a question mark.

The arrival office resends this rectification like a service telegram.

The return copy is only communicated to the sender when it is correct, at least if it does not result in a considerable delay. In this case, a note is written on the copy indicated that a rectification will be sent later.

The integral repetition of registered telegrams does not exclude the partial collation determined by § VIII, which is required, in so far that the telegram has not been exchanged in direct communication by the originating office and the destination office.

By general rule, return telegrams accompanied by notices relative to the delivery receive, like paid response, an order number at the office that receives them, and their transmissions are incidentally treated like new telegrams.

The return telegram is given in the following form:

Paris by Beirut. — N° . . . — Date.

Registered Telegram to N° . . . from . . . — for return.

(Primary text.)

Delivered (date) — to — h — m — m. or s. — to Mr

(or a style for non-delivery).

When the registered telegram is received directly from the originating office to the destination office, the latter office immediately give the integral collation: but the originating office only sends this to the sender when it has received notices relative to the delivery, under the form mentioned above.

XIX

The primary text of the telegram must be fully transmitted to the destination office successively and reproduced in the copy addressed to the addressee, but in the preamble, each office only reproduces, after the word *forward*, the addressed to which the telegram may then be sent.

The requests for forwarding provided for in § 4 of Article 26 of the Convention may be made by the post.

Each Administration retains for themselves the ability to forward, when it is necessary, according to the indications given to the domicile of the addressee, telegrams for which no special indication was given.

The international tax of forwarded telegrams is simply the tax pertaining to the first route, the complete address counted in the total number of words.

XX

By transmitting a telegram addressed to two or more addressees, it is necessary, in the preamble, to indicate the number of addressees.

The indication given in § 5 of Article 27 of the Convention must enter in the body of the address, and by consequence in the number of taxed words.

It is reproduced in the potential indications.

XXI

The sender must write in the official record the potential indications relative to the delivery to a domicile, to paid responses, to registered telegrams, or to forwarded telegrams.

The words, numbers, or signs added by the office in the interest of service are not taxed.

XXII

The name of the office of departure, the date, the hour, and the minute of deposit are transmitted from the office and inscribed on the copy sent to the addressee.

The sender may repeat their indications, in total or in part, in the text of the telegram: they enter thusly into the count of the words.

XXIII

The telegrams discussed in Article 36 of the Convention are formed as follows: *Paris by Berlin*. — *Service taxed*. They take rank among service telegrams and take a number in the order.

If the sender of a registered telegram notices an error in the text of the return telegram and requests a clarification, the rectifying telegram is transmitted for free by the originating office, so long as the error was not caused by the sender.

The addressee of an ordinary or registered telegram may request a clarification of passages that appear in doubt, and they are cleared as follows: 1st the price of a simple telegram for the request; 2nd the price of a telegram calculated following the length of the repeated passage, conforming to the rule prescribed in § XVIII.

These taxes are reimbursed to them if the repetition finds that the telegraphic service had altered the meaning of the telegram. In that case, the arrival office conducts the reimbursement by the office and with no delay.

The sums paid for taxed service telegrams remain earned entirely by the Administration that collected them, and are not figured in the international counts.

The telegraphic office that receives a telegram by which one asks from them the annulation of another telegram they had previously received, notifies the originating office by post, the party who had made the request, as far as the sender has not paid the price of a telegraphic response.

XXIV

If the tax to be collected at the arrival is not recovered, the loss is supported by arrival office, unless there are special conventions, and brought to a close under article 59 of the Convention.

However, the telegraphic Administrations take, as far as possible, necessary measures in order that the taxes collected upon arrival and would not be paid by the addressee are recovered by the

sender. When thusly recovered, the office who made the telegram maintains a count for the interested office.

XXV

The Administrations and telegraphic offices take necessary measures to diminish, as far as possible, the number of service telegrams benefiting from a gratuity.

Details not presenting a sense of urgency are requested or given by post.

XXVI

Each reclamation or reimbursement of tax must be presented to the originating office, if there is a question about an altered telegram, to be accompanied by the copy sent to the addressee.

The sender who does not reside in the country where they sent their telegram may present their reclamation at the office of origin, by the intermediary of another office. In this case, if it is known that the reclamation is justified, the office that received it is charged with effectuating the reimbursement.

For ordinary telegrams not sent to a destination (Art. 46 of the Convention), or for registered telegrams that do not fulfill their purpose (Art. 47), the reimbursement is supported by the offices on the lines of which there were irregularities which justified the reclamation by the sender.

In the case of alterations to the transmission, the originating office determines the errors that delayed the telegram from fulfilling its purpose, and the part contributable to the various Administrations is resolved according to the number of faults determined in this way.

The errors resulting from a non-fixed repetition are imputable to the sending office. The errors committed in a case where the obligatory repetition was not made, in spite of the request by the sending office, are imputable to the office that received the telegram. The two offices are responsible if the obligatory repetition was not made by the office that received the telegram and was not requested by the sending office.

If a response has fewer words than were paid for, the exceeding is not returned.

Reclamations communicated from office to office are transmitted with a complete dossier, which is to say that they contain (in original or in copy) all the pieces or letters that are concerned.

When a reclamation is found to be justified, the originating office effectuates the reimbursement without waiting for a response from the interested offices.

XXVII

The tax pertaining to semaphore transmissions of telegrams by sea is attributed to the State that made the transmission.

XXVIII

The tax that serves as the base for the distribution among States, or to the determination of the means mentioned in Article 49 of the Convention, those which result from the regular application of taxes, without which it must take count of errors in taxation that may have been made. Each Administration incidentally keeps for itself the right to request from senders or addressees, following the scenarios, the remainder of required taxes by a initially incomplete taxation, and commit to reimburse sums taken in excess by error.

However, the number of words announced by the originating office serves as the base for application of the tax in the international counts, except for the case where it would have been rectified by a common agreement with the corresponding office.

XXIX

The exchange of monthly counts take place before the end of the quarter that follows the month that they concern.

The review of the accounts takes place in a maximum delay of six months, from the date of their delivery. The office that has not received, in this interval, corrective compliance considers the account as accepted without other reason and inscribes the amount in the quarterly calculation.

It is not accepted for reclamation, in the counts, for the subject of telegrams more than one year from the date.

The present rules, intended to be complete the dispositions of the diplomatic Convention of whose project is currently submitted

for the approval of international Conference of Paris, will be entered into rigor at the same time as the Convention.

Completed in Paris, 11th April, 1865.

Signed : BRUNNER,

DE CHAUVIN, for the Grand-Ducy of Bade,

DE WEBER,

DE DYCK,

FASSIAUX,

J. VINCHENT,

FABER,

SAL SANZ,

IGNACIO DE HAKAR,

Vicomte H. DE VOUGY,

JAGERSCHMIDT,

PHOCION ROQUE

GAUSS,

J. DE MINOTTO,

NIELSEN,

STARING,

J. V. DAMASIO,

DE CHAUVIN,

Major General DE GUERHARD,

DE CHAUVIN, for the realm of Saxony,

P. BRÄNDSTROM,

L. CURCHOD,

AGATHON,

KLEIN.

SPACE LAW BIBLIOGRAPHY

Kyle Hansen

BOOKS AND OFFICIAL PUBLICATIONS

FRANCIS LYALL & PAUL B. LARSEN, *SPACE LAW: A TREATISE* (2d ed., 2018).

MONOGRAPH SERIES IV: *NEWSPACE COMMERCIALISATION AND THE LAW* (Tanveer Ahmad & Jinyuan Su eds., McGill 2017).

MONOGRAPH SERIES V: *CONFLICTS IN SPACE AND THE RULE OF LAW* (Maria Manoli & Sandy Belle Habchi eds., McGill 2018).

RECENT DEVELOPMENTS IN SPACE LAW: OPPORTUNITIES AND CHALLENGES (R. Venkata Rao et al. eds., 2017).

SECURE WORLD FOUNDATION, *HANDBOOK FOR NEW ACTORS IN SPACE* (Christopher D. Johnson ed., 2017).

U.S. DEP'T OF COM. & FED. AVIATION ADMIN., *INTRODUCTION TO U.S. EXPORT CONTROLS FOR THE COMMERCIAL SPACE INDUSTRY* (2d ed. Nov. 2017).

ARTICLES

American Bar Association, *Space Law Then, Now, and in the Future: A Conversation with Pamela Meredith and Laura Montgomery*, 30:4 THE AIR & SPACE LAW. (Winter 2017).

Atsuki Mizushima et al., *What Is an Appropriate Interaction between International Law and Domestic Legal Systems to Promote Space Resources Development*, 42 AIR & SPACE L. 543 (2017).

Brigitte Zypries, *Space, the Public, and Politics*, 41 SPACE POL'Y 73 (2017).

Chelsey Davis & Mark J. Sundahl, *The Hague Working Group on Space Resources: Creating the Legal Building Blocks for a New Industry*, 30:3 THE AIR & SPACE LAW. (Fall 2017).

Cihan Ercan & Izzet Kale, *The role of space in the security and defence policy of Turkey. A change in outlook: Security in space versus security from space*, 42 SPACE POL'Y 17 (2017).

Dejian Kong, *Shaping a legal framework for China's BeiDou Navigation Satellite System*, 42 SPACE POL'Y 26 (2017).

Emily M. Nevala, *Waste in Space: Remediating Space Debris through the Doctrine of Abandonment and the Law of Capture*, 66 AM. U. L. R. 1495 (2017).

Frances Brown, *Is Space Being Reinvented?*, in SPACE POL'Y (2017), <https://doi.org/10.1016/j.spacepol.2017.11.001>.

Frans von der Dunk, *Asteroid Mining: International and National Legal Aspects*, 26 MICH ST. INT'L L. REV. 83 (2017).

George Khoukaz, *ADR That is Out of This World: A Regime for the Resolution of Outer-Space Disputes*, 2018 J. DISP. RESOL. 265 (2018).

Hannah Svonavec, *Saving Space with Un-Authorized Acts: Questioning the Authority of the United Nations to Oversee Humankind's Exploration and Development of Outer Space*, 36 J. L. & COM. 57 (2017).

Humaid Alshamsi et al., *Space Station Asgardia 2117: From Theoretical Science to a New Nation in Outer Space*, 16 SANTA CLARA J. INT'L L. 37 (2018).

Jacob A. Reed, *Cold War Treaties in a New World: The Inevitable End of the Outer Space and Antarctic Treaty Systems*, 42 AIR & SPACE L. 463 (2017).

James S. J. Schwartz, *Myth-free Space Advocacy Part III: The Myth of Educational Inspiration*, in SPACE POL'Y (2017), <https://doi.org/10.1016/j.spacepol.2017.12.001>.

Jinyuan Su, *Legality of Unilateral Exploitation of Space Resources under International Law*, 66 INT'L & COMP. L. Q. 991 (2017).

John Hickman, *Exoplanet naming, electoral competition and strategic failure*, 42 SPACE POL'Y 62 (2017).

Kai-Uwe Schrogl, *The popularisation of space – A European perspective*, 41 SPACE POL'Y 70 (2017).

Katarina Damjanov, *Accounting for Non-Humans in Space Exploration*, in SPACE POL'Y (2018), <https://doi.org/10.1016/j.spacepol.2018.01.001>.

Katie E. Lee, *Colonizing the Final Frontier: Why Space Exploration beyond Low-Earth Orbit Is Central to U.S. Foreign Policy, and the Legal Challenges It May Pose*, 27 S. CAL. INTERDISC. L. J. 231 (2017).

Kenneth Quinn, *Sky's No Longer the Limit*, 30:3 THE AIR & SPACE LAW. (Fall 2017).

Kentaro Tanaka, *Applicability of remote sensing policies to space situational awareness*, 42 SPACE POL'Y 83 (2017).

Konrad Szocik et. al., *War or peace? The possible scenarios of colonising Mars*, 42 SPACE POL'Y 31 (2017).

Kubo Mačák, *Silent War: Applicability of the Jus in Bello to Military Space Operations*, 94 INT'L L. STUD. 1 (2018).

Léa Gringé, *Science fiction works for the development of the aerospace sector*, 41 SPACE POL'Y 42 (2017).

Malissa Caroline Barger & Ethan L. Smith, *HB - 1 Space Flight*, 34:1 GA. ST. U. L. REV. 251 (2018).

Marine Alalinarde, *The popularization of space – Link between science, policy, and public perception Star Trek as an early mind-opener for space endeavors*, 41 SPACE POL'Y 36 (Aug. 2017).

Marissa N. Lefland & Darcy C. Osta, *Recent Developments in Aviation and Space Law*, 52:2 TORT TRIAL & INS. PRAC. L. J. 265 (2017).

Mark Shelhamer, *Why send humans into space? Science and non-science motivations for human space flight*, 42 SPACE POL'Y 37 (2017).

Marta E. Wachowicz & Marek Bury, *Space technology transfer problems in the context of protecting the space heritage*, 42 SPACE POL'Y 66 (2017).

Matthew Schaefer, *The Contours of Permissionless Innovation in the Outer Space Domain*, 39 U. PA. J. INT'L. L. 103 (Fall 2017).

Milan M. Ćirković, *Is Contact a Process?*, 42 SPACE POL'Y 103 (2017).

Morgan Sterling Saletta & Kevin Orrman-Rossiter, *Can Space Mining Benefit All of Humanity?: The Resource Fund and Citizen's Dividend Model of Alaska, the 'last frontier'*, in SPACE POL'Y (2018), <https://doi.org/10.1016/j.spacepol.2018.02.002>.

Nathan E. Clark, *Gauging the Effectiveness of Soft Law in Theory and Practice: A Case Study of the International Charter on Space and Major Disasters*, 43:1 AIR & SPACE L. 77 (Wolters Kluwer, 2018).

P. Paul Fitzgerald, *Intercontinental Space Flight: Learning from the Concorde*, 42 AIR & SPACE L. 583 (2017).

Paul Stephen Dempsey, *The Intersection of Air Law and Space Law*, in PUBLIC INTERNATIONAL AIR LAW SECOND EDITION 933 (Paul Stephen Dempsey ed., McGill 2017).

Peter Martinez, *Development of an International Compendium of Guidelines for the Long-Term Sustainability of Outer Space Activities*, in SPACE POL'Y (2018), <https://doi.org/10.1016/j.spacepol.2018.01.002>.

Philip De Man & Ward Munters, *Reciprocal Limits to the Freedom to Use Outer Space by all States: Common but Differentiated Responsibilities?*, 43:1 AIR & SPACE L. 21 (Wolters Kluwer, 2018).

Philip De Man, *State practice, domestic legislation and the interpretation of fundamental principles of international space law*, 42 SPACE POL'Y 92 (2017).

Pierre Bertrand et al., *Participatory technology assessment for Mars mission planning: Public values and rationales*, 42 SPACE POL'Y 41 (2017).

Ram S. Jakhu et al., *Conflicts in Space and the Rule of Law*, 66 ZLW 657 (2017).

Ramesh Sivanpillai et al., *Accessing satellite imagery for disaster response through the International Charter: Lessons learned from the 2011 US Midwestern Floods*, 42 SPACE POL'Y 54 (2017).

Rong Du, *China's Approach to Space Sustainability: Legal and Policy Analysis*, 42 SPACE POL'Y 8 (2017).

Samantha Brainard & Zoe Szajnfarder, *Understanding the burden of government oversight on engineering work: Adding empirical data to the debate*, 42 SPACE POL'Y 70 (2017).

Shane Fitzmaurice, *GATS Regulation for Launch Services: Resolving the United States-India Conflict*, 27 MINN. J. INT'L L. 283 (2018).

Skip Smith, *A Space Law Primer for Colorado Lawyers: Part 1: International Space Law*, 47 COLO. LAW. 48 (2018).

Stephan Hobe & Philip de Man, *National Appropriation of Outer Space and State Jurisdiction to Regulate the Exploitation, Exploration, and Utilization of Space Resources*, 66 ZLW 460 (2017).

Stephan Hobe, *The IISL Assumes Responsibility for Questions of Cyber Law*, 66 ZLW 647 (2017).

Thomas Hoerber & Harald Köpping Athanasopoulos, *Popularising European space policy: Introduction*, 41 SPACE POL'Y 1 (2017).

Thomas Hoerber, *Framing in European Space Policy*, in SPACE POL'Y (2018), <https://doi.org/10.1016/j.spacepol.2018.02.001>.

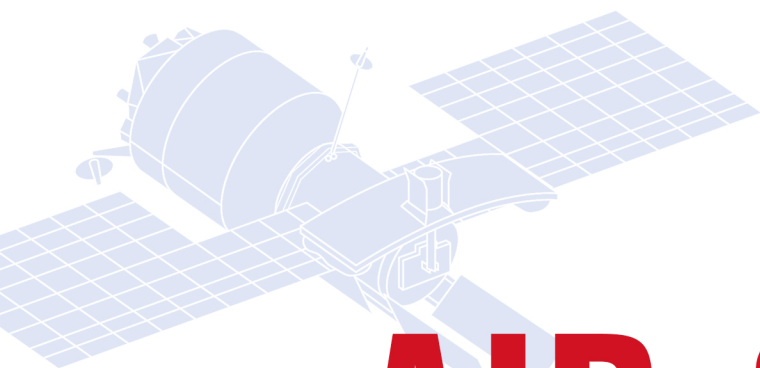
Valentina Vecchio, *Customary International Law in the Outer Space Treaty: Space Law as Laboratory for the Evolution of Public International Law*, 66 ZLW 491 (2017).

W. Henry Lambright, *Relay leadership and long-term policy: The case of Mars*, 42 SPACE POL'Y 1 (2017).

Wolff Heintschel von Heinegg, *Neutrality and Outer Space*, 93 INT'L L. STUD. 526 (2017).



The University of Mississippi School of Law



LL.M.

in

AIR & SPACE

LAW

LL.M. COURSES

Comparative National Space Law
International Aviation Finance and Leasing Law
International Space Law
International Telecommunication Law
Remote Sensing Law
Private International Air Law
Public International Air Law
Space Security Law
U.S. Aviation Law
U.S. Space Law

LL.M. PROGRAM ADVANTAGES

Unique emphasis in U.S. air and space law.
Extensive air law expertise and 45+ years in space law.
On-campus or distance, full-time or part-time.
Participate, if qualified, in the JOURNAL OF SPACE LAW.
Comprehensive air and space law collection.
Access to University of Mississippi Space Law Archives.
American Bar Association accredited law school.

The **University of Mississippi School of Law** is a world leader in air and space law education, research, and public service.

This LL.M. degree program is designed for both U.S. and foreign-trained law school graduates interested in a rigorous legal curriculum in U.S., international, and comparative air and space law.

Learn more at www.law.olemiss.edu/llm
llm@olemiss.edu

