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

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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.

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FOREWORD

By Joanne Irene Gabrynowicz[*]

"The longer you can look back, the farther you can look forward."
--Winston Churchill[1]

This volume of the JOURNAL OF SPACE LAW is truly unique. It celebrates the 50th anniversary of the publication of one of the most important books in all of space law: *Space Law and Government* by the late Andrew G. Haley. Appleton, Century, and Crofts published it in 1963. Along with *The Law and Public Order of Outer Space,* by McDougal, Laswell, and Vlasic published that same year, it is one of the two seminal texts on space law.

In 1963, the world had already experienced *Sputnik I* and its leaders were grappling with how to respond to the threats *Sputnik I* represented. In the few short years since the end of World War II and the atomic bombings of Hiroshima and Nagasaki, *Sputnik I*—and the launch vehicle that successfully carried it into space—represented the ability to place nuclear weapons into space and have them rain down on Earth. In short, *Sputnik I* represented an unprecedented potential conflict of global proportions that could result in the destruction of Earth and everything on it. When it comes to conflict humans ultimately have two—and only two—ways of addressing it: by reaching an agreement or fighting about it. Even the strategically diplomatic device of agreeing to disagree, while facilitating the ability to get past a difficult situation, as a practical matter, serves to place the only two real options further into the future. Hopefully, by agreeing to disagree, time will reveal how to re-

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[*] Joanne Irene Gabrynowicz is the Editor-in-Chief of the JOURNAL OF SPACE LAW. She is also a professor of space law and remote sensing law and the Director of the National Center for Remote Sensing, Air, and Space Law at the University of Mississippi School of Law. Prof. Gabrynowicz was the recipient of the 2001 Women in Aerospace Outstanding International Award and the 2011 International Institute of Space Law's Distinguished Service Award. She is a Director of the International Institute of Space Law and a member of the American Bar Association Forum on Air and Space Law.

[1] CHURCHILL BY HIMSELF 577 (Richard Langworth, 2008).

solve the problem or render it moot. Nonetheless, the underlying conflict continues to lie dormant. At the level of nations the options of addressing conflict by agreement or fighting are law or war.

In this light, *Space Law and Government* can be seen as one of the first attempts to define what would be needed to move humankind away from potential war and toward a legal regime that would address the threats that *Sputnik I* and its launch vehicle represented. This issue of the JOURNAL OF SPACE LAW revisits some of Haley's ideas and examines, with the benefit of a half-century of hindsight, how they have fared over 5 decades. This examination is done by some of the people who knew Haley best.

In his article, *Reflections on Space Law and Government* William J. Potts, Jr. recalls his former law partner, his life and times and the events that catalyzed Haley's movement into what would later be known as space law. In his article, *Space Law and Government 50 Years Later*, Dr. Stephen E. Doyle takes a macro view of the original book. No one is better qualified to do so as Dr. Doyle supported Haley in Haley's space related activities and writing. Dr. Doyle was employed by Haley as a summer law clerk at Haley, Bader and Potts from June to August in the years 1962, 1963, and 1964. Dr. Doyle also served as an associate attorney in the firm to support Haley in space related matters from July to December 1965.

Present day experts also examine some of Haley's early substantive positions. In *A Natural System of Law? Andrew Haley and the International Legal Regulation of Outer Space*, Dr. Steven Freeland considers Haley's well-known position that space law, being new to the human experience, would have to be based on natural law theory. He concludes that although the natural law system Haley wished for did not come into being, modern space lawyers are well advised to "heed Haley's strong convictions that fundamental sentiments of 'humanity'…should underpin the legal regulation of outer space…to avoid the possibility of… alternate scenarios… that may be too frightening to contemplate."

Today, space lawyers are striving to address the legal issues of what is now called "orbital debris" but what Haley pre-

sciently identified as "space trash." In his article, *"Space Trash": Lessons Learned (and Ignored) from Space Law and* Government, James E. Dunstan traces Haley's reasoning in dealing with "space trash" and opines that following this reasoning customary international law could evolve under a variety of possible scenarios.

James D. Rendleman addresses a major issue well known to Haley: military space. As a lawyer advising the military in the earliest days of developing space technology to be acquired and used by the military in space, Haley experienced a very different military than the one that uses space today. Today's military is vastly more complex and operates in a complicated world with multiple existing and rising spacefaring nations. In his article, *Brave New World of Hosted Payloads*, Mr. Rendleman describes the ever-growing demands from today's military for space-based information that is requiring re-thinking the acquisition process as well as the technology it governs.

Another substantive topic for which Haley is known is the field of metalaw. Another lawyer known for his work in the metalaw field, George S. Robinson takes a look at Haley's approach to metalaw. He observes that metalaw is derived from natural law theory, particularly what Haley called the "Interstellar Golden Rule'. Dr. Robinson traces the development of these concepts and suggests they are not necessarily rooted in natural law theory and proposes that as reliable empirical data become available a more secular understanding of metalaw emerges.

The inspiration for Ryan T. Noble's article, *Archived Documents as Evidence and Legal Authority: Lessons Learned Applicable to the Law of Outer Space* came from his work with the Halley Collection housed in the space law archive at the National Center for Remote Sensing, Air and Space Law at the University of Mississippi School of Law. During that time Mr. Noble had the opportunity to work with many primary sources that were created in the very early stages of space law development. In addition to being documents with historical value, Mr. Noble recognized the authoritative and evidentiary value of the documents. His article traces the use of similar kinds of docu-

ments in other fields of law and extrapolates how this use can be possible for space law.

In aggregate, the Churchill quote at the top of this foreword truly does describe the articles published in this issue. They look back at what was to determine what might be.

EDITORIAL ANNOUNCEMENT

So looking forward, this is the best time and place for me to inform the readership of the JOURNAL OF SPACE LAW that with volume 39, number 2, I will assume the title of Editor-in-Chief Emerita. It has been an honor to follow in the role so capably created by the late Stephen Gorove. In the 12 plus years that I have had the privilege to follow in his footsteps, the JOURNAL OF SPACE LAW achieved a number of successes. In addition to numerous articles, book reviews, and commentaries published by eminent authors, the JOURNAL OF SPACE LAW featured a number of special volumes that published the papers of a number of special symposia and colloquia: *The 1st International Conference on the State of Remote Sensing Law*; *The 2nd International Conference on the State of Remote Sensing Law*; and, *Divergences and Convergences - Space Law and Intellectual Property Regimes*; among others.

I have a number of personal favorite issues. Among them is Volume 37, Number 1. It is dedicated to the historic enactment of Title 51 of the United States Code: *National and Commercial Space Programs*. Title 51 is the positive law codification of all U.S. national space law promulgated since 1958 and it was the first title the U.S. Congress added to the U.S. Code in 83 years. It was the intention of the JOURNAL OF SPACE LAW to serve the space law community by making this dedicated issue a complete reference work for Title 51. For this reason, the JOURNAL OF SPACE LAW, for the first time, made an entire electronic volume available at the time of its publication at no cost. The Stanford law librarian called Volume 37, Number 1 a "gem."[2]

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[2] Law Library Blog, *Title 51* (July 6, 2011), http://liblog.law.stanford.edu/tag/journal-of-space-law/.

Additionally, the JOURNAL OF SPACE LAW—through collaborations with scholars in various nations—published translations of then newly enacted Chinese, French, German, Japanese, Kazakh, Mexican, and Russian space law, regulations, and agreements. The JOURNAL OF SPACE LAW also facilitated space law capacity building worldwide when it entered the digital era by making its issues available on-line, without charge. It also provided a Cumulative Index and supplemental materials that supported the articles in each issue.

This impressive work product was created by the dedicated and talented faculty and staff of the National Center for Remote Sensing, Air and Space Law. They were aided by a multitude of law students who edited, wrote articles and casenotes, and provided research assistance. There are far too many names from more than 12 years of mastheads to list here. However, I warmly thank and acknowledge each and every one of them for their contribution. It's been a great ride.

Joanne Irene Gabrynowicz

Oxford, MS, USA

12 September 2013

CALL FOR PAPERS

JOURNAL OF SPACE LAW
UNIVERSITY OF MISSISSIPPI SCHOOL OF LAW

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The National Center for Remote Sensing, Air, and Space Law of the University of Mississippi School of Law is delighted to announce that it will publish Volume 40, Issue 1 of the JOURNAL OF SPACE LAW in the first half of 2014.

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To be considered for the next issue, submissions should be received on or before February 1, 2014. However, the JOURNAL OF SPACE LAW will continue to accept and review submissions on an on-going basis.

SPACE LAW AND GOVERNMENT 50 YEARS LATER

Stephen E. Doyle[*]

INTRODUCTION

Andrew G. Haley wrote *Space Law and Government*[1] in multiple pieces over time, pieces which were collected in 1961, consolidated, edited, and annotated in the summer of 1962, and published as a book in 1963. The work was heralded at the time as a significant contribution to the development of space law. Today we have the opportunity to assess the significance of the work from the perspective of 50 years later in time. This chapter-by-chapter assessment of Haley's work identifies its visions, its unrealized expectations, and its lacunae.

In a Foreword to the work, then U. S. Vice President, Lyndon Johnson, wrote "I note that a major portion of *Space Law and Government* is devoted to discussing international cooperation in space exploration on official and non-governmental levels. This is indeed useful." This insightful observation characterized not only the book created by Haley, but the man himself. In all his activities in the astronautical realm Haley was assuredly a citizen of the world and an ardent supporter of international cooperation in astronautics.[2]

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[*] The author was employed by Andrew Haley as a summer law clerk at Haley, Bader and Potts June to August 1962, 1963, and 1964, where he supported Haley in his space related activities and writing. The author also served as an associate attorney in the firm, to support Haley in space related matters from July to December 1965. He joined the Federal Communications Commission in December 1965. Currently, the author is an Honorary Director of the International Institute of Space Law; a retired attorney at law, civil servant, industrialist, author and lecturer. www.stephenedoyle.com.

[1] ANDREW G. HALEY, SPACE LAW AND GOVERNMENT (New York: Appleton-Century-Crofts, 1963).

[2] Biographical information about Andrew G. Haley may be found at SHIRLEY THOMAS, 7 MEN OF SPACE,139 (Chilton Books, Philadelphia, 1965); *Our Respects to Andrew Gallagher Haley*, BROADCASTING (Nov. 11, 1957); Stephen E. Doyle, *Astronautics Loses an Original: Andrew G. Haley*, ASTRONAUTICS AND AERONAUTICS, 60-65 (Nov. 1966); and Stephen E. Doyle, *Andrew Gallagher Haley: A Biographical Sketch (1904-1996)*, *in* THE EAGLE HAS RETURNED, THE SECOND PART, PROCEEDINGS OF THE

Haley was a diligent researcher and exceptional writer during his early professional life. A review of his early writings (in the 1930s and early 40s) about radio communication law, immigration law, the law concerning broadcast lotteries, and international agreements relating to broadcasting,[3] clearly show extensive research and broad and creative approaches to the topics of his choice. After his tour of duty as the President and General Manager of the Aerojet Engineering Company in California (1942-1945), Haley returned to Washington, D.C. and re-entered the practice of law. As his practice and law firm grew, he was able to call upon those who worked for him and with him to assist in his writing.

Initially infrequently, but more often as time went on, Haley would invite an associate to look into a topic area, discover and record the prevailing views in existing literature, and produce that material in a draft form which Haley could use as the basis of a paper or an article for a publication. In this way, the time-consuming brute work of research, and recording what was in the literature, could then be supplemented with a modicum of effort presenting Haley's personal views, assessments and proposals on the selected topic. If one examines Haley's later papers carefully, one can almost see the transition from the labors of his associates, providing essential background for a piece, to the presentation of Haley's own views on the subject. His nephew and an associate in the firm, Michael Bader, and another associate, William Potts, often prepared the researched content of later published articles, but invariably one finds the concluding and substantive Haley contributions to the work. This same process was employed in the assembly, comprehensive editing and footnoting, and eventual publication of *Space Law and Government.*[4]

DEDICATION CONFERENCE OF THE INTERNATIONAL SPACE HALL OF FAME (Alamogordo, New Mexico, Oct. 1976); 45 SCIENCE AND TECHNOLOGY SERIES (American Astronautical Society, 1977).

[3] For a comprehensive bibliography of all Haley's publications prior to 1962, see SPACE LAW AND GOVERNMENT, *supra* note 1, at 528-539.

[4] SPACE LAW AND GOVERNMENT, *supra* note 1, at xvi-xvii, Preface (for Haley's description of the genesis and creation of his book).

THE PROMISE AND CHALLENGE OF SPACE

The opening chapter of the book is devoted to "The Promise and Challenge of Space Endeavor." In the preamble to Chapter 1 Haley wrote: "The underlying principles of all man's activities in space should be (a) all benefits derived are on behalf of all mankind, and (b) the free use of outer space is assured to every nation for all peaceful and scientific purposes." These two fundamental principles, as perceived by Haley and contemporaries, were later incorporated explicitly in Article 1 of the Outer Space Treaty of 1967.[5] Haley began with a recitation of benefits to be derived from space activities including new jobs, new categories of work, new consumer goods, increased educational programs and facilities, and a host of economic values. He derived these observations from other published sources, but he considered them inadequate as a list of total benefits because in 1963 "the greatest benefits to come from space activities, however, are probably still unseen and unpredictable." After reciting examples to support this observation, Haley wrote:

> It thus appears safe to predict that space activities will make far-reaching practical contributions to the welfare of mankind. But space flight is a long-term process which will unfold over many generations, and it would not be realistic for us today to try to predict its ultimate impact in any detail.[6]

Declining to be drawn into detailed predictions was wise and sensible, considering the broad scientific and practical benefits, most of which subsequently appeared during the three decades following the appearance of Haley's book. The significant area of national defense, and later military space programs are infrequently referred to and not pursued in any detail throughout

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[5] "The exploration and use of outer space, including the moon and other celestial bodies, shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development, and shall be the province of all mankind. Outer space . . . shall be free for exploration and use by all States without discrimination of any kind, on a basis of equality and in accordance with international law ." Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, art. 1, opened for signature Jan. 27, 1967, 18 U.S.T. 2410, 610 U.N.T.S. 205 [hereinafter Outer Space Treaty].

[6] SPACE LAW AND GOVERNMENT, *supra* note 1, at 3.

Haley's work. His interest and focus were on the potential benefits of civil governmental and commercial space programs. He steered clear of discussing and projecting the defense program areas, likely because he knew that almost all such activities in 1963 were classified for reasons of national security and could not be elaborated in a civilian text on astronautics.

In a subtle differentiation, Haley sought to separate, characterize, and contrast the early contributions of the Soviet Union to spaceflight and the U.S. contributions. He noted that prestige is obtained in two aspects from such activities: the prestige of "first-time achievement" and the separate prestige associated with the intrinsic value of contributions made "by a particular space accomplishment." Haley observed that: "[p]utting the first satellite into orbit was a spectacular achievement; giving the world an operative meteorological or communications satellite system may in the long run be the more rewarded contribution in terms of prestige."[7]

Haley immediately followed his discussion of the benefits of space flight operations with comments manifesting his driving international motivations, as noted above by Lyndon Johnson:

> A less talked-about but nonetheless real political benefit of space flight is the fact that it encourages closer ties among nations. Some specific examples of cooperation in space research and related pursuits will be cited in later chapters of this volume. However space does more than provide new opportunities for international cooperation. More fundamentally, perhaps, it cannot help but make more apparent than ever the impracticality of war.[8]

Substantial argument is presented at this point to emphasize the important potential international influence of space flight. Haley was an internationalist, an opponent of war, and a crusader for world peace and increased understanding. He referred to and quoted others who held similar opinions, and quoted the following observation by Arthur C. Clarke, whom Haley de-

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[7] *Id.* at 7.
[8] *Id.*

scribed as a science writer and originator of the communication satellite concept:

> We all know the narrow, limited type of mind which is interested in nothing beyond its town or village, and bases its judgments on these parochial standards. We are slowly – perhaps too slowly – evolving from that mentality toward a world outlook. Few things will do more to accelerate that evolution than the conquest of space. It is not easy to see how the more extreme forms of nationalism can long survive when men begin to see the earth in its true perspective as a single small globe among the stars.[9]

Haley optimistically believed space flight would stress the fundamentally unifying characteristics of humans over local customs, history and the place in which they were born. It is an unfortunate reality, 50 years later in time, to find that religious, racial, and political parochialism and intolerance are still rampant in world society. Humans have not yet collectively perceived the futility of war, or the destructive nature of hate and ridicule. There are still leaders among us who promote division; they teach intolerance even to the extent of promoting racial annihilation. We have individuals who wish to destroy nations and peoples against whom they hold a basic difference, whether in religious belief, political preference or racial origin. The concepts of tolerance, right reason, and rule of law mean nothing to the rulers who lead their nations or factions in continuing aggression and feckless destruction of life and property by terrorism. Andrew Haley's optimism is increasingly difficult to maintain in a world consuming itself with hatred, envy, and conflict.

Haley did not assume unrealistic goals for his work. He wrote of his book that "[t]he present work will attempt … to outline some of the needs of law for the space age, and to present some of the thinking of those who have considered the problem to date." First among the arguments propounded by Haley was his assertion that if order were to prevail, international agreements establishing peaceful regulation were an immediate es-

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[9] *Id*. at 8, *quoted from* A. C. CLARKE, THE CHALLENGE OF THE SPACESHIP 7-8 (Harper & Row, New York, 1959).

sential. Included as an Appendix to Haley's book was the most significant effort to that time to establish order in the pursuit of space flight activities, UN General Assembly Resolution 1721 (XVI), which had been unanimously adopted on 20 December 1961. This instrument was the substantive precursor to the *Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies*, which entered into force on 10 October 1967, one year after Haley's death.

THE PROBLEM OF SPACE DEBRIS

In 1963 Haley was already concerned about the accelerating number of objects being placed in space and the attendant problem of eventually increasing the presence of space debris in Earth orbit. He concluded his brief assessment with the statement that:

> Ideally, … no objects should be allowed to go into outer space without a code of law requiring that they be controllable; they should be earth-returnable, or capable of being projected into orbits around the sun or into some other area where they could not be injurious to life, property, and near-terrestrial navigation.[10]

It is the case that it took almost 50 years for the United Nations to take any definitive action concerning the management of space debris. The UN General Assembly in 2008 adopted resolution 62/217, endorsing the Space Debris Mitigation Guidelines developed by the UN Committee on the Peaceful Uses of Outer Space. These voluntary guidelines outline space debris mitigation measures for the planning, design, manufacture, and operational phases of spacecraft and launch vehicles. The guidelines call for limiting the long-term presence of spacecraft in low-Earth orbit (LEO), up to some 1,600 kilometers (1,000 miles) above Earth's surface, after the end of their mission. The guidelines also call for the removal of such spacecraft from orbit or for their disposal in other orbits that avoid their long-term presence

[10] *Id.* at 11.

in the LEO region, where the majority of satellites are placed and where they are in greatest danger of collision. Haley had suggested that these measures be implemented decades earlier.

The balance of the opening chapter contains an impressive, broad and inclusive summary of statements by national leaders, legal scholars, pundits, and others to the affect that cooperation on establishment of legal principles relating to activities in space will be easier if accomplished sooner, but increasingly more difficult as time passes and national programs and activities expand and increase. Haley urged early action to address the need for a rule of law in space and quoted many authorities of a similar mind.[11]

Missing from Haley's recitation of benefits of space, which are clearly visible to us today, are any discussions of the use of satellites for direct broadcasting to individual homes and receivers, use of satellites for Earth resources sensing, today called remote sensing, and the global value of operational navigation satellite systems. Haley also could not see the eventual growth of commercial competition in the rendering of launch vehicle services by multiple nations, as well as the broad international competition existing today in the design and building of specialized satellites and satellite systems. Whether intentional or not, Haley also failed to project the uses of outer space for national defense purposes such as early warning systems, treaty verification systems and coastal monitoring.

THE BASES OF INTERNATIONAL LAW

In Chapter 2 of the book, Haley turned his attention to "The Traditional Bases of International Law." Drawing upon his early studies as a law student with James Brown Scott in the 1920s, Haley argued in favor of considering Natural Law as an essential basis for space law, contrasting it with the positivist approach of Yale law professor Myres McDougal and others. The second chapter is in effect an exercise in jurisprudential preference assessment. Although interesting to read and to contemplate, the philosophical discussion presents neither specific

[11] *Id.* at 11-21.

substance nor form to satisfy the needs for space law declared in the first chapter of the book.

The discussion moves from contrasting approaches to law, to a real-world discussion of "The process of formulation of law." In this portion of the work[12] Haley more meaningfully addressed how the law was emerging among nations in the international community in 1963, and turned attention to the significance of "traditional practices," and the use of traditional practices as bases of decisions resolving conflicts among nations. Haley noted that one immediately significant aspect of the importance of traditional practices was the emergence of the implied consent of States to the over flight of their national territories, then well in place as a consequence of lacking objection by any State to the over flight of its territory by the more than 100 satellites launched into Earth orbit by 1963. So important was this topic in Haley's mind that he devoted the entire third chapter of his book to the topic "National Consent to Overflight."

THE UPPER LIMIT OF SOVEREIGNTY

From the earliest days of commentary on space law, pundits and commentators have consistently identified the question of the upper limit of national territorial airspace as a "critical question." It is unarguably the case that all nations have absolute sovereignty over the airspace above their national territories. Numerous national laws and international treaties have enshrined this principle since the end of World War I and the 1919 *Treaty of Versailles*. Possibly the most broadly subscribed document containing this principle today is the *Chicago Convention of 1944*, which provides in Article 1 that: "[t]he contracting States recognize that every State has complete and exclusive sovereignty over the airspace above its territory." In contrast, the unanimously adopted United Nations Resolution 1721 (XVI), dated 20 December 1961, provided in part that "Outer Space and celestial bodies are free for exploration and use by all States in conformity with international law and are not subject to national appropriation."

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[12] *Id.* at 37-38.

Thus, there must be a point at which the absolute sovereignty of States over national airspace gives way to outer space, which is free for exploration and use by all, and over which there should be no exercise of national appropriation. John Cobb Cooper, the first to write about space law in the United States in the late 1940s, featured this issue in his early works as the most critical and essential issue of space law to be resolved. Much of the consequent early commentary on space law in English keyed off Cooper's concern and extensively addressed alternative solutions to this problem. Suffice it to say that today, in 2013, the issue remains yet to be officially resolved by agreement among States, probably eventually in a United Nations Resolution at a date to be determined. My presumption is that the upper limit of national sovereignty over airspace will be set eventually by international agreement at 100 km.

Haley was among those to whom the "upper limit" question was one of importance and deserving attention for its early resolution. Haley's response to the issue was to seek a scientifically verifiable demarcation that would be objectively demonstrable. Haley favored reliance on a demarcation he referred to as the von Kármán primary jurisdictional line. This line, suggested by world renowned aerodynamicist Theodore von Kármán, would define airspace as existing up to the altitude at which an aircraft, depending upon aerodynamic lift to sustain flight, could maintain altitude; but above this altitude the centrifugal force of a flying object would take over as the principle motive force supporting its maintenance of flight status. Von Kármán stipulated that this altitude would be in the range of 275,000 feet above the Earth's surface, or an altitude of about 52 miles. The fourth chapter of the Haley book contains more than 40 pages offering an elaborate historical consideration of the many alternative solutions proposed to the "upper limit" issue, and concludes with an assessment that the Von Kármán jurisdictional line is the preferred solution to the problem. This conclusion was stated explicitly in the preamble to Chapter 4, where Haley wrote:

> It is shown that one proposed solution, the "von Kármán line," should serve as the terminal point for civil and criminal venue, and in general for exercise of national sovereignty, because the

> scientific and jurisprudential considerations determining the line are entirely realistic, identifiable, and sufficient.[13]

SOVEREIGNTY OVER CELESTIAL BODIES

Having dealt exhaustively and conclusively with the historical literature describing the issue of the limits of national sovereignty, Haley took up in chapter 5 of his book the matter of "Sovereignty over Celestial Bodies." In the latter 1950s an international conference was convened to establish an agreed basis under which exploration and peaceful uses of Antarctica could go forward, despite the pendency of historical claims over all or portions of the Antarctic continent by a dozen different countries. The result of that international deliberation was establishment of the *Antarctic Treaty of 1959*. Phillip C. Jessup and Howard Taubenfeld produced an interpretive book on the value of the Antarctic Treaty as a model for an appropriate legal regime for outer space. Their 1959 book was titled *Controls for Outer Space and the Antarctic Analogy*. David F. Maxwell, Chairman of the American Bar Association's Committee on the Law of Outer Space, assessed the values of the Antarctic Treaty as a precedent for space law in these terms:

> The treaty itself fulfills the highest hopes of mankind. Forged on the anvil of long and tedious negotiation, it epitomizes the ultimate in diplomatic achievement. Its terms embody all the guideposts necessary to ensure the exploration of Antarctica for the benefit of all mankind – limiting specifically its use for peaceful purposes, prohibiting any measure of a military nature, establishing freedom of scientific investigation, facilitating the exchange of information among participating countries, and providing for an inspection system to ensure compliance.[14]

Haley was unable to camouflage his opinion. In an immediate following declaration of his views, Haley wrote emphatically:

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[13] *Id. at* 75.

[14] David F. Maxwell, *Outer Space – The Key to World Peace Under Law*, FOURTH COLLOQUIUM ON THE LAW OF OUTER SPACE 15, 22 (University of Oklahoma Research Institute, Norman Oklahoma, 1963).

> Seen in proper perspective, this treaty, the supposed archetype for the problems of space law, is no more than the grandest internationally agreed upon "question-begging" that diplomacy has devised. To allay and minimize the problems that did, *and still do* [in 1963], exist in Antarctica, this treaty was drawn up. To ascribe to the treaty so high a place in the efforts of international diplomacy as Mr. Maxwell suggests would, in this author's opinion, encourage the taking of just such temporary and stop-gap measures in the area of our immediate space problems – prime among which is the problem of national sovereignty.

Despite the fact that Haley repeatedly wrote of outer space as preferably enjoying the status of free and equal use by all, *res communis*, as practiced on the high seas, he seems preoccupied here by an apparent conviction of the absolute need for some form of control of territory on celestial bodies. As matters developed, the Antarctic analogy was largely reflected in the Outer *Space Treaty of 1967*, and in the subsequent operation of that treaty. What appeared doable to some was apparently far preferable in 1967 to trying to resolve at the outset the long-term issue of how property ownership would be established in space.

All are free to use the high seas. All are welcome and able to take from the seas marine life, which, when it is secured, is considered owned by the extractor. Similarly, it appears to this author that materials reduced to use in space should be considered owned by the extractor who has expended the cost and exerted the energy to accomplish the extraction. The user gains no title to territory, nor any right to exclude others from similar pursuit on the basis of equality.

Haley's apparent desire was to find a way to administer property ownership in space, but his health denied him the opportunity to work that problem, because he died just three years after publishing the book, and one year before the *Outer Space Treaty of 1967* entered into force. It is unfortunate that as we consider how far we have not come since 1963, we can see how disappointed Haley would have been, had he lived. He wrote that "[a]dvancement in technology could well be the necessity

that will mother the invention of a one-world mentality."[15] It was a pious and worthy hope, but humankind may be further from its realization today than we were in 1963!

SPACE VEHICLE REGULATION

Chapter 6 of Haley's book[16] is devoted to "Space Vehicle Regulation." Therein are presented administrative issues and the need for administrative regulations and laws. Haley pointed out and discussed eventual needs for national and international registration of spacecraft, licensing of departing spacecraft, preflight inspections, regulation of dangerous instrumentalities, all of which point to the need for an international administrative body, of which Haley described the desired nature and composition. He also discussed the need for a mechanism to deal with judicial inquiry and settlement of disputes. After briefly exploring subjects including the roles of UN specialized agencies, police power and the problem of enforcement, dealing with trespass and nuisance in outer space, liability, the statute of limitations, and allowance of egress to space, the chapter concluded with a few pages summarily treating military uses of outer space.[17] The problems of what constitute "peaceful uses," the undeniable right of a nation's self defense, and the need to limit military uses of space were discussed, but no immediate solutions were identified. Haley concluded:

> military considerations cannot be completely ignored, and nations must evaluate carefully the positions they wish to take and the extent to which military policy is to be dovetailed with technological and scientific long range planning.[18]

One may speculate that Haley would have been pleased to see the particular proscriptions of certain classes of military activities expressly forbidden in space by the language of Article IV of *the Outer Space Treaty of 1967*.[19]

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[15] SPACE LAW AND GOVERNMENT, *supra* note 1, at 134.
[16] *Id.* at 136-158.
[17] *Id.* at 154-158.
[18] *Id*. at 158.
[19] Outer Space Treaty, *supra* note 5, at art. IV provides:

SPACE COMMUNICATIONS

Chapter 7 of the book addresses "Space Communications." It begins with basic technical information describing the elements of a radio system and the nature of the radio magnetic spectrum. Haley then included a substantial section describing the various uses of space communication technologies and the attendant need for international cooperation to obtain and maintain order in the use of the radio magnetic spectrum. Haley traced the history of the efforts, in many of which he was directly involved, to accomplish internationally agreed allocations for space communications. The chapter then explored trends and requirements of future developments in space communications and the enabling technologies emerging. Haley described the recently adopted *Communications Satellite Act of 1962* and explained its rationale and limitations. What emerges from a reading of this chapter is a clear awareness that Haley, by experience and interest, had gained more information about the interactions and interdependence of space law and satellite communications than any comparable topic or area addressed by this book. Haley knew more about the communications issues and the communication laws than he ever did about any other area of demanding, immediate problems emerging in the space field. The more than 70 pages of Chapter 7 constitute a remarkably thorough primer on the technology of space radio as well as a broad and detailed presentation of the existing and the needed provisions of national and international laws to permit

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States Parties to the Treaty undertake not to place in orbit around the earth any objects carrying nuclear weapons or any other kinds of weapons of mass destruction, install such weapons on celestial bodies, or station such weapons in outer space in any other manner.

The Moon and other celestial bodies shall be used by all States Parties to the Treaty exclusively for peaceful purposes. The establishment of military bases, installations and fortifications, the testing of any type of weapons and the conduct of military maneuvers on celestial bodies shall be forbidden. The use of military personnel for scientific research or for any other peaceful purposes shall not be prohibited. The use of any equipment or facility necessary for peaceful exploration of the moon and other celestial bodies shall also not be prohibited.

orderly progress to occur. Discussion in Chapter 7 eventually focuses on the legal aspects of communications by satellite. This is a topic area to which Haley had apportioned a great deal of his professional time and energy. From early in the 1950s Haley was urging the U. S. and other governments to pay attention to the absolute need, in fact the *enabling need* for clear, internationally agreed radio frequency allocations to permit interference free space flight and activities in outer space.

In his early insistence on the need to establish international agreement relating to radio usage, Haley was absolutely correct. He was instrumental during his lifetime in proposing and obtaining international agreement to numerous space-related radio allocations and regulations. Haley wrote extensively about these matters. In early 1966, shortly before his death, he personally compiled many of his relevant articles and papers concerning satellite communications, and produced them as a self-published book, entitled *Satellite Communications*. As the senior partner of the law firm Haley, Bader and Potts, Haley would from time to time employ law clerks in the firm to assemble and prepare materials for publication. His book on satellite communications, containing descriptions of all his earlier work on satellite communication matters, was a limited publication with hard covers binding duplicated papers and article reprints expediently assembled in an Acco fastener binding. The book is an impressive and comprehensive collection on which publication processing time ran out, because of his rapidly failing health. Andrew Haley died September 10, 1966, shortly after he released his final book, *Satellite Communications*.

LIABILITY FOR DAMAGES

Chapter 8 of *Space Law and Government* is devoted to issues of "Liability for Personal and Property Damages in Space Activities." In the author's Preface, Haley notes that he was assisted by Ibrahim Shihata of Harvard University, a specialist in liability issues, who prepared a draft describing liability and personal property issues existing in 1963 and anticipated for the future. This chapter of the book is undoubtedly the most thoroughly researched and documented legal discussion in the work.

In a book review of *Space Law and Government* I wrote in 1965,[20] I noted that this chapter was the only one in the book, which I believed then and still do believe, could stand on its own merit as a legal treatise of a relevant subject area of space law.

FORENSICS, JURISPRUDENCE AND CONTAMINATION

Haley then turned in Chapter 9 to "Space Medical Jurisprudence." The opening sentence of the preamble to the chapter reads: "[t]he development of forensic medicine in space has been a seriously neglected topic in space literature." It was Haley's intention with this chapter to heighten the sensitivity of not only space travelers, but that of the eventual authorities who will be required to deal with forensic medical issues in space in due course.

The chapter is largely reportorial, describing a good deal of fascinating history, looking back into the annals of medicine for millennia. A future need for forensic medicine in space is postulated, but there are no specific recommendations of action to accomplish necessary means to provide forensic space medicine. The chapter also discussed at some length the issues of contamination and back contamination and the attendant requirements of decontamination of artifacts to be sent to space, and the careful handling and quarantine required for artifacts or materials returned from space. In connection with control of contamination Haley offered eight recommended courses of action to obtain and insure sterilization of objects and seven supplementary actions, all intended to avoid contamination, including recommendations for dealing with newly discovered life forms. The chapter then described international actions up to 1963, including the establishment of the *ad hoc* Committee on Contamination by Extraterrestrial Exploration (CETEX) by the International Council of Scientific Unions (ICSU) in March 1958. Shortly thereafter, in 1959, ICSU established its standing Committee on Space Research (COSPAR), as an institution to follow-up and further develop the international cooperation in

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[20] Stephen E. Doyle, book review, *Space Law and Government. By Andrew G. Haley. New York: Appleton-Century-Crofts, 1963. Pp. xvii, 584*, 1965 DUKE L. J. 214, 217 (1965).

space related activities initiated during the 66-nation cooperative International Geophysical Year (IGY) of 1957-58. COSPAR assumed the jurisdiction of the contamination issues formerly assigned to CETEX. Haley's international focus is then brought to the questions of personal injury and criminal behavior in space. Observing the total lack of useful experience to deal with such issues, Haley concluded that: "[f]inally, with respect to the criminal aspects of space medical jurisprudence, in all probability new methods of detecting and proving criminal offenses involving human beings will have to emerge, through further scientific investigation and refinement of methods." One could fairly question today, in 2013, if we have come very much further than Haley was in 1963 in our understanding of or willingness to address the topic of space medical jurisprudence.

INTERGOVERNMENTAL ORGANIZATIONS

For several years during the 1950s Haley served on and as chairman of the International Astronautical Federation's (IAF) Committee on International Relations. He assumed a responsibility, diligently pursued, to bring the IAF into formal relationships with many of the existing international organizations with an interest in astronautical affairs. In identifying the organizations in the international community which he sought to work with, he also tells of his efforts to achieve cooperation. Chapter 10 contains a history and description of Haley's work to engage intergovernmental organizations with interests in astronautics into working relationships with the IAF. Within the United Nations Organization he described the General Assembly and the Economic and Social Council (ECOSOC), and went on to describe his efforts with the Educational, Scientific and Cultural Organization (UNESCO), the international Civil Aviation Organization (ICAO), the International Telecommunication Union (ITU), and the World Meteorological Organization (WMO). Haley concluded this section of the work addressing the United Nations Committee on the Peaceful Uses of Outer Space, including the initial *ad hoc* committee, as well as the creation and early growth of the permanent committee on outer space.

Other organizations are described and discussed briefly, including the International Council of Scientific Unions (ICSU) and its Committee on Space Research (COSPAR), and Haley concluded this tour of governmental organizations with discussion of the National Aeronautics and Space Administration, its associated National Aeronautics and Space Council, and the Congressional committees assigned oversight of astronautics in the U. S. House of Representatives and the Senate. There was still relatively little else to report of a governmental or intergovernmental nature, because the eventual emergence of the International Telecommunications Satellite Organization (INTELSAT); the International Maritime Satellite Organization (INMARSAT); and regional organizations such as the Arab Satellite Telecommunications Corporation (ARABSAT), the European Space Agency (ESA), and International Communications Satellite Organizations among the then Communist countries (INTERSPUTNIK) were yet to be formed as of 1963.

NONGOVERNMENTAL ORGANIZATIONS CONCERNED WITH ASTRONAUTICS

Chapter 11 takes up "Nongovernmental Organizations." This portion of the book expands on an earlier record of the involvement of Haley in the founding, promotion and development of international organizations and programs of cooperation in astronautics. In an earlier book, published in 1958,[21] Haley told not only of his international efforts to establish the International Astronautical Federation, but also his leadership roles in the American Rocket Society and other nongovernmental forums such as the American Bar Association. Haley's writings on astronautics from the outset in the 1950s placed heavy emphasis on the need for international attention to the needs of and international cooperation in realizing the benefits of astronautics. After he left the Aerojet Engineering Corporation in California and returned to law practice in Washington, D. C., Haley assumed continually increasing roles in the American Rocket So-

[21] ANDREW G. HALEY, ROCKETS AND SPACE EXPLORATION: THE INTERNATIONAL STORY (Van Nostrand, 1958).

ciety (ARS), serving during the 1950s sequentially as Vice President, President, as a Director, as General Counsel and as Chairman of the Board of the ARS. His senior positions in the ARS management structure facilitated his early involvement in the founding of the International Astronautical Federation (IAF). He also served in the 1950s as a Vice President, the President, and the General Counsel to the IAF. Among Haley's crowning achievements in the international field, he was instrumental in creating the International Academy of Astronautics in 1960 and in founding the International Institute of Space Law the same year.

Today, it cannot be denied that the benefits of astronautics are shared among the nations of the Earth through the efforts of multiple international organizations; organizations which Haley never named in particular, but organizations Haley projected as essential to bring the benefits of space endeavors to humanity. As significant example of relevant international organizations we can name the European Space Agency (ESA), the International Telecommunications Satellite Organization (INTELSAT), the International Maritime Satellite Organization (INMARSAT), the Arab Communication Satellite Corporation (ARABSAT), the European Telecommunication Satellite Organization (EUTELSAT), The European Meteorological Satellite Organization (EUMETSAT), and the *International Space Station* (ISS) consortium, among others.

There are in addition numerous regional cooperative ventures and bilateral cooperative programs, as well as a thriving international competitive market in the provision and sale of rocket launch services, purchased from among nations in an open competitive market. There are also internationally competitive services for imaging and remote sensing of the Earth, and for navigational services covering most of the Earth's surface. This extensive expanse of international cooperative activities are certainly not attributable to Andrew Haley, but without his vision and efforts in the 1950s it is likely that much of what we collectively enjoy from astronautics today could not have been so readily realizable in so short a period.

METALAW

Chapter 12 presents Haley's proposal of 'Metalaw,' subtitled "The Possibility of other World's with Intelligent Life." This subject has been extensively discussed by other authors in the intervening years since 1963, and another paper in the current number of this Journal is addressing the topic thoroughly.[22] Consequently we will not spend time or effort here, which would only duplicate the work of others.

A REFERENCE LIBRARY ON ASTRONAUTICS FROM 1963

Space Law and Government concluded with more than 110 pages of texts gathered in Appendices, which are well worth considering in their individual significance and importance to astronautics, as well as to Haley. The Appendices include:

I. International Conventions, Agreements, Resolutions and Proposals

A. The Antarctic Treaty of 1959.
B. Int'l. Telecommunication Union, Radio Regulations (Geneva, Dec, 1959)
C. Radio Frequency allocations proposed by the International Astronautical
D. Federation (1959)
E. Extracts of a Kennedy/Khrushchev letter Exchange (March 1962)
F. Joint Communique on US/Soviet Talks (June 1962)
G. Significant Recent United Nations Documents: eight are included.
H. Preliminary Views of the US for Frequency Allocations for Space Radio Communications (extracts)
I. Proposed Program for Preparation for the ITU 1963 Extraordinary Radio Advisory Conference (EARC, Geneva, 1963).
J. Was left blank.

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[22] George S. Robinson,*The Biochemical Foundations of Evolving Metalaw: Moving at a Glance to the Biological Basis of Sentient "Essence"*, 39(1) J. Space L. 181 (2013).

K. United States and International Action in the International Consultative Committee on Radio (CCIR) and International Telecommunication Union on Space Telecommunications.

II. United States Laws

A. National Aeronautics and Space Act of 1958, as amended.
B. Communications Satellite Act of 1962

III. International Organizations

A. Constitution and Member List of the International Astronautical Federation
B. Statutes and Structure of the International Academy of Astronautics
C. Statutes of the International Institute of Space Law
D. Charter of the Committee on Space Research of ICSU
E. CCIR Study Groups of the ITU

IV. Miscellaneous

A. Definitions of "Atmosphere" and "Air"
B. Abbreviations and Acronyms

V. Bibliography

A. Bibliographies of Space Legal Literature
B. Selected and Partial Bibliography of the works of the Author

SUMMARY AND CONCLUSION

In the author's Preface Haley gave credit to the editorial assistants he had working in his firm on the texts of chapters 1, 2, 3, 5, 10, and 11.[23] He also gave explicit recognition to his assistant in developing Chapter 8.[24] By implication, it is quite clear that Haley considered himself the lead author and editor of chapters 4, 6, 7, 9 and 12. Much of his original thinking and projections of problems and solutions are found in that latter list of chapters.

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[23] SPACE LAW AND GOVERNMENT, *supra* note 1, at xv.
[24] *Id.* at xvi.

Throughout *Space Law and Government* one finds that the lawyer Haley is also the industrialist Haley, the technician Haley, and the historian Haley. The title of the book does not reflect the extensive content of useful background of history and technology in each topic area. From our perspective of 50 years later in time, this 1963 book remains a valuable reference source, as well as a broad and reliable picture of the state of law and government related to outer space activities in 1963.

"SPACE TRASH": LESSONS LEARNED (AND IGNORED) FROM SPACE LAW AND GOVERNMENT

James E. Dunstan[*]

Then, too, the Soviet Union and the United States have already sent into outer space many vehicles which are not controllable. A collision in which two orbital bodies would hit and exfoliate, but continue in some irregular orbit for many more hundreds of years, would constitute a threat to life and property in outer space-and many similar threats are possible. Objects have been placed in orbit-both satellite vehicles and spent rocket stages-that could come back to earth at almost any place. Such objects might land on the Kremlin, on the Vatican, or on Buckingham Palace; as far as the dispersion factor is concerned, we still do not know enough. We do know that satellites do not come back as small particles or completely exfoliated, because they would burn up; but objects in space may come back as great chunks if they were large enough to start with and if they are not brought down in a controlled re-entry. Finding answers to these problems, naturally, is not easy. Ideally, however, no objects should be allowed to go into outer space without a code of law requiring that they be controllable; they should be earth-returnable, or capable of being projected into orbits around the sun or into

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[*] James E. Dunstan began his legal career in 1983, joining Andrew G. Haley's firm Haley, Bader & Potts upon graduation from the Georgetown University Law Center, where he was the first chairman of the Georgetown Space Law Group. Jim matured as a young lawyer steeped in stories of the exploits of "Uncle Andy" (since Andrew G. Haley was the uncle of Michael Haley Bader, then the senior partner at Haley Bader & Potts, along with Bill Potts, who writes separately in this edition of the *Journal of Space Law*). Jim became a partner at Haley Bader & Potts in 1988, and served at its Finance Partner for ten years until the members of Haley Bader & Potts joined Garvey Schubert Barer in 2000, where Jim served as head of the Telecommunication and Information Technology group for five years. Jim left Garvey in 2010 to found Mobius Legal Group, PLLC. Dunstan first wrote about Haley's *Space Law and Government* in 1987, in "*Space Law and Government: A Generation Later,*" Proceedings of the Eighth Princeton/Space Studies Institute Conference on Space Manufacturing (AIAA, 1987). The author wishes to thank Ryan T. Noble for assisting in the research and retrieval of key original source materials that went into this article.

> *some other area where they could not be injurious to life, property, and near-terrestrial navigation.*[1]

Absent the outdated reference to the Soviet Union and its iconic seat of power, the Kremlin, the quote above is as true today, in 2013, as it was in 1963, when it appeared in Andrew G. Haley's seminal work, *Space Law and Government*. Fifty years after Haley warned of the dangers of "space trash,"[2] we now face a reality of tens of thousands of pieces of orbital debris spinning over our heads,[3] a permanently manned space station that regularly must alter its orbit to avoid the possibility of a collision,[4] and expert opinions that range from a prediction that some orbits may soon be dangerously cluttered, to others who claim that we may already be experiencing the beginnings of the "Kessler Syndrome,"[5] wherein an ever-increasing cascade of orbital collisions renders parts of space unusable.

If "space trash" was identified by Haley as a potential problem back in 1963, what happened (or didn't happen) in the intervening fifty years to put us in the current position where billions of dollars of space assets[6] are at risk of loss and we have scant hope of solving the problem within the next decade? This article will assess the current problem of orbital debris, analyze what Haley said about the problem (and potential solutions) in 1963, track the development of international law and policy in this area over the past half-century, and in the end propose potential actions that could be taken at the domestic and international level to deal with the orbital debris problem.

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[1] ANDREW G. HALEY, SPACE LAW AND GOVERNMENT 11 (Meredith Press, 1963).

[2] *Id.* at 206. "As we must deal with the conservation and safety of life and property, a second and more serious long-range problem must also be considered, namely, the continued orbiting of man-made space vehicles for periods of undetermined length-extending even to centuries or millennia. This uncontrollable 'space trash' will constitute a hazard to safety of life and property in outer space as long as it continues in orbit."

[3] *See infra,* Section I.

[4] *Id.*

[5] *Id.*

[6] The total "space economy" in 2009 was estimated to be between $150 and $165 billion dollars per year, much of that generated by the space assets in orbit. *See* OECD, *Executive Summary*, *in* THE SPACE ECONOMY AT A GLANCE 2011 (OECD Publishing, 2011).

I. THE MAGNITUDE OF THE CURRENT ORBITAL DEBRIS PROBLEM

Space is big, there can be no doubt of that. For instance, the total area of the 800 kilometer orbital sphere[7] encompasses 664 million square kilometers (or 411 million square miles) of area. Were the approximately 1000 currently operating satellites all bunched in this one orbit (which they obviously are not), each would have some 664,000 square kilometers (411,000 square miles) in which to operate.[8] The mindset of many in the early years of spaceflight was that space was so vast that the likelihood of two objects actually colliding was so remote as to not be worth worrying about, and certainly not worth taking into consideration when planning space activities. This became known as the "Big Sky" theory of space operations.[9] Recent debris generating collisions (both accidental and intentional) have demonstrated, however, that the days of the "Big Sky" theory are relegated to the pages of history, if the theory ever had any validity to begin with. Today satellites must operate in orbits that not only contain 1000 other operating satellites, but 50

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[7] The 800 kilometer orbit was chosen for this calculation because it is considered one of the more crowded orbits. *See infra*, Section I.

[8] This calculation is a significant oversimplification since in addition to assuming that the approximately 1000 operating satellites all occupy the 800 kilometer orbit, the calculation assumes that all are exactly orbiting on the surface of a perfect sphere 800 kilometers above the mean surface of the Earth (and hence 7271 kilometers above the center of the Earth). Therefore, it only calculates the square kilometers surface area of the sphere. Since satellites don't operate at exactly the same orbital altitude, even within a designated orbit, and since orbits aren't entirely circular (the apogee – or high point – of an orbit is usually slightly different than the perigee – or low point), to be more accurate the calculation should be made using a three dimensional slice of sphere centered around 800 kilometers above the surface of the Earth, making the amount of "Big Sky" surrounding each satellite appear much larger. However, what also makes the calculation incorrect is the assumption that somehow all of satellites are flying "in formation," while in reality, they are orbiting in a variety of directions (predominately West to East, North to South (polar) or South to North (polar)), such that their orbits cross each other.

[9] The origin of the term "Big Sky" is unknown. Most likely it comes from aviation traffic modeling where the assumption is that two randomly flying bodies are unlikely to collide because of the size of the three dimensional space in which they operate. The earliest reference this author can find to such a theory being applied to space is the SURVEY OF SPACE LAW, STAFF REPORT OF THE SELECT COMMITTEE ON ASTRONAUTICS AND SPACE EXPLORATION, H. R. DOC. NO. 89, 86TH CONG., 1ST SESS., at 7 (1959) [hereinafter SURVEY OF SPACE LAW] (where Dr. John P. Haden, the director of Project Vanguard is quoted as saying "space is a very big area").

years' worth of rocket bodies, derelict satellites, and the flotsam and jetsam caused by on-orbit explosions[10] and even routine space deployment activities, where pieces just float away from a vehicle while deploying payloads or during normal operation.[11]

The United States Strategic Command's (USSTRATCOM's) Joint Space Operations Center (JSpOC) is tasked with tracking all objects in space.[12] According to its website,[13] since Sputnik was launched by the Soviets in 1957, JSpOC has cataloged more than 39,000 man-made objects in space, and it is currently tracking more than 16,000 objects orbiting Earth.[14] Of these, only five percent (5%), or approximately 800, are functioning payloads or satellites, eight percent (8%) are rocket bodies, and the other 87 percent are either debris or inactive satellites.[15] This translates into a situation where at most, only five percent of the objects currently being tracked have the ability to take any action (such as changing orbits) to avoid a potential collision, even if notified in time to take action. The remaining 15,000 objects, ranging in size from bus-size down to bullet-sized (or smaller), whiz around the earth at more than 17,500

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[10] Between 1961 and 1995, for instance, 124 fragmentation events were cataloged. *See* Office of Science and Technology Policy, *Interagency Report on Orbital Debris,* 12 (Nov. 1995), *available at* http://orbitaldebris.jsc.nasa.gov/library/references.html.

[11] One of the earliest and most publicized pieces of space debris was NASA astronaut Ed White's glove, which he lost on the first American spacewalk during the Gemini 4 flight (June 3, 1965). *See* National Aeronautics and Space Administration, *Gemini 4*, http://nssdc.gsfc.nasa.gov/nmc/masterCatalog.do?sc=1965-043A (last visited Sept. 12, 2013). Fortunately, the Gemini 4 capsule was orbiting at a relatively low altitude (166 x 290 km orbit), such that the glove reentered the atmosphere within a month. For a look at eight interesting (tagged as "weird) pieces of orbital debris, *see* Clara Moskowitz, *Lost in Space: 8 Weird Pieces of Space Junk*, WIRED (Feb. 13, 2013), http://www.wired.com/wiredscience/2009/02/spacestuff/.

[12] *See Threats From Space: A Review of U.S. Government Efforts To Track and Mitigate Asteroids and Meteors* (Mar. 19, 2013) (testimony of General William L. Shelton before the U.S. House of Representatives Committee on Science, Space and Technology), available at http://www.hq.nasa.gov/legislative/hearings/2013%20hearings/3-19-2013%20SHELTON.pdf.

[13] U.S. Strategic Command, *USSTRATCOM Space Control and Space Surveillance*, http://www.stratcom.mil/factsheets/USSTRATCOM_Space_Control_and_Space_Surveillance/ (last visited Sept. 12, 2013).

[14] *Id.* In comparison, in 1995, when the first comprehensive study of orbital debris was conducted by the United States government, U.S. Space Command was tracking less than 8,000 objects. *See Interagency Report on Orbital Debris, supra* note 10, at 5.

[15] *Id.*

miles per hour without the ability of anyone to control their orbits.

The Union of Concerned Scientists (UCS) also keeps a database of functioning space objects, and as of December 1, 2012, lists 1,046 operating satellites (about 25 percent more than appear in the JSpOC database).[16] As discussed below, the impact of orbital debris is truly global in nature. The oldest satellite still operating, according to the UCS database, is the AMSAT/OSCAR 7 satellite, launched November 15, 1974.[17] Of the 1046 operating satellites cataloged by UCS, 455 are operated by the United States, 110 by Russia, and 107 by China, leaving 374 satellites in the hands of other countries. Indeed, a review of the database reveals that 47 countries currently exclusively or jointly control operating satellites.[18] Given that there are 192 member countries in the United Nations,[19] this means that nearly 25 percent of all UN members currently have operating satellites in orbit (before even including nations that have access to satellite assets and operations through their membership in international organizations and consortia).[20] In

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[16] Union of Concerned Scientists, UCS Satellite Database, http://www.ucsusa.org/nuclear_weapons_and_global_security/space_weapons/technical_issues/ucs-satellite-database.html (last visited Sept. 12, 2013). As discussed more fully in this section, the disparity between the number of satellites cataloged by the Union of Concerned Scientists and JSpOC raises questions, if not significant concerns, as to which of these lists is accurate, and why the databases differ so significantly.

[17] *Id.*

[18] *Id.* The UCS database lists the following countries as either individually or jointly operating satellites (which does not include international consortia): Algeria (1), Argentina (10), Australia (5), Belarus (1), Belgium (2), Brazil (9), Canada (22), Chile (1), Denmark (1), Egypt (3), France (16), Germany (21), Greece (3), Hungary (1), India (28), Indonesia (7), Iran (1), Israel (9), Italy (14), Japan (43), Kazakhstan (1), Luxembourg (17), Malaysia (5), Mexico (4), Morocco (1), the Netherlands (10), Nigeria (3), Norway (5), Pakistan (2), Philippines (1), Saudi Arabia (10), Singapore (3), South Korea (5), Spain (10), Sweden (4), Switzerland (2), Taiwan (8), Thailand (4), Turkey (4), Ukraine (1), United Arab Emirates (5), United Kingdom (21), Venezuela (2), Vietnam (2). In addition, the UCS database lists 52 satellites as operated by "Multinational," including those operated by the Arab Satellite Communications Organization (ASCO), the European Telecommunications Satellite Consortium (EUTELSAT), and the Regional African Satellite Communications Organization (RASCOM). Because of the joint operation of a number of satellites and 17 satellites listed under the European Space Agency, the total number listed above exceeds the total of 1046 currently operating satellites as of December 1, 2012.

[19] UN, *Member States*, http://www.un.org/en/members/ (last visited Sept. 12, 2013).

[20] *See supra,* note 14.

contrast, the United Nations, which is tasked under the Registration Convention[21] to keep a registry of objects launched into space, lists only 42 nations as having notified them of placing an object into orbit above Earth.[22] On the UCS list but not on the United Nation list are nine countries: Belarus, Belgium, Indonesia, Iran, Morocco, Norway, Singapore, Taiwan, and Vietnam. Of these, five are not signatories to the Registration Convention (Iran, Morocco, Singapore, Taiwan and Vietnam). The only country on the UN list but not on the UCS list is Poland, whose notification to the UN indicated that its PW-Sat, launched February 13, 2012, was launched under French and ESA auspices.

There is also a significant difference between the JSpOC-identified number of 16,649 tracked objects,[23] and the number of tracked objects cited by NASA's Orbital Debris Program Office,[24] which reports that more than 21,000 pieces of orbital debris larger than 10 centimeters are "known to exist."[25] In addition, NASA's Orbital Debris Program Office ("ODPO") estimates that there are approximately 500,000 objects between 1 and 10 cm,

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[21] Convention on Registration of Objects Launched into Outer Space, *opened for signature* Jan. 14, 1975, 28 U.S.T. 695, T.I.A.S. 8480 (hereinafter Registration Convention]. S*ee infra,* section III(A).

[22] *See* UNOOSA, *Convention on Registration of Objects Launched into Outer Space, Notifications from States & Organizations*, http://www.oosa.unvienna.org/oosa/en/SORegister/docsstatidx.html (last visited Sept. 12, 2013). The United Nation list of notifications including the following countries (ESA and the European Organization for the Exploitation of Meteorological Satellites (EUMETSAT) are omitted): Algeria, Argentina, Australia, Brazil, Canada, Chile, China, Czech Republic (includes information from Czechoslovakia), Democratic People's Republic of Korea (North Korea), Denmark, Egypt, France, Germany (includes information from the Federal Republic of Germany), Greece, Hungary, India, Israel, Italy, Japan, Kazakhstan, Luxembourg, Malaysia, Mexico, The Netherlands, Nigeria, Pakistan, Philippines, Poland, Republic of Korea (South Korea), Russian Federation (includes information from the Union of Soviet Socialist Republics), Saudi Arabia, Spain, Sweden, Thailand, Turkey, Ukraine, United Arab Emirates, United Kingdom of Great Britain and Northern Ireland, United States of America, and Venezuela.

[23] 17(2) ORBITAL DEBRIS Q. NEWS (NASA) 10 (Apr., 2013) (citing U.S. Space Surveillance Network data), http://orbitaldebris.jsc.nasa.gov/newsletter/pdfs/ODQNv17i2.pdf.

[24] NASA Orbital Debris Program Office, *About Us*, http://orbitaldebris.jsc.nasa.gov/faqs.html#3 (last visited Sept. 12, 2013).

[25] NASA Orbital Debris Program Office, *Orbital Debris Frequently Asked Questions #3* (Mar. 2012), http://orbitaldebris.jsc.nasa.gov/faqs.html#3. The difference in number may be explained by the fact that NASA may know of the existence of more objects than JSpOC actually tracks in real-time, or publicly reports.

and more than 100 million objects smaller than 1 centimeter.[26] Orbital debris is concentrated mainly in Low Earth Orbit (LEO), with the most congested (and dangerous) areas being polar orbits around 800 kilometers.[27] A second band of orbital debris exists in the Geostationary (or Clarke) Orbit (GEO).[28]

Of the JSpOC-tracked orbital debris, the source of such debris is not uniform across operating countries, as depicted in Table 1 below:

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[26] Even small objects can cause damage or destruction to a satellite, given that the relative impact speed of two bodies in orbit are on the order of 10 kilometers a second (or close to 20,000 miles per hour). NASA Orbital Debris Program Office, *Orbital Debris Frequently Asked Questions* #7 (Mar. 2012), http://orbitaldebris.jsc.nasa.gov/faqs.html#7. Items as small as paint flecks have been known to cause damage in space (including requiring the replacement of a Space Shuttle window after STS-7 was struck while on-orbit. NASA, *International Space Station*, http://www.nasa.gov/mission_pages/station/news/orbital_debris.html (last visited Sept. 12, 2013).

[27] J. Liou and N. Johnson, *A Sensitivity Study of the Effectiveness of Active Debris Removal in LEO,* IAC-07-A6.3.05 (2007), http://ntrs.nasa.gov/archive/nasa/casi.ntrs.nasa.gov/20070013702_2007011170.pdf. Polar orbits present the highest likelihood of "conjunctions" because each satellite crosses the North and South Pole on each orbit. These "choke points" above the poles increase dramatically the chances that two satellites flying at the same altitude could collide. *See* J. PELTON, SPACE DEBRIS AND OTHER THREATS FROM OUTER SPACE 70 (International Space University, 2013).

[28] *Id.*

Table 1: Payloads and Debris By Contributing Country							
Country of Origin	Payload	Rocket Bodies & Debris	Total	Percent of all Payloads in Space	Percent of Orbital Debris Generated	Ratio of Debris to Payload[29]	Ratio of Debris to Payloads (minus major accidents)[30]
China	140	3612	3752	3.90%	27.65%	25.80	5.37
ESA	42	46	88	1.17%	0.35%	1.10	1.10
France	56	442	498	1.56%	3.38%	7.89	7.89
India	49	125	174	1.37%	0.96%	2.55	2.55
Japan	125	83	208	3.48%	0.64%	0.66	0.66
Russia	1427	4830	6257	39.77%	36.98%	3.38	1.63
USA	1134	3804	4938	31.61%	29.12%	3.35	1.15
Other	615	119	734	17.14%	0.91%	0.19	0.19
	3588	13061	16649	100.00%	100.00%		

As can be seen from this list, there is a significant difference in the amount of debris created per satellite orbited depending on which country is analyzed. To be slightly more fair to China, Russia and the United States, the large debris numbers associated with each is attributable to two major space incidents, as described by NASA's ODPO:

> Prior to 2007, the principal source of debris was from explosions of old launch vehicle upper stages left in orbit with stored energy sources, e.g., residual propellants and high pressure fluids. The intentional destruction of the Fengyun-1C weather satellite by China in 2007 and the accidental collision of American and Russian communications satellites in 2009

[29] This represents the ratio of debris created to payloads orbited. So in the instance of China, while they currently are operating 140 payloads (satellites) in orbit, they have created 3,612 trackable pieces of debris, or 25 pieces of debris created for each payload orbited.

[30] For this calculation, the debris created by China by its Fengyun FY-1C ASAT test is removed from the equation, as are the debris created by the collision of the Iridium 33 and COSMOS 2251 satellites, both discussed more fully below.

> greatly increased the number of large debris in orbit and now represent one-third of all cataloged orbital debris.[31]

More specifically, China's very high debris numbers in Table 1 are a result of its anti-satellite "test" conducted January 11, 2007, when the Chinese used a kinetic kill vehicle to destroy its nearly one-metric ton Fengyun FY-1C weather satellite, which was in a polar orbit of 865 kilometers, resulting in at least 2,300 new pieces of orbital debris that is being currently tracked, and an estimated 150,000 pieces larger than 1 centimeter,[32] very little of which had reentered the atmosphere.[33] Indeed, a piece of FY-1C was reported to have struck the Russian BLITS ("Ball Lens in The Space") laser-ranging satellite, which weighed only 7.35 kg, on January 22, 2013, splitting BLITS into at least two pieces (and thus creating even more orbital debris).[34]

The second event that underscores the discrepancy between payloads and debris for both the United States and Russia was the collision between the Iridium 33 (a U.S. Commercial satellite with a mass of 560 kg) and retired (derelict) Cosmos 2251 (a Russian satellite with a mass of 950 kg), on February 10, 2009, at an altitude of 789 km. NASA experts now believe the collision created another 2,500 trackable objects.[35] On October 31, 2012, the International Space Station was forced to make a debris avoidance maneuver (DAM), to avoid a fragment from Iridium 33.[36]

Yet even when these two debris-causing incidents are removed, there remains a significant disparity between the major spacefaring nations in terms of debris generation, ranging from

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[31] *Orbital Debris Frequently Asked Questions #3*, *supra* note 25.

[32] 13(1) ORBITAL DEBRIS Q. NEWS (NASA) (Jan. 2009), http://orbitaldebris.jsc.nasa.gov/newsletter/pdfs/ODQNv13i1.pdf.

[33] 12(1) ORBITAL DEBRIS Q. NEWS (NASA) (Jan. 2008), http://orbitaldebris.jsc.nasa.gov/newsletter/pdfs/ODQNv12i1.pdf.

[34] Karl Tate, *Russian Satellite Crash with Chinese ASAT Debris Explained (Infographic)*, SPACE.COM (Mar. 08, 2013), http://www.space.com/20145-russian-satellite-chinese-debris-crash-infographic.html.

[35] 17(1) ORBITAL DEBRIS Q. NEWS (NASA), 4 (Jan. 2013), http://orbitaldebris.jsc.nasa.gov/newsletter/pdfs/ODQNv17i1.pdf.

[36] *Id.* at 3.

a 0.19 payload to debris ratio for the 40-odd "Other" countries to a high of 7.89 payload to debris ratio for France. Again, the numbers and ratios used in this analysis are less important than the demonstration of the fact that orbital debris is a global issue, both in terms of who is creating debris, as well as who might be affected by a future collision in space.

This issue also impacts more than the potential loss of a space asset. NASA has been required to execute maneuvers of the *International Space Station* (ISS) on a regular basis to avoid the chance of a collision (any situation where the conjunction analysis indicates greater than a 1 in 10,000 chance of collision).[37] According to NASA's Orbital Debris Program Office:

> For the first dozen years of its existence, the ISS averaged only one collision avoidance maneuver per year. However, in the past 12 months (April 2011 to April 2012), the ISS was forced to execute four collision avoidance maneuvers and would have conducted two additional maneuvers if the warnings had come sooner.[38]

Obviously, such maneuvers require substantial propellant to be carried out, which must be resupplied from the ground (currently from Russian resupply rockets which NASA must pay for). So there is a very real cost to coping with the current orbital debris problem in LEO.

Finally, and most importantly, the orbital debris situation is not static. While a certain number of pieces of debris reenter the atmosphere each year, countries continue to launch vehicles and create more debris on a yearly basis. Yet this accounts for a relatively slow and somewhat manageable increase in orbital debris. This steady state ecosystem of junk is upset, however, whenever there is a major collision incident, which as discussed above, interjects between 2,500 and 3,500 new trackable pieces of junk per incident. The fear, which is not yet predictable, is if such major collision events continue, there may be a cascading

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[37] *See* NASA Orbital Debris Program Office, *Orbital Debris Frequently Asked Questions* (Mar. 2012), http://orbitaldebris.jsc.nasa.gov/faqs.html.

[38] 16(2) ORBITAL DEBRIS QUARTERLY NEWS (NASA), 1 (Apr. 2012), http://orbitaldebris.jsc.nasa.gov/newsletter/pdfs/ODQNv16i2.pdf.

effect dubbed "the Kessler Syndrome," whereby collision events and new debris occur at exponentially increasing rates creating huge clouds of debris and rendering certain orbits useless because of the clutter.[39]

Heretofore this introduction section outlining the problem presented by orbital debris has only addressed the danger of the potential collision between two physical objects in space. Another danger posed to satellites is from unintentional radiofrequency interference caused by an uncontrollable satellite, whose operator is unable to turn off its radio transmissions.[40] The most recent example of this hazard was posed by the Galaxy 15 satellite operated by Intelsat. It originally occupied the 133° West geostationary position. On April 5, 2010, Intelsat lost control of the satellite, and it began to wander eastward across the geostationary arc, and soon became dubbed the "Zombiesat."[41] There was not a significant probability that it would actually collide with another satellite, but in losing control of the satellite, Intelsat also was unable to turn off its 24 C-Band and 2 L-Band transponders.[42] As Galaxy 15 slowly drifted from the 133° West position ultimately to the 93° West position, it had the potential to significantly interfere with the operation of other C-

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[39] The "Kessler Syndrome" is named after (and not directly by), retired NASA engineer Donald J. Kessler. According to Kessler, the term was coined by a colleague, John Gabbard, a NORAD analyst. *See* Donald J. Kessler, *The Kessler Syndrome* (Mar. 8, 2009), http://webpages.charter.net/dkessler/files/KesSym.html. *See also* Donald J. Kessler & Burton G. Cour-Palais, *Collisional Frequency of Artificial Satellites: The Creation of a Debris Belt*, Paper 8A0210, 83(A6) J. GEOPHYSICAL RES., 2637 (June 1, 1978); Donald J. Kessler, *Collisional Cascading: The limits of population growth in low earth orbit*, 11(12) ADVANCES IN SCIENCE RES., 63-66 (1991). *See also* James Rendleman, *Space Traffic Management – Private Regulation*, *in* PROC. OF THE AIAA SPACE 2012 CONF. & EXPO., n. 6, AIAA 2012-5124 (Sept. 2012), http://arc.aiaa.org/doi/abs/10.2514/6.2012-5124. For a fascinating PBS interview with Donald Kessler about orbital debris and the "Kessler Syndrome," *see* https://www.youtube.com/watch?v=LaKz8VDkDkI (last visited Sept. 29, 2013).

[40] As discussed *infra*, Section II, Haley thought that radiofrequency interference from derelict spacecraft posed the greatest immediate danger to space operations.

[41] *See* Peter B. de Selding, *Attempt to Shut Down Zombie Satellite Galaxy 15 Fails* (May 05, 2010) http://www.space.com/8344-attempt-shut-zombie-satellite-galaxy-15-fails.html (concerning Galaxy).

[42] The C-Band consists of frequencies between 4 and 8 GHz, of which the range between 3.7 to 4.2 GHz used for space-to-Earth communications (downlinks) and 5.925 to 6.425 are used Earth-to-space communications (uplinks). *See* B. ELBERT, INTRODUCTION TO SATELLITE COMMUNICATION 31 (Artech House, Inc., 2008).

Band transponders in the area (not to mention the loss of commercial service provided by Galaxy 15 at the 133° West position). The largest single interference impact was to the SES World Skies AMC-11 satellite, which provides a significant amount of the cable television programming fed to cable systems in the United States.[43] To avoid this interference, SES began maneuvering the AMC-11 satellite on May 26, 2010, to the eastern edge of its 131° West slot, and maneuvered its SES-1 satellite to follow behind Galaxy 15 to take over the transmissions for AMC-11 as it was maneuvered back into position in the center of the 131° West "box."[44] Ultimately, Intelsat regained control of Galaxy 15 on December 23, 2010, and the satellite was successfully moved back to its 133° West position.

From the analysis above, it is very clear that orbital debris is a significant problem, and a problem that is costing the spacefaring nations real money in terms of lost assets and station-keeping fuel to conduct avoidance maneuvers. It is also clear that this is not a problem impacting only the relatively few nations that actually have launch capabilities. With fully one-quarter of the nations of the world operating space assets, and virtually every country benefitting from the services delivered from space assets (everything from communications, to weather data to environmental remotes sensing to location services), orbital debris is an international problem of the highest order. The question then becomes, did this problem sneak up on the world, or was it simply ignored and the hard questions avoided during the first fifty years of spaceflight? For this, we must turn back to *Space Law and Government*, to see what Andrew

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[43] *See* Jeff Hill, *Intelsat Wins GAO CBSP Decision; Warns Galaxy 15 May Drift into AMC 11 Orbit* (May 13, 2010), SATELLITETODAY.COM, http://www.satellitetoday.com/st/topnews/34137.html.

[44] For an excellent animation of the maneuver, *see* http://www.youtube.com/watch?v=wVp8UNnG3YE. This author has discussed the maneuver with a number of aerospace engineers familiar with geostationary satellite operations, and they estimate that the maneuver required between one and six months of station-keeping fuel for AMC-11. Thus, while there was no direct cost to any satellite operator of the Galaxy 15 "Zombiesat," the useful life of AMC-11 may be cut short by as much as half a year, and for a satellite that was placed into service in 2004 and well into the second half of its estimated 15 year useful life, potential lost revenues from an early termination of AMC-11 could be significant.

G. Haley had to say about the potential problem, and the logical solutions to avoid the situation we now face.

II. HALEY'S ANALYSIS OF THE 'SPACE TRASH' PROBLEM IN 1963 AND PROPOSED SOLUTIONS

Haley covered a wide variety of legal issues in *Space Law and Government*, and "space trash" was not one of main foci of the book. Yet the analysis he undertook on a variety of issues related to space law (e.g., where does space begin,[45] freedom of overflight,[46] liability for accidents,[47] and even *metalaw*[48]) provides keen insight as to the state of space law just six years into the space age. While many agree that *Space Law and Government* was the first comprehensive text on the law of outer space, Haley spent a substantial portion of the book documenting the efforts underway at that early stage of spaceflight to address significant legal issues, and cited to significant international[49] and U.S. government efforts to catalog and analyze space law issues.[50] Yet in noting this work, Haley understood the politics of the time, and that space could become the "high ground" of the Cold War. His strong reaction to this is best quoted in its entirety here, because it presages the development of international policy on orbital debris, without Haley even knowing it.

> It is unfortunate too, that the work of the United Nations Legal Committee, the Committee on the Law of Outer Space of the American Bar Association, and the USSR Juridical Committee on Cosmic Law, should thus far be encyclopedic in nature-with the result that these great forums are failing to con-

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[45] *See* SPACE LAW AND GOVERNMENT, *supra* note 1, at 75-117.

[46] *Id.* at 40-61.

[47] *Id.* at 233-265.

[48] *Id.* at 394-424.

[49] *See, e.g., id.* at 314-333 (discussing the 1959 report on the U.N.'s then-ad hoc Committee on the Peaceful Uses of Outer Space, U.N. Doc. A/4141 (1959) (hereinafter 1959 COPUOS Study), which addressed many of the issues discussed in *Space Law and Government*. Interestingly, that 1959 report did not specifically identify orbital debris as a potential issue with which the international community should be concerned.).

[50] *See, e.g.,* SPACE LAW AND GOVERNMENT, *supra* note 1, at 130, n. 40 (*citing* SURVEY OF SPACE LAW, *supra* note 9); *see also* SPACE LAW AND GOVERNMENT, *supra* note 1, 386 (*citing* Leon Lipson, Nicholas Katzenbach, *Report to NASA on the Law of Outer Space*, 61 COLUM. L. REV. 1074 (1961) (hereinafter the Katzenbach Report).

tribute in an effective manner to the wealth of thinking on the law of outer space.

Indeed, it appears now that to avoid the slowing process of political haggling this urgent and even critical task must be undertaken by non-governmental international organizations such as the International Institute of Space Law of the International Astronautical Federation. It is a pity that purely national committees and official international bodies have so far been incapable of synoptic thinking!

The United Nations, having taken a look at the issues presented and the solutions offered, has commenced the piecemeal and stop-gap solution which the author predicted, several years ago, would be adopted. The advocates of the U.N. and U.S. Government "wait and see" policy will undoubtedly point to the General Assembly Resolution of December 20, 1961 and ask, "What more do you want?" However, as we have pointed out earlier, what is needed is not the broad meaningless language that "international law ... applies to outer space" and "celestial bodies are free for exploration and use by all states in conformity with international law and are not subject to national appropriation." The invitation which immediately follows these quoted statements is what was needed in 1955, not in 1961: "The General Assembly ... Invites the Committee on Peaceful Uses of Outer Space to study and report on the legal problems which may arise from the exploration and use of outer space."

Negatively phrased sweeping generalizations are not contributing to the solution of the immediate problems. We now need agreement on what men *may* do, what effect their actions *will* have, where they *may* go and how they *may* travel. Listing in vague terms what outer space is, or is not, will not serve the purpose; and to say that outer space and its celestial bodies "are not subject to national appropriation" is only the temporary means of putting off the question of what may be done. This single limitation does not prevent the use of other means to secure control. Processes and practices other than "national appropriation" still exist unrestrained, and we have not even

> yet agreed upon what constitutes "national appropriation" here on earth.[51]

Haley's demand that the international law and policy community move forward to work on a solution to the key issues facing space operations is justified by his prediction of the alternative future, where "wait and see," has become an unmovable dead weight with no inertia.

In contrast to the ominous chords struck above, Haley was actually optimistic that many of the issues raised in *Space Law and Government* could be solved through a combination of international treaty, bilateral agreement between nations, and especially the use of customary international law,[52] which Haley found to be of critical importance in analyzing space law issues, notwithstanding the human species had launched its first satellite into orbit only six years before the publication of *Space Law and Government*, and only a dozen humans had been sent into space, with the longest U.S. flight to date lasting 34 hours and 22 orbits.[53]

So while Haley was concerned about space trash, as discussed below, he saw a fairly clear path to address and prevent

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[51] SPACE LAW AND GOVERNMENT, *supra* note 1, at 131 (footnotes omitted, emphasis in original).

[52] Haley's analysis and justification for the use of customary international law in establishing and interpreting international space laws is detailed and persuasive, but beyond the scope of this article (indeed this section of *Space Law and Government* warrants an article of its own). Haley himself teed up the issue of freedom to orbit above a nation in 1955 by writing several articles and making speeches all over the world positing that if any nation did orbit a satellite during the upcoming International Geophysical Year (IGY), held in 1957-1958, and no country objected to the overflight, the right of free overflight would be established. *See* SPACE LAW AND GOVERNMENT, *supra* note 1, at 62. Countering academic arguments that, like the law of adverse possession, establishment of international law through custom required years if not generations, Haley concluded otherwise, saying that "The present situation, however, is entirely different. An earth satellite will pass over numerous countries in a period of hours and these nations are immediately aware of the launching. Knowledge of the impending launching may even have been available for a considerable time prior to the actual event. In view of this, the nations could be expected to express their consent-or non-consent-in a timely manner." *Id.* at 60-61.

[53] Mercury 9, piloted by Gordon Cooper, launched May 15, 1963, landed May 16, 1963. *See* NASA, Human Space Flight: A Record of Achievement, 1961-1998, http://www.hq.nasa.gov/office/pao/History/40thann/humanspf.htm#mercury (last visited Sept. 12, 2013).

actual damage to the orbital environment going forward. As it turned out, however, the quote at the beginning of this article became a poignant prediction of what would happen in the future if the nations of the world failed to consider the issue of disposing of satellites at the end of their useful lives.

When it came to the issue of orbital debris and the activities that could negatively impact the ability of other satellites to function, Haley was first and foremost concerned with radiofrequency interference between satellites and ground stations, mainly caused by the fact that most early satellites had no "off" switch.

> In the context of communications, it cannot be emphasized too often that radio controls, guidance, tracking, and scanning are essential elements in the use and safety of space travel. Abuses of allocations leading to confusion of radio commands could result in extensive losses and irreparable damage. This fundamental tool of the space scientist must be kept in working condition, and the lawyers and diplomats at the council tables must be constantly aware that the burden is upon them to create and enforce workable laws and rules of the road for the use of radio in space travel.
>
> One important requirement, to be discussed in detail in Section 7-7 infra, is the control of the radio transmitter on an earth-circling vehicle so that it will not continue to operate indefinitely. At present, radio engineers throughout the world are possessed of the unpleasant knowledge that for indeterminate periods certain frequencies are being in a sense usurped for satellite operation to the possible detriment of assigned frequency usage. The radio spectrum is limited, and the frequencies involved are extremely valuable; they may be quite essential to some other services. Accordingly, there must also exist a radio command or other device capable of silencing these earth-circling vehicle radio transmitters.[54]

Haley went out of his way not to criticize the Soviets,[55] yet pointed out that Sputnik's transmit frequency (20 MHz) was

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[54] SPACE LAW AND GOVERNMENT, *supra* note 1, at 172.
[55] *Id.* at 169.

commonly used by scientists all around the world, and many of those scientists reported receiving interference from Sputnik's transmissions.[56] Haley then turned to the problem presented by the Vanguard I satellite (launched March 17, 1958 by the Naval Research Lab), which was powered by solar cells and again had no "off" switch. Haley predicted that because of its much higher orbit than Sputnik (654 x 3,969 kilometers), the 108 MHz radio could transmit for between 200 and 1000 years.[57] Haley was partially correct. Vanguard I remains the oldest man-made object in space, and it will likely stay in orbit for another 200 years. Its radio ceased operating (or at least ground stations could no longer receive the gradually weakening signal), after May, 1964 (within a year of when *Space Law and Government* was published).[58]

Haley had been preaching on this subject for a number of years, dating back to at least 1952,[59] and his solution for the problem was simple. The International Telecommunication Union (ITU), already chartered by the United Nations and having been in operation for nearly 100 years (as opposed to the United Nations, which in 1959 was barely over a decade old), was Haley's choice for resolving the interference issues. The ITU had to step in and begin allocating frequencies for space use before any more satellites "usurped" frequencies, according to Haley. Actually, by the time *Space Law and Government* was published, the ITU was well on its way to solving this part of the "space pollution" puzzle by allocating frequencies for Earth-to-space and space-to-Earth operations as early as 1959.[60]

The reader might conclude from this discussion that Haley was setting up a "straw man" by spending dozens of pages of *Space Law and Government* on an issue that had largely been solved. The reader might also question why this author is even discussing a problem long ago solved. The reason is two-fold: First, as discussed *supra*, the problem of a rogue or derelict sat-

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[56] *Id.* at 170.
[57] *Id.* at 179.
[58] *See* SSDD, *Vanguard I,* http://code8100.nrl.navy.mil/about/heritage/vanguard.htm (last visited Sept. 12, 2013).
[59] *See* SPACE LAW AND GOVERNMENT*, supra* note 1, at 173.
[60] *Id.* at 174.

ellite interfering with the operations of other satellites has not been completely solved, as demonstrated by the case of Galaxy 15. The ability that SES had to avoid the interference and maneuver its AMC-11 satellite as Galaxy 15 encroached its GEO orbital position was directly related to the ITU frequency allocation process and various national licensing regimes, such that SES knew exactly what frequencies Galaxy 15 was transmitting on, and where Galaxy 15 was licensed to operate, and it could take steps to mitigate the interference that Galaxy might cause to its AMC-11 satellite. The second, and more important reason to discuss this issue in its historical context is because Haley had faith that the same sort of international regulatory regime could be established to ensure that satellites themselves would not pose a danger to space navigation, because an international organization could be established to require that nations remove their old satellites and debris.

> As we must deal with the conservation and safety of life and property, a second and more serious long-range problem must also be considered, namely, the continued orbiting of man-made space vehicles for periods of undetermined length-extending even to centuries or millennia. This uncontrollable "space trash" will constitute a hazard to safety of life and property in outer space as long as it continues in orbit.
>
> It is quite clear that the radio command problem is simple of solution, whereas the disposal of "space trash" is most difficult to solve, and the latter problem is really the most serious by far. Certainly, the "probabilities" of collision and all aspects of threats to safety over the next century should be the subject of a searching study under the supervision of NASA by such organizations as the Rand Corporation.[61]

Haley's solution to the "serious" future problem of orbital debris was similar to his solution to the frequency pollution issue: Establish international norms requiring nations to register their space vehicles and dispose of them at end-of-life, and stand up an international organization to police this registry to ensure

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[61] *Id.* at 206.

that nations remained in compliance. Unlike the solution for radio pollution, however, Haley was not so naïve as to think that this part of the puzzle would be easy to solve, so he began with the need to register all objects sent into space.

> Registration of vehicles-their weight, payload, trajectory, function, expected life, and all other pertinent data-could obviously involve matters of national security. But there is apparently no reason why all those facts that are relevant but not necessarily crucial in nature could not be disclosed, e.g., the time of a launch, the trajectory or expected orbital path, the vehicle weight, and matters of similar import, which are frequently released to the press for publication.
>
> If an international commission were functioning, this material could be carefully logged and efficiently kept in readily accessible sources. A uniform system of reporting activities would slowly come into being, and smaller, later-arriving astronautical powers would come into an existing framework of registration, with precedent to act as guide and a centralized office to be notified. As the numbers of vehicles increase, the work of this office would grow in importance.
>
> Many relevant facts will be made available through a system of registration. The source of damage-causing vehicles, for example, will be internationally identifiable. Indeed, the sources of all existing vehicles will be on permanent record. Vehicles violating communications or other regulations will be identifiable, together with the country that launched them, and measures can then be taken to prevent further abuses. As long as only two or three nations are actively involved in space activities these may seem naive observations, but when there are eight or ten different nations continually launching vehicles into space, the problem of numbers alone will be acute.
>
> Whatever the systems of recordation hitherto employed by American and Soviet space scientists and officials, a uniform system should be agreed upon for the future. An international agency, preferably within the U.N., should be established to localize and formalize the registration activity. The longer we

> wait to tackle this problem, the greater its dimensions become and the more difficult of solution.[62]

But Haley went further, concluding that registration alone was not going to be enough, that vehicles and satellites needed to be *licensed* by some international authority.[63] Haley also fully understood that registration and licensing by themselves would be insufficient unless the regulating entity had the power to enforce its rules. He noted with a certain disdain the history of the ITU's inability to actually force nations to abide by its frequency allocation determinations.

> Yet merely to create a series of specialized agencies is not enough. In communications, for example, the International Telecommunication Union, affiliated with the U.N., is now the primary source of determination of frequency allocations. When these allocations are violated, as they have been in the past, some agency within the international structure will have to have authority to apply sanctions to such violations. At present, no such sanctioning body exists, and there is no more effective sanction available than irate expressions of disdain for the violator. Situations of this kind will multiply in space activity as regulations are developed, and unless the specialists can support their regulations by the application of sanctions, the violations of rules will go on.[64]

Haley also recognized the difficult political path this presented at the height of the Cold War. While Haley himself enjoyed access to people and places deep inside the Soviet sphere of influence because of his position with various international organizations,[65] he also knew first-hand, as a former Army officer and in the General Counsel's office of the Federal Communications Commission, that coming up with an international agreement whereby countries would hand over both valuable

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[62] *Id.* at 138.
[63] *Id.* at 139-140.
[64] *Id.* at 150.
[65] *See, e.g., id.* at 328-392 (discussions of the development of various international organizations highlight the many countries during the 1950s which Haley visited).

information, and police powers to an international agency, was a formidable task.

> The foregoing discussion in this chapter has been offered, in many instances, in contemplation of the existence of a police power in some international agency. If, in this time of extreme nationalistic tendencies and ideological struggles, it is difficult even to discuss the question of an international police power, actually creating one would be a far greater struggle. Eventually, however, some recognized police power must come into being in order to enforce the regulations of the many international and interplanetary activities which the space age surely will bring upon us. If no effort is made to cope with and resolve this problem today, the only justifiable expectation is that it will be much more onerous tomorrow. Some writers are extremely optimistic regarding the potential role of the U.N. in enforcing controls of space activity. Donald W. Cox, for example, has written that one of the prime shortcomings in all the literature on the establishment of an upper limit to national sovereignty is the absence of any clear realization that a U.N. police force is needed for purposes of enforcement. In any event, the problem of police power and enforcement – assuming a body of law for space can be promulgated – is one of the questions to which leading figures on both national and international levels must devote a major amount of time and effort.[66]

And that's where Haley left us. He identified the problem of orbital debris in a way few if any of his contemporaries had, he pointed out the proper pathway forward to avoid contaminating orbits, but then brought the discussion "back down to Earth," by acknowledging how difficult it ultimately would be to reach international consensus on a registration and licensing regime with full police powers. He was confident, nonetheless, that this was possible, and if implemented, would establish bedrock principles of space law that would bind the spacefaring nations into a course of action for the next century.

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[66] *Id.* at 150-51.

> [T]he rule of law in outer space also includes a third principle, namely, the norm of orderliness. This norm has received more recognition than is generally known. It embraces the orderly use of the radio spectrum-which belongs to all mankind – including the development and use of devices which will turn off transmitters on space vehicles so that interfering signals may be eliminated; it also embraces the use of devices that will cause earth-orbiting vehicles to return to earth, so that they will not perpetually exist as a hazard to safety and property in outer space; and so on.[67]

III. THE DEVELOPMENT OF INTERNATIONAL LAW AND POLICY SURROUNDING ORBITAL DEBRIS: 1963 TO PRESENT

A. A Slow Recognition of the Problem

In the early days of spaceflight there certainly was no consensus that satellites could ever pose a threat to each other (other than radio interference). Until *Space Law and Government*, there was little attention paid to the issue. For instance, in the 1959 Congressional *Survey of Space Law*,[68] while there were concerns raised about radio interference from no longer controllable satellites, it was stated plainly: "This does not mean that scientists worry about collision, for space is a very big area."[69] The only real threat of derelict spacecraft, according to Dr. John P. Hagen, director of Project Vanguard, is to make detection of incoming ICBM's from the Soviet Union more difficult. "Filling the air with a great many dead satellite bodies is simply going to make that task extremely difficult."[70]

The COPUOS 1959 report on the status of space law had this to say about what we now refer to as orbital debris:

> The continued orbiting of satellites beyond the period of their useful operational life imposes the necessity of continuing

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[67] *Id.* at 157. The author can't help but wonder whether Haley at some point intended to return to this paragraph and embellishing it further. The sentence fragment "and so on" seems strangely out of place in a book that otherwise is tightly written.

[68] SURVEY OF SPACE LAW, *supra* note 9.

[69] *Id.,* p. 7.

[70] *Id.* at 6 (*quoting* Hearings before the House Select Committee on Astronautics and Space Exploration, April 21, 1958, at 323).

> their observation and registration. The foreseeable increase in this space 'traffic' problem is formidable. Destruction or recovery of such spent satellites, if possible, might be desirable to limit the 'traffic' problem to those satellites actually performing useful functions. This is feasible in larger satellites, which are capable of carrying the necessary braking rockets required to cause the satellites to descend at the end of their useful lives. *The 'traffic' problem is, of course, not in space itself, but in the capacity of ground tracking networks."*[71]

In other words, as far as COPUOS was concerned in 1959, the orbital debris issue was tied back into the radio interference issue discussed above. Similarly, the 1960 Katzenbach Report only briefly dealt with the issue of orbital debris:

> There is scientific opinion to the effect that a state with space capabilities could propel into orbit a large quantity of "junk" (for example, radioactive waste) the effect of which would be to preclude much further scientific experimentation and increase the hazards of space travel and the possibility of surprise missile attack. Such a program would overload tracking facilities and could distort communications. Presumably an effort would be made to justify it as a measure of self-defense.
>
> It is important that all nations with space capabilities use them with discretion and reserve in the interest of future scientific and technological programs. As space capabilities increase, the possibility of an iron curtain holding back scientific progress for years to come increases as well. Steps to limit the number of satellites that can be put into orbit and to furnish some assurance that each serves a useful function would be constructive contributions to the law of space. It would be unconscionable to future generations for us unnecessarily to hamper their opportunities.[72]

Here again we see that there is little or no concern about orbital debris from "normal" operations of nations.[73] The Katzenbach

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[71] 1959 COPUOS Study, *supra* note 49, at 17, ¶ 72 (emphasis added).

[72] Katzenbach Report, *supra note* 50, at 29-30.

[73] The term "collision" is used elsewhere in the Katzenbach Report, but only in the context of providing a list of issues addressed in other space law literature. *See id.* at 41 ("34. The legal problems created by space flight, as upon ascent and descent, property

Report's only concern was with a nation using debris as a weapon, and the effectiveness of this weapon would only be to interfere with space communications.[74]

Within this context, then, we can analyze the development of international law as it applies to orbital activities to determine what it says about responsibility for orbital debris. Any such analysis must begin with a review of the "Big Four Plus One" international treaties that impact space law, to wit:

1) Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the

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damage, collision, interference with communications, landing on other planets and the moon, and the creation of space stations, cannot be solved by any one nation, but require regulation by an international authority under the auspices of the U.N. or the ICAO"); and *id.* at 42 ("49. An international coordinated program, which the existing international organizations could provide, should be established to lay down and supervise regulations relating to the launching of satellites, the traffic of objects in space, liability arising from any possible collision and related problems"). It can be argued, however, that the "collisions" the Katzenbach Report talks about are collisions between satellites and aircraft and satellites and objects on the surface of the Earth. *See id.* at 45 ("76. International agreement should be sought on the problem of ascending and descending spacecraft and the dangers of collision with aircraft and property damage, and on the problem of interference with telecommunications by spacecraft in orbit"). Further, the issue of a collision between two objects was not addressed in terms of the impact on the space environment (e.g., debris), but rather, from the perspective of liability of one of the parties under a tort theory. *See id.* at 78 (listing as a subject of an article "A fantasy set several decades in the future, and suggesting that (1) traditional conflict-of-laws rules should apply in a dispute with an extragalactic legal system; (2) rules covering collisions in outer space should be derived from general maritime law; and (3) to avoid possible legal complications the orbit of a U.S. satellite should be planned to miss space over the USSR and Nicaragua").

[74] The citations above help to provide a much needed context to the legal and policy approaches taken by the United States and the international community in the first decade of spaceflight. There was significant concern about space becoming the new "high ground" in the cold war, and much of the impetus for getting any international space treaty negotiated, signed, and ratified by the super powers was to eliminate the danger of "bombs in orbit." *See., e.g.,* Hearings Before the Committee on Foreign Relations, United States Senate, 90th CONG., 1ST SESS., at 7 (Mar. 7, 13, and Apr. 12, 1967) ("another origin of this treaty, as the Secretary of State has pointed out, is the "no bombs in orbit" resolution, and it is pertinent to recall the origin of that particular declaration"). *See also*, Bureau of Arms Control, Verification and Compliance, *Narrative,* http://www.state.gov/t/isn/5181.htm (last visited Sept. 23, 2013) (U.S. State Department discussion of the 1967 Outer Space Treaty as the "second of the so-called 'non-armament' treaties.").

Moon and Other Celestial Bodies ("1967 Outer Space Treaty," or simply "OST");[75]

2) Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space ("1968 Rescue and Return Agreement");[76]

3) Convention on International Liability for Damage Caused by Space Objects (1972 "Liability Convention");[77]

4) Convention on Registration of Objects Launched into Outer Space (1975 "Registration Convention");[78]

5) Agreement Governing the Activities of States on the Moon and Other Celestial Bodies (1979 "Moon Agreement).[79]

Although none of the international agreement directly addresses the issue of orbital debris, several contain provisions that could (and should) have had a bearing on the orbital debris issue and developing international law and policy in this area.

Turning first to the 1967 Outer Space Treaty, the OST contains a number of provisions that could have a legal bearing on orbital debris. First, Article VIII speaks to the ownership of objects launched into space:

> A State Party to the Treaty on whose registry an object launched into outer space is carried shall retain jurisdiction and control over such object, and over any personnel thereof, while in outer space or on a celestial body. Ownership of objects launched into outer space, including objects landed or constructed on a celestial body, and of their component parts,

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

[76] Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space, *opened for signature* Apr. 22, 1968, 19 U.S.T. 7570, 672 U.N.T.S. 119 [hereinafter Rescue and Return Agreement].

[77] Convention on International Liability for Damage Caused by Space Objects, *opened for signature* Mar. 29 1972, 24 U.S.T. 2389, 961 U.N.T.S. 187 [hereinafter Liability Convention].

[78] Registration Convention, *supra* note 21.

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

> is not affected by their presence in outer space or on a celestial body or by their return to the Earth.[80]

Second, Article VII of the OST specifies that states are liable for the damage caused by their vehicles during launch and once in orbit:

> Each State Party to the Treaty that launches or procures the launching of an object into outer space, including the Moon and other celestial bodies, and each State Party from whose territory or facility an object is launched, is internationally liable for damage to another State Party to the Treaty or to its natural or juridical persons by such object or its component parts on the Earth, in air space or in outer space, including the Moon and other celestial bodies.[81]

Article IX of the OST provides that States "shall conduct all their activities in outer space, including the, Moon and other celestial bodies, with due regard to the corresponding interests of all other States Parties to the Treaty." Article IX continues that exploration of outer space, the Moon, and other celestial bodies by States shall be conducted "so as to avoid their harmful contamination" and requires nations to "where necessary, ... adopt appropriate measures for this purpose." Article IX requires that a State planning an activity or experiment that could potentially harm the activities of another State in the peaceful exploration and use of outer space consult with any such parties prior to launch.[82]

It is easy in 2013, therefore, to look at these provisions and conclude that orbital debris is adequately addressed in the following manner: launching states must maintain control over their objects (Article VIII), are liable for any damage caused by such items (Article VII), and must not place or leave an object in an orbit if it could interfere with another states' objects or contaminate orbits (Article IX). It is also a very small step to conclude that the OST prohibits the launch of any item without a

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[80] Outer Space Treaty, *supra* note 75, at art. VIII.
[81] *Id.* at art. VII.
[82] *Id.* at art. IX.

plan to minimize any debris caused by its launch and operation, including a requirement that the object either be deorbited, or moved to an orbit where it could cause no collision threat at end-of-life.

If one studies both the history of the OST and the customary international law that has evolved surrounding these provisions, however, one finds that orbital debris was never considered in these contexts. In ratifying the OST, the United States Senate did not even discuss the issue of "debris," "trash," or "junk" during the March and April, 1967 hearings on ratifying the OST, which constitute 162 pages of analysis and hearing colloquy.[83] Article VIII was discussed only in terms of the rights of states to retrieve any vehicles that reentered and land in another country.[84] The "interference" provision of Article IX was interpreted by the U.S. Senate to relate mainly to radiofrequency interference, and the duties of states not to jam or otherwise interfere with the operations of satellites.[85] The remainder of Article IX was interpreted by the U.S. Senate to provide a prohibition against contaminating the atmosphere with nuclear testing.[86]

Furthermore, while there are several references to vehicles and objects as being on the "registry" of a given state,[87] the OST does not explicitly require states to register their objects, nor does it set up any specific mechanism for registration, nor propose any penalties or sanctions for a state failing to properly register it launches.[88] The U.S. Senate noted the failure of the

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[83] Hearings before the Committee on Foreign Relations, *supra* note 74.

[84] *Id.* at 42.

[85] *Id.* at 39, 54, & 71.

[86] *Id.* at 42 & 100.

[87] Outer Space Treaty, supra note 75, at art. V (astronauts making a landing in a foreign jurisdiction "shall be safely and promptly returned to the State of registry of their space vehicle"); and *id.* at art. VIII ("A State Party to the Treaty on whose registry an object launched into outer space is carried shall retain jurisdiction and control over such object, and over any personnel thereof, while in outer space or on a celestial body").

[88] The United Nations established a space registry in 1962, following the adoption of U.N. Resolution 1721B (XVI) (1961).

Believing that the United Nations should provide a focal point for international co-operation in the peaceful exploration and use of outer space,

then-current U.N. registration system while debating ratification of the OST.

> Mr. GOLDBERG. Oh, yes, and we have communicated with them and have said that our devices detect satellites in space originating from the Soviet Union that have not been reported. Now, this is not only a matter of the question of cooperative efforts in space. This is a matter of national security. We believe that when there is registration of all launchings this gives us an opportunity to, and the world community to, check up on whether the launchings are, indeed, peaceful or whether they are for some other purposes. And we have made it a matter of protest and we have been fairly successful with our protests because, following the protests, the Soviet Union, which has not put some launchings into the registry of the U.N., they are doing better after a protest.[89]

Of course, the Soviet Union charged the same thing – that the United States routinely failed to fully and timely register all objects it launched into space.[90]

As noted above, Haley's first requirement to solve the long term problem of orbital debris was the establishment of a fully functioning registration system.[91] A crucial step was taken when the Registration Convention was adopted by the U.N. in 1975.[92] It provided, in pertinent part under Article IV:

> Each State of registry shall furnish to the Secretary-General of the United Nations, as soon as practicable, the following information concerning each space object carried on its registry:

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1. Calls upon States launching objects into orbit or beyond to furnish information promptly to the Committee on the Peaceful Uses of Outer Space, through the Secretary-General, for the registration of launchings;

2. Requests the Secretary-General to maintain a public registry of the information furnished in accordance with paragraph 1 above.

See also United Nations Office for Outer Space Affairs, Registration of Objects Launched into Outer Space, http://www.oosa.unvienna.org/oosa/SORegister/index.html (last visited Sept. 23, 2013).

[89] Hearings Before the Committee on Foreign Relations, United States Senate, *supra* note 74, at 61.

[90] *See* I. DIEDERIKS-VERSCHOOR, AN INTRODUCTION TO SPACE LAW 42 (1993).

[91] SPACE LAW AND GOVERNMENT, *supra* note 1, at 138.

[92] *Registration Convention, supra* note 21.

(a) name of launching State or States;
(b) an appropriate designator of the space object or its registration number;
(c) date and territory or location of launch;
(d) basic orbital parameters, including:
(i) nodal period;
(ii) inclination;
(iii) apogee;
(iv) perigee;
(e) general function of the space object.[93]

Importantly, the Registration Convention defined "space object" to "include[] component parts of a space object as well as its launch vehicle and parts thereof."[94] There is the implicit assumption in the Registration Convention that states will update the registry in the event that the orbital parameters of a space object were to change.[95] In theory, a state should update the registry in the event that one of its satellites explodes, exfoliates, or otherwise breaks into pieces, with each piece separately registered if its orbital parameters now differ from the original registration.

As Haley predicted, however, the Registration Convention lacked any sanctions or penalties for a state not registering, not providing complete information about its space objects, or not updating the registry. In fact, the spacefaring nations have done almost none of these. Some launching states do not provide space object data until months after a launch.[96] Many, if not most of the registrations fail to include orbital data on all payloads and spent stages.[97] And some claim that military satel-

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[93] *Id.* at art. IV.
[94] *Id.* at art. I.
[95] *See, e.g., id.* at art. IV(2)("Each State of registry may, from time to time, provide the Secretary-General of the United Nations with additional information concerning a space object carried on its registry"); *and* art. IV(3)(" Each State of registry shall notify the Secretary-General of the United Nations, to the greatest extent feasible and as soon as practicable, of space objects concerning which it has previously transmitted information, and which have been but no longer are in earth orbit.")
[96] FRANCIS LYALL & PAUL LARSEN, SPACE LAW: A TREATISE 93 (Ashgate Publishing, 2009).
[97] *Id.*

lites are often never registered at all.[98] The standard form used by the United Nations does not even adequately allow for the registration of a launch which contains multiple satellites and may leave multiple spent bodies in orbit.[99] The UN registry, therefore, looks almost nothing like the UCS database of space objects, which in turn looks little like the JSpOC database. At least until the early 1990's,[100] if not far later, the spacefaring nations simply were not concerned with the number of space objects orbiting Earth, or even keeping track of them. The "Big Sky" theory was in full force.

Finally, the Liability Convention sets for the obligations of states for their activities. The Liability Convention states that "states shall be absolutely liable to pay compensation for damage caused by its space object on the surface of the earth or to aircraft flight."[101] As to damage caused to other objects in space, Article III states that a launching state shall be liable "only if the damage is due to its fault or the fault of persons for whom it is responsible."[102] In other words, a strict liability regime applies to damages on Earth, whereas a negligence regime applies to damages caused in space. These differing legal approaches, as discussed below, may have played a key role in why the orbital debris problem has been ignored by the international legal community for so long.

But the separate question must be asked, why did the international community ignore the warnings of Haley in *Space Law and Government* for nearly 30 years? It would be patently false to conclude that Haley was not ignored, his work was just never given proper attention at the time. The importance of *Space Law and Government* from the day it was written was obvious: The first forward to the book was written by none

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[98] AN INTRODUCTION TO SPACE LAW, *supra* note 90.

[99] *See* UNOOSA, *United Nations Register of Objects Launched into Outer Space: Model Registration Form*, http://www.oosa.unvienna.org/oosa/SORegister/resources.html (last visited Sept. 23, 2013).

[100] *See infra,* discussion of the history of orbital debris mitigation policies.

[101] Liability Convention, *supra* note 77, at art. II. "Space object" is defined in a rather circular manner, to include a "space object as well as its launch vehicle and parts thereof." *Id.* at art. I.

[102] *Id.* at art. III.

other than the Vice President of the United States, Lyndon B. Johnson, who only a few short months after he penned the forward, and by the time the book was available to the public, would ascend to the presidency upon the assignation of John F. Kennedy. Here is what Johnson had to say about the importance of space law and Haley's book:

> In this foreword I intend to indicate that the great new problems confronting civilization in the Age of Space require the close and devoted attention of the social scientists as well as of the natural scientists, and that principles of justice and order should be established in these early days of man's exploration of space. *Space Law and Government* is a penetrating examination and analysis of such principles and, as such, merits the careful attention of thoughtful people in all walks of life . . . The distinguished background of the author and the painstaking research which has gone into this book point up the value of *Space Law and Government.*[103]

Additional forwards were written by Carl Albert, Majority Leader, U.S. House of Representatives, and George P. Miller, Chairman, House Committee on Science and Astronautics.[104] Albert had this to say about Haley and the importance of *Space Law and Government*:

> I have known Mr. Haley for many years, having served with him in the military during the Second World War. He is an author, scientist, and lawyer. He is outstanding in the field of communications law and possesses the finest credentials to offer that is to my knowledge the first comprehensive study on space law and government. . . I am confident that *Space Law and Government* will be a major contribution to our emerging Space Age. Mr. Haley has devoted to the preparation of this work a matchless integrity and years of research and exhaustive study of the legal and sociological aspects of space flight. I commend this work to my colleagues with confidence.[105]

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[103] SPACE LAW AND GOVERNMENT, *supra* note 1, at vii, viii.
[104] *Id.* at viii, ix.
[105] *Id.*

Finally, Chairman Miller also recognized the importance of this work:

> Mr. Haley embodies the benefit of his knowledge and experience in his penetrating book. It is a major contribution to the world's understanding of the nature of man's activities in space and in the legal consequences flowing from such activities. It deserves an honored place among the great and epoch-making legal studies in the libraries of the world.[106]

Clearly, *Space Law and Government* did not "fly under the radar" as an academic treatise destined from the outset to be placed on the bookshelves of a few scholars to collect dust, and otherwise be ignored. Haley was a legal practitioner, after all, not an academic scholar. His work in opening up communications spectrum above 890 MHz after World War II to commercial operators had as much impact on 21st Century communications as any other human on the planet.[107]

Haley's warnings of the dangers of an unmanaged satellite population were not ignored because *Space Law and Government* was unknown. Rather, it is more likely that the spacefaring nations ignored Haley's warnings for thirty years for one of two reasons, either in order to limit liability, or for national security reasons.

The desire to limit liability has some logical merit. Under both the OST and the Liability Convention, after all, nations are strictly liable for their space activities where such activities cause damage during launch, or upon reentry to any aircraft in air or property on the ground.[108] For damage caused in orbit, the international treaty regime adopts a negligence standard.[109] The Restatement (Second) of Torts defines negligence as "conduct that falls below the standard established by law for the protection of others against unreasonable risk of harm."[110] In a

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[106] *Id.* at ix.

[107] *See, id.* at 175-76 (discussion of the FCC's "Above 890 MHz" proceeding and opening up formerly government-only spectrum to new uses, including space communications).

[108] Outer Space Treaty, *supra* note 75, at art. VII.

[109] *Id.*

[110] RESTATEMENT (SECOND) OF TORTS, §282.

successful negligence suit, the plaintiff must show that each of the following five elements is present:

> (1) a duty of care is owed by the defendant to the plaintiff;
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> (2) a breach of that duty has occurred;
>
> (3) an actual causal connection between the defendant's conduct and the resulting harm;
>
> (4) proximate cause, which relates to whether the harm was foreseeable; and
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> (5) damages resulting from the defendant's conduct.[111]

So, by failing to establish sanctions in the Registration Convention for failure to register all items launched into outer space, by failing specifically adopt debris mitigation standards (including the deorbiting or placement of satellites in "safe" orbits at the end of their useful lives), and by failing to even track derelict satellites and spent upper stages in the early years of spaceflight, the spacefaring nations effectively established, through customary international law, that there was no duty of care when it comes to orbital debris, thus making it difficult, if not impossible, to prove that a satellite loss was caused by a collision, and the source of the colliding debris.

An equally plausible reason for the international community to ignore Haley's warnings was the issue of national defense. Simply put, the United States and the Soviet Union simply did not want anyone (especially each other), knowing what surveillance satellites were overhead. In the past decade, with the passage of time, more information concerning the Eisenhower administration has been released. This information provides strong evidence that while Eisenhower knew there was no "missile gap," the false supposition of which may well have led to the defeat of his Vice President Richard Nixon in the 1960 presidential election, Eisenhower was unwilling to prove the lack of the "missile gap," because to do so would have revealed the full extent of the U.S. surveillance capacities in 1960, in-

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[111] *Id.*

cluding space reconnaissance, which was then just coming online.[112] If Eisenhower was willing to see his party lose the White House in 1960 to protect the secrets of the space reconnaissance community, it is easily as plausible to posit that there existed in the early days of spaceflight an unwritten policy to keep discussion of orbital debris "off the table" of international organizations, because as policy makers well knew from *Space Law and Government*, the only antidote to space debris would be full registration, full tracking, and full liability for damages caused, in other words, transparency in space operations, something the United States was no more willing to do than was the Soviet Union.

Eisenhower's farewell speech to the Nation, delivered on national television on January 17, 1961, may well provide a glimpse of the internal struggle Eisenhower felt over the rise of the "military-industrial complex" and the impact it was having on domestic and international relations.

> This conjunction of an immense military establishment and a large arms industry is new in the American experience. The total influence -- economic, political, even spiritual -- is felt in every city, every State house, every office of the Federal government. We recognize the imperative need for this development. Yet we must not fail to comprehend its grave implications. Our toil, resources and livelihood are all involved; so is the very structure of our society.
>
> In the councils of government, we must guard against the acquisition of unwarranted influence, whether sought or unsought, by the military-industrial complex. The potential for the disastrous rise of misplaced power exists and will persist.
>
> We must never let the weight of this combination endanger our liberties or democratic processes. We should take nothing for granted. Only an alert and knowledgeable citizenry can compel the proper meshing of the huge industrial and military ma-

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[112] *See,* Y. MIECZKOWSKI, EISENHOWER'S SPUTNIK MOMENT: THE RACE FOR SPACE AND WORLD PRESTIGE (Cornell University, 2013); *see also* W. MCDOUGALL, THE HEAVENS AND THE EARTH: A POLITICAL HISTORY OF THE SPACE AGE PP (Basic Books, 1985).

> chinery of defense with our peaceful methods and goals, so that security and liberty may prosper together.[113]

For whatever reason, adherence to the misguided "Big Sky theory," a desire to limit liability, or a belief that national security interests trumped the need to protect the orbital environment from contamination, the spacefaring nations largely ignored Haley's warnings until at least the 1990's, when the potential magnitude of this "tragedy of the commons"[114] began to be discussed.

B. Establishment of Orbital Debris Mitigation Guidelines

The first steps to begin mitigation of future orbital debris were undertaken by NASA in 1982 with the adoption of NASA Management Instruction 1700.8, which specified that all unspent propellants and gases from Delta upper stages were to be vented so as to prevent explosions due to the mixing of fuel residues.[115] DOD adopted similar internal guidelines in 1987.[116] President Reagan's 1988 National Space Policy directed that "all space sectors will seek to minimize the creation of space debris . . . consistent with mission requirements and cost effec-

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[113] Dwight D. Eisenhower, Eisenhower Farewell Address, Pub. Papers 1035-1040 (1960). *See also*, J. LEDBETTER, UNWARRANTED INFLUENCE: DWIGHT D. EISENHOWER AND THE MILITARY-INDUSTRIAL COMPLEX (Yale University Press, 2011). The reader is invited to actually watch closely recordings of the farewell address, copies of which are available from a number of online sources, including YouTube. The strain on Eisenhower's face as he delivered this portion of the address is evident, and contrasts his demeanor during much of the rest of the farewell address.

[114] The term "Tragedy of Commons" has its origins in British land use, and the ability of farmers and ranchers to use common ground to graze cattle and sheep. In 1833 William Forster Lloyd published a pamphlet pointing out that with no one taking care of the common grounds, while each rancher profited from the common ground usage in proportion to his/her use, all ranchers would ultimately suffer if the common ground was overgrazed and became unusable. The term itself has been attributed to the article "The Tragedy of the Commons," published by Garrett Hardin in the journal Science in 1968 dealing more generally with the economics of the misuse of commonly held resources.

[115] *See, Interagency Report on Orbital Debris, supra* note 10, at 27. That policy was updated in August 1995 by NASA Safety Standard 1740.14. *See,* 1(1) ORBITAL DEBRIS Q. NEWS (June 1996).

[116] AFMC, Space and Missile Systems Center regulation SDR 55-1. *See, Interagency Report on Orbital Debris, supra* note 10, at 27.

tiveness."[117] The NASA guidelines were updated in August 1995 by NASA Safety Standard 1740.14.[118] Both the FCC and the FAA currently have similar orbital debris mitigation policies as part of their licensing authority,[119] and today both aggressively enforce their rules.[120]

The international community began to come to grips with the orbital debris problem in the early 1990's as well. Study Group 4 of the ITU endorsed a recommendation in 1993 that all geosynchronous orbit satellites be boosted not less than 300 km above the GEO orbit at the end of live and that all residual liquids be vented and all batteries "safed."[121] The Inter-Agency Space Debris Coordination Committee (IADC) was formed in 1993 by the major space agencies of the world: ESA,[122] JAXA, NASA, and the Russian Space Agency (RSA). CNSA (China) joined in 1995, and BNSC (UK), CNES (France), and ISRO (India) joined in 1996, the German Aerospace Centre (DLR) in

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[117] *See Presidential Directive on National Space Policy* (Feb. 11, 1988), http://www.hq.nasa.gov/office/pao/History/policy88.html.

[118] *See* 1(1) ORBITAL DEBRIS Q. NEWS (June 1996).

[119] *See, e.g.,* Second Report and Order in IB Docket No. 02-54, 69 FED. REG. 54581 (Sept. 9, 2004) (adopting rules related to orbital debris mitigation by the FCC codified at 47 C.F.R. § 25.114); *see also* 14 C.F.R. § 415.39 (FAA rules related to orbital debris mitigation requiring applicants for a launch license to demonstrate that: (1) there will be no unplanned contact between the vehicle, its components, and payload after payload separation; (2) no debris will be generated from the conversion of chemical, pressure, and kinetic energy sources into energy that fragments the vehicle or its components; and (3) stored energy must be removed by depleting residual fuel and leaving all fuel line valves open, venting any pressurized system, leaving all batteries in permanent discharge state, and removing any remaining source of stored energy).

[120] For example, the FCC returned an application to modify the authorization of the in-orbit Ku-band AMC-5 satellite, because SES Americom, Inc., had failed to submit an orbital debris mitigation plan pursuant to Section 25.114 of the FCC's rules. *See* Letter of Robert G. Nelson to Daniel C. H. Mah, DA 10-1259 (July 2, 2010). AMC-5 was placed into orbit prior to the adoption of the FCC's rules. Nevertheless, in requesting authority to move AMC-5 half a degree (from 78.95° W.L. to 79.05° W.L. in the GEO orbit), the FCC concluded that it had the jurisdiction to require SES to now file a debris mitigation plan, which would have to include agreeing to expand the fuel necessary to move AMC-5 out of the GEO orbit to a higher safe orbit at the end of its useful life.

[121] International Telecommunications Recommendation, ITU-R S.1003 (Geneva, 1993). *Id.*

[122] ESA has developed its own Code of Conduct entitled "Requirements on Space Debris Mitigation for Agency Projects," which went into effect on April 1, 2008. *See* ESA *Mitigating Space Debris Generation*, http://www.esa.int/Our_Activities/Operations/Space_Debris/Mitigating_space_debris_generation (last visited Sept. 26, 2013).

1997, and the Italian Space Agency (ASI) in 1998.[123] The IADC adopted space debris mitigation guidelines in 2002, and revised them again in 2007.[124] The guidelines have three major principles:

(1) Preventing on-orbit break-ups;[125]
(2) Removing spacecraft and orbital stages that have reached the end of their mission operations from the useful densely populated orbit regions;[126] and
(3) Limiting the objects released during normal operations.[127]

COPOUS itself took up the issue of orbital debris as a separate agenda item in February, 1994.[128] It embarked on a multi-year study of the issue, which included a program to measure orbital debris in 1996, model the space debris environment in 1997, and began development of space debris mitigation measures in 1998.[129] At the 47th IAF Congress held in Beijing China in October of 1996, there were three sessions dedicated to or-

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[123] *See* Inter-Agency Space Debris Coordination Committee, http://www.iadc-online.org/index.cgi?item=home (last visited Sept. 26, 2013).

[124] IADC Space Debris Mitigation Guidelines, IADC-02-01 (*revised* Sept., 2007) (hereinafter IADC Guidelines).

[125] "On-orbit break-ups caused by the following factors should be prevented using the measures described in 5.2.1 – 5.2.3:

(1) The potential for break-ups during mission should be minimized;
(2) All space systems should be designed and operated so as to prevent accidental explosions and ruptures at end-of- mission;
(3) Intentional destructions, which will generate long-lived orbital debris, should not be planned or conducted."

Id. at 8. Section 5.2.1 deals with stored energy and the requirement to vent or safe them; Section 5.2.3 deals with spacecraft designs and building in failure mode analysis in the design to minimize break-up event in the event of a spacecraft failure. *Id.*

[126] Under the IADC Guidelines, spacecraft in GEO are to be moved to orbits of at least 235 kilometers above their current GEO position. Objects in LEO should be deorbited or placed in an orbit whereby the anticipated reentry is within 25 years. *Id.* at 9.

[127] "In all operational orbit regimes, spacecraft and orbital stages should be designed not to release debris during normal operations. Where this is not feasible any release of debris should be minimised in number, area and orbital lifetime. Any program, project or experiment that will release objects in orbit should not be planned unless an adequate assessment can verify that the effect on the orbital environment, and the hazard to other operating spacecraft and orbital stages, is acceptably low in the long-term." *Id.* at 8.

[128] *See Technical Report on Space Debris*, A/AC. 105/720 (1999).

[129] *Id.* at 1.

bital debris issues.[130] In 1999 COPUOS issued a Technical Report on Space Debris.[131] In February, 2007, the Scientific and Technical Subcommittee (STSC) of COPUOS adopted orbital debris mitigation guidelines consistent with the U.S. and IADC guidelines. The U.N. General Assembly endorsed the guidelines in 2007.

From the discussion above, the reader might be asking, "why are we still talking about orbital debris if the problem was solved back in 2007?" The answer is that the orbital debris problem was in no way solved by the belated measures undertaken within the last decade and a half. The reason is two-fold. First, unlike the U.S. approach of promulgating enforceable rules with real sanctioning power (as Haley warned was necessary in *Space Law and Government*), the U.N. Guidelines are mere suggestions, and member states are free to adhere to or disregard them. A recent example evidences just how weak many of the international guidelines are. In 2002, ESA launched Envisat, an 8,000 kilogram Earth observation satellite into the highly crowded 790 km polar orbit.[132] At 26 meters x 10 meters, by 5 meters, it is one of the largest satellites orbiting Earth. It had an expected operational life of five years, but continued to operate for an additional five years.[133] In April of 2012, ground controllers lost contact with the satellite. Although being operated well beyond its expected operational life, no efforts were made to deorbit the satellite, move it to a safer orbit, or safe the fuels and batteries onboard.[134] It is estimated that the satellite will remain in orbit, and a danger to space navigation, for between 100[135] and 150[136] years. ESA's response to why nothing was done to prepare Envisat for its inevitable end of life? According to one report, "ESA officials insist that

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[130] *See* 1(1) ORBITAL DEBRIS Q. NEWS, 2 (June 1996).

[131] *See Technical Report on Space Debris, supra* note 128.

[132] *See* ESA, *Observing the Earth*, http://www.esa.int/Our_Activities/Observing_the_Earth/Envisat_overview, (last visited Sept. 26, 2013).

[133] *See* Rendleman, *supra* note 39, at 3-4.

[134] *See* Peter B. de Selding, *Satellite Failure Puts European Space Agency in Tough Position*, SPACE.COM (Oct. 8, 2012), http://www.space.com/17950-failed-satellite-esa-envisat-liability.html.

[135] *Id.*

[136] *Rendleman, supra* note 39, at 4.

the international guidelines on disposal of debris were not in force when Envisat was designed."[137] So apparently, the international community will have to wait decades or more to even begin to slow the increase of orbital debris if spacefaring nations take the position that the orbital debris mitigation guidelines only apply to satellites ***designed*** after 2007. Given the average lead time to design and build a satellite (a minimum of three to five years), under this approach, the world is just now, in 2013, beginning to heed the warnings of Haley in *Space Law and Government* 50 years ago.[138]

Similarly, although China is a member of IADC through CNSA, its destruction of its Fengyun-1C weather satellite in 2007 clearly violated IADC guidelines, which state: "Any program, project or experiment that will release objects in orbit should not be planned unless an adequate assessment can verify that the effect on the orbital environment, and the hazard to other operating spacecraft and orbital stages, is acceptably low in the long-term."[139] China did none of these things prior to blowing up one if its own satellites, producing thousands of new pieces of space debris.

The "sudden loss" of the ability to control a satellite provides the second reason why we can't hope to begin to turn the tide on orbital debris anytime soon. Envisat provides a perfect example of how a multi-billion dollar space asset[140] was pushed well its design life because the environmental data being collected by Envisat was so important, and ESA could not afford a follow-on satellite to continue the function of Envisat, were it

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[137] Peter B. de Selding, *Envisat to Pose Big Orbital Debris Threat for 150 Years, Experts Say*, SPACE NEWS (July 26, 2010), at 1, http://www.spacenews.com/article/envisat-pose-big-orbital-debris-threat-150-years-experts-say.

[138] Compare this somewhat cavalier approach to the U.N. Guidelines by ESA with the position of the FCC, Second Report and Order in IB Docket No. 02-54, *supra* note 119, where the FCC required SES to file an orbital debris mitigation plan, including moving the satellite to a GEO graveyard for AMC-5, a satellite that was built and launched before the FCC adopted its orbital debris mitigation rules in 2004.

[139] IADC Guidelines, *supra* note 124, at 8.

[140] *See* ESA, *Envisat FAQs*, http://www.esa.int/Our_Activities/Observing_the_Earth/Envisat_FAQs (last visited Sept. 26, 2013) (Envisat cost 2.3 billion Euros).

retired at its designed end of life.[141] If it is the policy of satellite operators to squeeze every second of use out of a satellite, then even the best end of life disposal plans will be thwarted, because operators will continue to use satellites until they can no longer control them, meaning they also can't deorbit, reorbit, or safe them. Since there are no international sanctions, penalties, or repercussions for failing to comply with the end of life guidelines, there is little or no incentive for an operator to retire and safe a satellite while it is still functioning and either continuing to generate valuable scientific data, or in the case of a commercial satellite, revenue.[142] If the only penalties, as Haley put it, are "irate expressions of disdain" from the international community,[143] there is little to stop nations and operators from ignoring the guidelines, or simply failing to carry out the paper plans to dispose of a satellite before it poses a potential threat to space navigation. But as is discussed *infra*, in the next section, this attitude may have to change if liability can be assessed to an operator who fails to safe a satellite at end of life, and that satellite later causes damage to other orbiting satellites.

The final reason why even the best debris mitigation strategies going forward are not going to solve the orbital debris problem, is the fact that, as noted above, the vast majority of new debris is caused not by recent launches or recently orbited satel-

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[141] Stories of engineers coaxing years, if not decades, of additional on-orbit life from satellites are very common. *See, e.g.,* the story of the International Ultraviolet Explorer (IUE), launched in 1978 with a three year expected life, but with enough stationkeeping fuel for five years. When it was shut down on September 30, 1996, it had been in continuous operation for 18 years and 9 months. National Aeronautics and Space Administration, *IUE,* http://science1.nasa.gov/missions/iue/ (last visited Sept. 26, 2013). As the six gyros onboard gave out, one after another, NASA engineers figured how to continue to control and point the observatory by using the remaining gyros. But what has been hailed as a scientific and engineering victory now exists only as another piece of space junk, slowly drifting from its original position at the 70° W GEO position, to the 110° W GEO slot which tends to accumulate uncontrollable geostationary satellites. *See* International Ultraviolet Explorer, http://en.wikipedia.org/wiki/International_Ultraviolet_Explorer#cite_note-38 (last visited Sept. 26, 2013).

[142] This is probably more the case with one-off Earth observation satellites than it is for commercial communications satellites, where the "pipeline" for replacement satellites is more established, and operators often want to replace older satellites with new ones that have higher capabilities (and thus can generate higher revenues to justify building and launching replacements).

[143] SPACE LAW AND GOVERNMENT, *supra* note 1, at 150.

lites, but rather by the breakup of dormant satellites and upper stages, or the collision between such bodies, all of which long before became beyond the control of their human operators.[144] Even if the world were to stop any new launches, the orbital debris population would continue to rise because of "exfoliation" (as Haley called it) and future anticipated collisions. An IADC study, completed in January, 2013, concluded that the total amount of debris in LEO is likely to increase 30 percent over the next 200 years, even with 90% compliance with strict debris mitigation (end of life safeing) measures, and that catastrophic collisions can be expected every five to nine years.[145] The study assumed no new launches after 2006.[146] The study goes on to conclude that we may have already entered the Kessler Syndrome. The study concludes, rather ominously, that active remediation measures (removal of orbital debris) must be considered,[147] and that is what we will do in the next section of this article.

IV. ORBITAL DEBRIS REMOVAL: PROMISE AND CHALLENGES

Most of the preceding discussion tracking the slow development of international norms for debris mitigation has focused on the relationship of launching states to their own satellites while such states still have control over the objects. As has been demonstrated above regarding several satellites, including Envisat, however, debris mitigation policies are only as good as the intentions and actions of launching states to carry through with satellite safeing and removal from congested orbits at end-of-life. Further, the focus of debris mitigation policies has been on the satellite itself. The fact is, the most dangerous pieces of orbital debris (in terms of the probability they could collide with

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[144] *See Orbital Debris Frequently Asked Questions #3, supra* note 31, and accompanying text. Of course, the debris caused by the Chinese in destroying their own satellite certainly was not beyond their control, and hopefully the damage caused by this single episode will serve as a warning to the spacefaring nations that the intentional destruction of an orbiting object cannot be countenanced.

[145] *Stability of the Future LEO Environment*, IADC-12-08, Rev. 1 (Jan. 2013).

[146] Obviously, the world did not stop launching new satellites after 2006, so the results of the IADC study, disturbing as they are, significantly underestimate the increase in orbital debris that actually will occur over the next two centuries.

[147] *Id.*

other objects), are actually derelict upper stages, used to carry satellites to their final orbits, and then discarded in adjacent orbits that may be just as crowded as the orbit into which they deliver their payloads.[148] These upper stages tend to be very large, with large surface area cross sections, increasing the likelihood that they can collide with other objects.[149]

In recent years the topic of debris remediation (the active removal of space debris that is no longer controllable) has gained significant attention. The United States Defense Advanced Research Projects Agency (DARPA) requested comment on technical, economic, and legal issues involved in removing space debris in 2009,[150] which DARPA followed up with a three day workshop on December 8-10, 2009, at which this author and others presented ideas for debris remediation.[151] Suggested technical solutions covered in the DARPA symposium and suggested elsewhere, include the use of electromagnetic tethers,[152] lasers,[153] solar sails,[154] tractor beams,[155]and a variety of "snatch and deorbit"

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[148] *See,* James Dunstan and Bob Werb, *Legal and Economic Implications of Orbital Debris Removal: Comments of the Space Frontier Foundation,* at Chart One (Space Frontier Foundation, Oct. 30, 2009), *available at* http://www.scribd.com/doc/23379988/Legal-and-Economics-Implications-of-Orbital-Debris-Removal (hereinafter *Legal and Economic Implications*).

[149] The Atlas Centaur, upper stage, for example, which in various configurations has been launched over 200 times, is almost 13 meters (42 feet) long and with a diameter of over three meters (10 feet), with an inert (empty) weight of 2,247 kg (4,954 pounds). *See Atlas V-551*, SPACEFLIGHT 101, http://www.spaceflight101.com/atlas-v-551.html (last visited Sept. 26, 2013).

[150] *See* DARPA Solicitation DARPA-SN-09-68, FEDBIZOPPS.GOV (Sept. 17, 2009), *available at* https://www.fbo.gov/index?s=opportunity&mode=form&id=a55fd6e5721284ee7df2068d2b300b5f&tab=core&_cview=0 (last visited Sept. 26, 2013).

[151] *See* Stephen Clark, *Military agency studying space garbage service*, SPACEFLIGHT NOW (Dec. 12, 2009), http://www.spaceflightnow.com/news/n0912/12debris/. The DARPA "Catcher's Mitt" study described in the link above, however, never went beyond this three day symposium. While no official DARPA announcement was ever made as to why the study was not pursued, it was clear from many of the presentations that some of the tools suggested for removing orbital debris (e.g., ground-based or space-based laser), could just as easily be used as anti-satellite weapons.

[152] *See* J. Pearson, E. Levin, and J. Carroll, *Affordable Debris Removal and Collection in LEO*, *in* 63RD INT'L ASTRONAUTICAL CONG., Paper IAC-12-A6.6.7 (Oct. 1-5, 2012), *available at* http://www.star-tech-inc.com/id27.html.

[153] *See e.g.,* C. R. Phipps, et al., *Removing orbital debris with lasers*, ADVANCES IN SPACE RES., 49, 1283-1300 (2012).

[154] *See* Ray Sanders, *NASA to Test New Solar Sail Technology* (Oct. 13, 2011), http://www.universetoday.com/89869/nasa-to-test-new-solar-sail-technology/ (Report on

technologies.[156] Each advocate of a particular technological approach to active debris removal ("ADR"), passionately argues that there are no technical "show stoppers" to ADR. This is not to say that the technical solutions are easy (or cheap); most would take years if not decades of technology development, and ultimately it might cost as much to take down a piece of space trash as it did to launch it into orbit in the first place.[157] As with any "tragedy of the commons," figuring out who will pay for orbital debris removal is a difficult issue, and the economic solutions to the problem are not readily apparent to most.[158]

In addition to the technical and economic issues, however, there are significant legal issues related to removing orbital debris which are every bit as vexing as the technical and economic issues. The major difficulty the international legal community has had in coming to grips with the orbital debris problem stems from four provisions of international law:

1) Under the Outer Space Treaty, a state launching an object retains jurisdiction over that object, presumably forever;[159]

2) There is no explicit requirement under international treaty law to remove an object from space once its useful life is over (notwithstanding the various debris mitigation guidelines adopted by various countries);

NASA's solar sail program and the possibility of using solar sails for orbital debris removal).

[155] *See, e.g.,* Laura Boness, *Tractor beams may become a reality,* SCIENCE ILLUSTRATED (Nov. 2, 2011), http://scienceillustrated.com.au/blog/science/tractor-beams-may-become-a-reality/.

[156] *See, e.g.*, Leonard David, *"Sling-Sat" Could Remove Space Junk on the Cheap*, SPACE.COM (Mar. 1, 2013), http://www.space.com/20024-space-junk-removal-sling-sat.html.

[157] Many of the more exotic proposals, such as tethers and the "Sling-Sat" hope to be able to retrieve multiple space objects with a single spacecraft, thus reducing the cost, per debris removed, substantially. Each of these missions could easily run hundreds of millions of dollars, even if they could remove multiple pieces of debris.

[158] At the 2009 DARPA symposium, this author proposed the establishment of a bounty system for orbital debris removal whereby all satellite operators would pay into a fund an amount based on the size, orbit, and history of successful debris mitigation, an authority would be established to place a value on each piece of orbital debris (with the highest value assigned to those pieces which pose the greatest threat of collision), and then private entities would be awarded money from the fund for successful removal. *See, Legal and Economic Implications*, *supra* note 148.

[159] Outer Space Treaty, *supra* note 75, at art. VIII.

3) The Registration Convention lacks any enforcement mechanisms or sanctioning provisions which would require a launching state to register each part of a launch, and any subsequent debris coming from a launch; and

4) Under the Liability Convention, fault must be established before liability can be assigned to any activity occurring in orbit.[160]

As discussed above, there has been every reason for the spacefaring nations to ignore the orbital debris problem for the simple reason that to acknowledge it, and to establish norms of conduct, would go a long way toward establishing a "duty" and a "standard of care" that would feed into a negligence liability analysis.

The 1995 Inter-Agency Report on Orbital Debris[161] explained the conundrum this way:

> Although the Liability Convention provides a legal mechanism for establishing liability and damages, there would likely be problems of proof associated with a claim based on damage caused by orbital debris. In the likely event that damage to or destruction of a space objects was caused by a small, unobservable fragment, it would be difficult to establish the identity of the launching state and therefore to invoke the Liability Conventions.
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> Liability would then depend on whether a state's actions in controlling its space objects were 'reasonable.' The present state of space technology does not permit activities in space that are completely debris free; hence, a negligence regime might imply an obligation of states to take reasonable steps to prevent foreseeable damage. Many factors would come into play in decide what steps are reasonable and what damage is foreseeable, including the proximity of other space objects, the reason for the creation of the debris, the cost of preventing the

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[160] Liability Convention, *supra* note 77, at art. III.
[161] *Interagency Report on Orbital Debris 1995, supra* note 10.

> creation of the debris, and the feasibility of providing warnings to states potentially affected by the debris.[162]

Thus, it has always been easier for countries to conduct themselves and their activities as if there wasn't any actual duty to remove their orbital debris (just vague, unenforceable guidelines), and let "God sort it out."

States interested in actually cleaning up the cluttered space environment face the same legal conundrum, in that it can be argued that the removal of someone else's junk is a violation of international law, since the ownership of the object remains with the launching state under Article VIII of the Outer Space Treaty, even if the launching state has no ability to use, control, or remove the object. As the 1995 Interagency Report concluded:

> If the launching state consented to the destruction or removal of its orbital debris, or if it abandoned its rights to the debris through a clear expression of intent, destruction or removal could be considered lawful. However, under customary international law, state property remains state property unless expressly relinquished. (Under maritime law, for example, the U.S. has consistently maintained that sunken state ships remain the property of the flag state until title is expressly transferred or abandoned, and that abandonment cannot be implied from the absence, even over a long period of time, of acts evidencing an interest in such property.)[163]

As that same report points out, however, taking this legal approach directly conflicts with Article IX of the Outer Space Treaty, which requires states to conduct their activities "with due regard to the corresponding interests of all other States Parties to the Treaty."[164] The problem there is that to demonstrate that Article IX rights are being violated, a state would have to prove the element of negligence, that there is a duty of care as it relates to orbital debris that has been violated, and that spins us right back into the same conundrum.

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[162] *Id*. at 46.
[163] *Id.* at 47.
[164] *Id. See* Outer Space Treaty, *supra* note 75, at art. IX.

So once again, we are back where we started (and where Haley warned), with no enforceable international norms for liability for orbital debris, no sanctions for a country that fails to deorbit or move satellites to safe orbits at end-of-life, and nothing more than "irate expressions of disdain for the violator."[165] In the next section, however, a pathway forward is proposed that capitalizes on other concepts of international law, and the evolution of customary international law as it applies to orbital debris.

V. RECOMMENDED LEGAL AND POLICY APPROACHES TO SOLVING ORBITAL DEBRIS

The 1995 Interagency Report on Orbital Debris quoted above alluded to concepts of Maritime law that establish that ownership of a seagoing vessel remains with the state of flagging even after such a vessel is sunk.[166] This may be true as far as it goes, but nonetheless provides a false analogy when applied to outer space, because in most instances, the sunken ship alluded to sits quietly on the ocean floor, posing little danger to navigation. Derelict satellites, however, do pose a hazard to space navigation, and need to be treated as such. That is where another provision of maritime law can be of assistance. Under both international and U.S. domestic law, vessel owners are required to clear their vessels from navigable waters and not place impediments to free passage within their territorial waters.[167]

Under customary international law, the rules of navigation and the right of "innocent passage" have existed for hundreds, if not thousands of years.[168] Article 17 of The Law of the Sea Con-

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[165] SPACE LAW AND GOVERNMENT, *supra* note 1, at 150.

[166] *Interagency Report on Orbital Debris 1995, supra* note 10.

[167] *See* Corfu Channel Case (U.K. v. Alb.), 1949 I.C.J. 4 (Apr. 9) In *Corfu Channel,* the International Court of Justice (ICJ) held Albania liable for damage caused to two Royal Navy destroyers by mines placed in its territorial waters in the Corfu Channel. The court further found that Albania had a duty to notify both the international shipping community, and to warn the destroyers once they entered the Channel of the existence of these mines.

[168] *See*, SPACE LAW AND GOVERNMENT, *supra* note 1, at 57 ("A judicial decision of 1871 [The Scotia, 81 U.S. (14 Wall.) 170 (1871)], in a case involving a collision of a British and an American ship,69 held that the pertinent rules of navigation having been accepted as obligatory by more than thirty of the principal commercial states of the world, these rules became the law of the sea.")

vention guarantees that ships of all states "enjoy the right of innocent passage through the territorial sea."[169] Furthermore, coastal states may adopt laws and regulations relating to innocent passage that provide for "the safety of navigation and the regulation of maritime traffic."[170]

The United States, although not a signatory to the Law of the Sea Convention, has adopted specific rules as to vessels which endanger the safety of navigation. For instance, under 33 U.S.C. Section 409:

> It shall not be lawful to tie up or anchor vessels or other craft in navigable channels in such a manner as to prevent or obstruct the passage of other vessels or craft; or to sink, or permit or cause to be sunk, vessels or other craft in navigable channels . . .. And whenever a vessel, raft or other craft is wrecked and sunk in a navigable channel, it shall be the duty of the owner, lessee, or operator of such sunken craft to immediately mark it with a buoy or beacon . . . and it shall be the duty of the owner, lessee, or operator of such sunken craft to commence the immediate removal of the same, and prosecute such removal diligently, and failure to do so shall be considered as an abandonment of such craft, and subject the same to removal by the United States as provided for in sections 411 to 416, 418, and 502 of this title.[171]

Many U.S. state laws declare as abandoned "any watercraft that is inoperative and neglected, submerged or partially submerged or that has been left by the owner in coastal waters without intention of removal."[172] Under the Federal Abandoned Barge Act of 1992, it is illegal to abandon a barge in navigable waters. "Barge" is defined as a "non-self-propelled vessel,"[173] and "abandoned" is defined as "to moor, strand, wreck, sink, or leave a barge of more than 100 gross tons . . .for longer than forty-five

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[169] United Nations Convention on the Law of the Sea, art. XVII, *opened for signature* Dec. 10, 1982, U.N. Doc. A/CONF.62/122 (1982), 21 I.L.M. 1261 (1982).

[170] *Id.* at art. XXI.

[171] 33 U.S.C. § 409.

[172] *See, e.g.,* Title 12 Maine Rev. Stat. § 1866.

[173] 46 U.S. § 102.

days.[174] Under general American maritime law, "abandonment" "is an intentional relinquishment of all right, title and possession of a thing without the intention of ever reclaiming it. It consists of two elements, act and intention, with intention to abandon being the most important. It is a question of fact determined from all the circumstances. A mere passage of time will not necessarily work an abandonment if the owner has clearly shown a constant intent to salvage it."[175]

The analogy to space and orbital debris is clear. Space orbits, like the waters of the oceans, must be free for passage by all. Hazards to navigation need to be removed. This is especially true for derelict or abandoned vessels and space objects. The same definitions of abandoned used in maritime law can easily be applied to space objects. Indeed, the IADC orbital debris guidelines already make a clear distinction between "spacecraft" and "space debris" which is defined as "all man made objects including fragments and elements thereof, in Earth orbit or re-entering the atmosphere, that are non functional."[176]

Some would argue that this analysis is not applicable because the United States, and other countries, claim that government property in the form of shipwrecks can never become abandoned under Articles 95 and 96 of the Law of the Sea Convention,[177] and that under Article VIII of the OST, jurisdiction over all manmade objects placed in space remain with the launching state, and can never be lost.[178] This argument must fail because Articles 95 and 96 cannot be read in total isolation. Rather, Articles 95 and 96 of the Law of the Sea Convention must be read against the provisions cited above that guarantee the right of safe passage. As the *Corfu Channel* case makes clear, just because an object obstructing safe passage belongs to a state government (and not a state flagged vessel belonging to someone else) does not absolve the state from its duties to protect the right of safe passage. Articles 95 and 96 are clearly in-

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[174] 46 U.S. § 4701.

[175] *See* Lawrence Lipka, *Abandoned Property at Sea: Who Owns the Salvage "Finds"?*, 12 WM. & MARY L. REV. 97, 102, n. 28 (1970).

[176] IADC Guidelines*, supra* note 124, at arts. 3.1 & 3.2.

[177] Law of the Sea Convention, *supra* note 169, at arts. 95 & 96.

[178] Outer Space Treaty, *supra* note 75, at art. VIII.

tended to protect states from the seizing or looting of their property (including shipwrecks). It does not act as a trump card over state responsibility and the *due regard* of the activities of others that is required under customary international maritime law. In the aviation context, this has been made clear via treaty. While the Convention on International Civil Aviation of 1944 (Chicago Convention) exempts "state aircraft" from International Civil Aviation Organization (ICAO) procedures, it nonetheless requires "state aircraft" to fly with "due regard for the safety of civil aviation."[179]

In the same way, we must balance the rights *and responsibilities* as between OST Articles VII, VIII and IX to bring them into conformity with maritime and aviation law. A state should not be able to retain jurisdiction over a satellite it can no longer control and which it has effectively abandoned by any definition under maritime law, escape liability for the destruction a collision would cause, and allow that satellite to remain in an uncontrollable orbit contaminating outer space, interfering with the rights of other nations not to have their activities interfered with.

Some have suggested that this legal conundrum can be solved only through amendment to either the OST or the Liability Convention. This author believes Haley would disagree, even though Haley had hoped that in the early years of the space age enforceable treaties would be negotiated.[180] Instead, the problem can be solved through use of customary interna-

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[179] Convention on International Civil Aviation, art. 3, Dec. 7, 1944, 61 Stat. 1180, 15 U.N.T.S. 295.

[180] *See*, SPACE LAW AND GOVERNMENT, *supra* note 1 at 59:

> There is nothing about a formal treaty which makes it sacrosanct – which makes it even an essential source of international law. A treaty is merely a formal expression of the will of the contracting states – a formal method by which the nations involved show their consent to some act or agreement or series of acts and agreements. In many instances the principle set forth in the treaty itself may have been established in international law long before the signing of the formal document itself. Indeed, there are principles of international law which have never been embodied in treaty form but are nonetheless valid; and, by the same token, the mere fact that some purported rule of international law has been enacted in a treaty does not automatically give it validity.

tional law, which as Haley argued, can happen far more quickly in the context of an area of the law that remains underdeveloped, and where activities are open and apparent to all.

> There is in any event, no rule in international law which would require that consent, clearly shown, must be fortified by prolonged usage. Long ago Triepel recognized that under certain conditions one single act of international practice based on usage might suffice for a rule of international law. Normally a long period of usage has been required before a principle could become established as a part of international law, but this is so only because in most cases the consent of nations could not be ascertained by other nations except over a long period of years. . . . The present situation, however, is entirely different. An earth satellite will pass over numerous countries in a period of hours and these nations are immediately aware of the launching. Knowledge of the impending launching may even have been available for a considerable time prior to the actual event. In view of this, the nations could be expected to express their consent-or non-consent-in a timely manner.[181]

As discussed above, Haley used this reasoning to conclude that the concept of free overflight was established by the single even of the Soviets orbiting Sputnik I.[182] Other events in the history of spaceflight have established customary international law through single events, or a small series of events. For example, the right to own lunar samples returned to Earth was established by the United States (and to a lesser extent the Soviet Union) through their Apollo and Luna sample return missions and their approaches to those samples.[183]

So, based on this argument by Haley, can we conceive of a single event, or a small set of events, which could establish a new customary international law as it relates to space debris,

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[181] *Id.* at 60-61.

[182] *Id.*

[183] *See* J. Dunstan, *Toward a Unified Theory of Space Property Rights*, *in* SPACE: THE FREE-MARKET FRONTIER (CATO Institute, 2002) (wherein this author pointed out that the United States claims the Apollo samples as a "national resource," citing NASA policy as to release of Apollo samples, and argued that the exchange of Apollo samples for Soviet Luna samples evidenced one of the classic indicia of ownership – the ability to exchange a piece of property for another piece of property.).

and specifically to the remediation of this debris which is both consistent with the Outer Space Treaty, yet is more in line with the safe passage and due regard concepts of maritime and aviation law? This author believes such customary international law could evolve, under several different scenarios, each discussed below. Although these are considered to be independent events, the combining of more than one of these would strengthen the argument that customary international law has been established.

1) The United States, or any other launching state, could adopt a policy that clearly states that any commercial[184] satellite, component, or upper stage in orbit which is no longer operating and controllable shall be deemed to be "abandoned property" and subject to the Law of Finds.[185]

2) The United States, or any other launching state, could mount an ADR mission and deorbit a non-functional commercial[186] satellite, component, or orbiting upper stage launched from its state, and declare that the deorbiting was necessary because of the threat such object placed on space navigation, citing its responsibilities under Article VI and IX of the OST (requiring authorization and supervision over its nationals to ensure compliance with Article IX's requirement of conducting space activities with due regard to the rights of other states).

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[184] The scenario is limited to commercial (i.e., non-governmental) objects both to avoid the conflict with the maritime law proposition that governments can't abandon property, and to protect the national security interest of the declaring country in ensuring that another country doesn't deorbit and recover derelict surveillance satellites to discover their functionality and possibly use that technology in their own surveillance satellites.

[185] The Law of Finds dates far back into the common law, and grants title to unwanted property according to principle of "finders keepers"; actual possession of property creates an interest in that property that can ripen into clear title if no better possessory interest is interposed. To acquire title to property in this fashion, a finder would have to prove the property was either: (1) never owned, or (2) once owned but since abandoned. *See e.g.*, Armory v. Delamire, 93 Eng. Rep. 644 (K.B. 1722); Adams v. Unione Mediterranea Di Sicurta, 220 F.3d 659, 670 (5th Cir. 2000) (distinguishing the law of salvage and the law of finds based on the latter's affording award of title), Fairport Int'l Exploration v. Shipwrecked Vessel Known as the Captain Lawrence, 105 F.3d 1078, 1084 (6th Cir. 1997) (discussing how a claimant acquires title under the law of finds).

[186] *See supra*, note 184.

3) The IADC could adopt a guideline that states that any "non-functional" object would be deemed as "abandoned."

4) A spacefaring nation could deorbit an upper stage launched by another state after demonstrating through detailed conjunction analyses the danger to space navigation of allowing the derelict object to remain in orbit, and claiming the right of action by necessity.

While the first two actions would constitute the unilateral domestic acts of a single country, as Haley pointed out above, because the activity would occur outside the territory of the United States (or other initiating state) and instead in the *res communis* of outer space, such actions, if accepted by the international community either through assent or even silence, could lead to customary international law.[187] The third scenario, if it occurred, would represent a more traditional international organizational approach to establishing customary international law through the consensus building process. The IADC, which to date has appeared far less political than any of its international organizational siblings such as COPUOUS or the ITU, might be capable of adopting this position. Given its membership, however, it is far more likely that one of its members would either veto such a position, stall any efforts to pass such a resolution, or worst yet, oppose such a position on the international stage.

The final scenario is by far the most daring, but may well be the most likely to occur. At some point the space situational awareness (SSA) capabilities to track objects and conduct even more "all-against-all" conjunction analyses will allow governments of the world to predict a future collision with enough lead time to avoid it by actively intervening to remove an object from orbit, rather than require multiple other satellites to take defensive measures by conducting orbital maneuvers to avoid a collision. The argument of action by necessity in an intriguing one.

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[187] Indeed, were a bounty system established, similar to the one proposed by this author at the DARPA Orbital Debris Workshop in 2009, the United States government could establish a commercial market for orbital debris remediation that could actually be funded through the users of orbital slots. *See supra* note 158.

The International Law Commission Draft Articles on State Responsibility outline the provisions of customary international law on necessity.[188] Under Article 33, a State is absolved from liability under a claim of necessity if its action was "the only means of safeguarding an essential interest of the State against a grave and imminent peril."[189] Several candidate upper stages exist in the 800 km polar orbit that were placed there by the Soviet Union. Because of their size and orbit, they present the greatest risk to space navigation.[190] A compelling case could be made that the removal of one or two of these stages would lessen the probability of plunging us into (or further into) the Kessler Syndrome, and therefore be consistent with the Outer Space Treaty. The party conducting such active debris removal (ADR) activities would have to make clear that the objects removed qualified as "orbital debris" under the IADC guidelines.[191]

VI. CONCLUSIONS

Andrew G. Haley warned us of the potential problem of orbital debris back in 1963 in *Space Law and Government*. He specifically warned that adopting international treaties that contained no police power or sanctioning ability would lead directly to the "tragedy of the commons" that now exists in key orbits. Yet Haley also recognized that in an area of law that was nascent and lacked many decades of international conduct (as was the case of customary international aviation law in the 1960s) or thousands of years of international conduct (as is the

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[188] Articles on Responsibility of States for Internationally Wrongful Acts, International Law Commission, U.N. Doc. A/RES/56/83 (Jan. 28, 2002).

[189] *See id.* at art. 33.

[190] *See* Chris Bergin, *Project ADR: Removal of Large Orbital Debris Interests NASA*, NASA SPACEFLIGHT.COM (Jan. 9, 2011), http://www.nasaspaceflight.com/2011/01/project-adr-removal-large-orbital-debris-nasa-study/. *See also supra* note 27, and discussion related thereto.

[191] Obviously, the easiest approach to doing this would be to receive the approval of the Russian government to remove the Soviet upper stages. Given that absolute liability would remain on Russian in the event that the upper stages caused damage to persons or property on the surface of the Earth (Liability Convention, *supra* note 77 at art. II) receiving such approval might be problematic, and for the sake of this discussion, it is assumed that the party conducting the ADR would be doing it without the expressed permission of the state that originally launched the object.

case with customary international maritime law), the actions of just one, or a very few players, could create the "norm of orderliness" that Haley called for.[192]

Rather than spending the next few decades trying to get the international community to reach a consensus on the duties of nations to remove their own debris (since after all, this same community has been unable to even define where space begins after 50 years), maybe it is instead time for one of the major spacefaring nations to take one or more of the proactive steps outlined above to drive the final nail in the coffin of "the Big Sky" theory, and instead take the first steps to establishing customary international law that states that orbit debris is abandoned property, free to be removed by any party in order to ensure safe passage in all orbits. Anything less and all we will be able to do when the next major collision occurs creating thousands or hundreds of thousands of new pieces of debris will be to vocalize our "irate expressions of disdain."[193] Fifty years after it was written, *Space Law and Government* demands more of us today, when advancement in space technologies and our understanding of the space environment can lead us to no other conclusion but that the orbital debris crisis will not be solved by merely sitting back and hoping the next big collision won't occur in our lifetimes (or at least within the lifetimes of the satellites that we're most interested in). There is, instead, a clear "call to arms" in *Space Law and Government* that requires all who call themselves "space lawyers" should take up, and do what they can to work aggressively toward solutions to orbital debris, before it is too late.

> In context after context as problems are examined it must be kept in mind that as space science and technology move forward at hypersonic speed, the law cannot afford to remain earthbound. The mildest possible penalty for such a lag will be confusion. The maximum price we may pay is mutual destruction.[194]

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[192] SPACE LAW AND GOVERNMENT, *supra* note 1, at 157.
[193] *Id.* at 150.
[194] *Id.* at 123.

A NATURAL SYSTEM OF LAW? ANDREW HALEY AND THE INTERNATIONAL LEGAL REGULATION OF OUTER SPACE

Steven Freeland[1]

I. HALEY'S VISION FOR THE INTERNATIONAL LAW OF OUTER SPACE

It is, of course, trite to state that the vast majority of international law that now exists has evolved, both through custom and as codified in treaties, by way of, and for, application to 'terrestrial' situations. International law has been an incredibly important mechanism by which the relationships between States (and other entities that have international legal 'personality') have been regulated. Naturally, the vast majority of such interaction has taken place in respect of their dealings with each other on Earth – through trade, conflict, cooperation etc. International law has, in most situations, served States very well in this regard in the regulation of these interactions. It has ensured that there are standards for compliance, and pathways and forums for discussion and debate, so as facilitate mechanisms by which to best ensure that international society operates (relatively) efficiently and peacefully.

Of course, there are difficult areas where the necessary political will has been lacking, particularly by way of (self) enforcement – these are the things we would usually read about in the newspapers. But, for the main, this terrestrial-inspired form of international law works very well, and has facilitated great progress in many areas of human endeavor on Earth, even

[1] Professor of International Law, University of Western Sydney; Marie Curie Visiting Professor, iCourts Centre of Excellence for International Courts, University of Copenhagen; Visiting Professor, Faculty of Law, University of Vienna; Director, International Institute of Space Law; Member of the Space Law Committee, International Law Association; Member of Faculty, London Institute of Space Policy and Law. This article was written in May 2013.

though it often operates in the background. This is vital in an ever-increasingly globalized world.

Yet, this is by no means a 'given' in all circumstances. As the dawn of the 'space age' was just emerging in the late 1950s, important questions were being raised as to how international law would and should be adapted for, and adapt to, humankind's activities in the new frontier that was outer space. In 1958, Andrew Haley, considered by many to be the world's first space law practitioner,[2] wrote of the need to develop a new 'international formulation of space law.'[3] He believed that the level of positive benefits to be gained from humankind's endeavors in space would largely be dependent upon whether it had determined an appropriate body of law to govern such activities. In his view, the legal regime that would be most appropriate for the regulation of this new frontier could only be truly international in nature, without resort to the tools associated with what he referred to as 'municipal' (national) law. Moreover, for Haley, the international law to be applied to outer space must be of a *sui generis* nature, since 'it is evident that our space jurisprudence must be based on something other than the present day international law.'[4]

In other words, given the unique nature of outer space, and the complex and (in many senses) unprecedented character of much of humankind's activities in this 'different realm,' Haley firmly believed that care had to be taken 'not to attempt to apply to space rules which have meaning only when applied to terrestrial events.'[5] He was conscious, even in those early days, of the emergent issues that would be associated with space activities,[6] believing that specific international law norms should be developed to address these 'new' problems, and that the appro-

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[2] *See* The University of Mississippi School of Law, National Center for Remote Sensing, Air, and Space Law: Andrew Haley Collection, http://www.spacelaw.olemiss.edu/archives/haley/ (last visited Sept. 6, 2013).

[3] Andrew G. Haley, *Law of Outer Space – A Problem for International Agreement*, 7 AM. U. L. REV, 70, 71 (1958).

[4] *Id.* at 73.

[5] *Id.* at 72.

[6] *See,* e.g., Andrew G. Haley, *Space Age Presents Immediate Legal Problems,* 1 PROC. OF THE COLLOQ. OF OUTER SPACE 5 (1958).

priate legal framework should be based on a set of principles that are 'beyond terrestrial disagreement.'[7] 'Terrestrial' international law was therefore, in Haley's view, wholly inapplicable to the legal challenges that outer space presented.

For similar reasons, Haley also saw little value in considering that the by then well-established legal regulation of other 'regimes,' such as maritime law and aviation law, might offer a level of significant guidance as to how outer space should be governed. He concluded that those specific regimes, too, had evolved to address specific issues that were peculiar to their own circumstances, and that these were very different to the pertinent questions that related to the use and exploration of outer space. In any event, he saw that the legal problems that would arise with respect to space - citing as an example, those associated with human space travel - were 'vastly more complicated'[8] than with other regimes;[9] yet another reason, in his view, to bypass those 'precedents' and thus avoid the temptation to develop a legal framework for space by way of legal analogy. Instead, he in effect advocated for a 'clean-slate' approach to the development of international space law, based on his conceptions of how this process was to be undertaken.

Having declared his hand in this way, Haley went on to discuss in subsequent writings his ideas as to the appropriate nature of the international law regulation that should be applied to outer space, representing as it did a framework for development of the necessary rules. He took very much a theoretical and traditional approach to the bases upon which international law was 'created,' comparing two distinct – and in his mind largely opposed – philosophies of international law: the 'natural law' theory of international law and the 'positivist' approach.

Based on a historical survey of some of the leading legal theorists and practitioners, Haley characterized the former ap-

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[7] *Law of Outer Space – A Problem for International Agreement*, *supra* note 3, at 73.

[8] *Id.* at 72.

[9] As an illustration of both his foresight and the importance he placed on the longer term regulation of issues arising from human space travel, Haley opined that: "[a]s the venture into space continues there will arise, in a new frame of reference, problems of neutrality and belligerency, of nationality, domicile, statelessness, internment, asylum, sequestration, blockade, hovering, extraterritoriality, embargo, and so on". *Id.* at 77.

proach (which he championed) as 'based upon certain fundamental moral principles arising from the nature of man which are unchanging and which underlie, or should underlie, every body of law in every human community,'[10] He describes this philosophy of law in almost spiritual terms, contrasting it with the positivist viewpoint (which he thought as totally inappropriate and reflective of a 'municipal' approach to international law), whose 'weakness' was that it 'lack[ed] a body of principle more fundamental than existing specific rules of law.'[11]

Yet, although he regarded these two positions as philosophically opposed, he acknowledged that 'many specific rules may pass the tests … of both'[12] and that some form of harmonization (compromise) may be necessary, although not desirable. Nonetheless, in his view, the natural law approach was superior in a number of important aspects, and 'recognizes the possibility of an invalid law . . . [while] the positivist does not.'[13] It was on this premise that he went on to describe the basis of international law, revolving around notions of (State) consent, which he thought were vital in the formation of the 'new law of the space age.'[14]

This brief article will consider the principal points raised by Haley as seen in a more modern context, some 50+ years on, in order to examine how and whether they have stood the test of time in terms of the *lex specialis* of space law, as well as the other (semi-? non-?) legal trends relating to the regulation of outer space that have emerged, and the practice of States and non-governmental entities. Much has happened since the halcyon days of the 1960s with respect to the development of the fundamental principles of (international) space law. In the end, Haley's conception of the need for a natural evolution of fundamental principles has been proven not to precisely describe the current international regulation of the use and exploration of outer space; but neither is it totally inaccurate.

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[10] ANDREW G. HALEY, SPACE LAW AND GOVERNMENT 25 (1963).
[11] *Id.* at 31.
[12] *Id.* at 37.
[13] *Id.*
[14] *Id.* at 38.

In reaching this conclusion, it is necessary to briefly canvas the following issues: (i) the nature of existing international space law; (ii) the 'applicability' of existing (terrestrial) international law to space activities; and (iii) the tendencies towards so-called 'soft law' regulation with respect to the use and exploration of outer space.

II. THE NATURE OF EXISTING INTERNATIONAL SPACE LAW

As is well known, on 4 October 1957, a Soviet space object, *Sputnik I*, was launched and subsequently orbited the Earth over 1,400 times during the following three month period. Thus began humankind's adventures in outer space. This milestone heralded the dawn of the space age and, over the ensuing decades, has given rise to the gradual development of fundamental principles that would underpin the legal regulation of the use and exploration of outer space.

Whilst there had been some (largely) academic scholarship prior to *Sputnik I* regarding the nature and scope of those laws that might be relevant and appropriate in relation to activities in outer space, these had generally been discussed only at a hypothetical level.[15] The journey of *Sputnik I* highlighted almost immediately some of the difficult (practical) legal questions, involving previously undetermined concepts, upon which Haley was soon to comment, and which led him to quickly conclude on the need to create a completely new international legal framework untainted by existing law. Indeed, with the launch of *Sputnik I*, the reality of humankind's aspirations and capabilities with respect to outer space had all of a sudden become apparent, and the world had to react – quickly – to an unprecedented event in an unregulated legal environment, particularly as it was clear that this was just the beginning of what would become an ever-increasing quest to undertake a wide range of space activities.

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[15] For a summary of the main academic theories relating to "space law" in the period prior to the launch of *Sputnik I*, *see, e.g.*, FRANCIS LYALL & PAUL B LARSEN, SPACE LAW: A TREATISE 3-9 (2009).

First and foremost, this necessitated clarification as to the legal categorization of outer space for the purposes of international law. This marked an important aspect of Haley's conception that outer space was *different* from other legal areas, such that unique legal solutions had to be found. Haley was particularly concerned with the legal status of celestial bodies and the pressing need for all the space faring States to clearly enunciate that there was no possibility of establishing sovereignty over them. One of his most profound concerns was that 'colonialism' must never be permitted to occur in outer space, since he believed that 'wars, colonialism and strong nationalism [had] . . . overwhelmed the sound basis of international law' that was grounded on his cherished philosophy of natural law.[16]

In the end, Haley's concerns in this regard were, in fact, immediately addressed. Although the Soviet Union had not sought the permission of any other State to undertake the *Sputnik I* mission, there were no significant international protests asserting that this artificial satellite had infringed any country's sovereignty as it circled the Earth. The almost total international (in) action that stemmed from the *Sputnik* mission confirmed that this new frontier for human activity – outer space – did not, from a legal perspective, possess the traditional elements of sovereignty that had already been well established under the binding terrestrial international law principles that regulated land, sea and air space on Earth, and which Haley regarded as irrelevant for the legal characterization of outer space. Haley's arguments against turning to other regimes for guidance in the development of international space law thus seemed well-founded.

Instead, it was almost immediately assumed that outer space was to be regarded as an area beyond territorial sovereignty. Describing the early emergence of this customary international principle in the context of outer space, Judge Manfred Lachs of the International Court of Justice observed, shortly

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[16] *See generally*, SPACE LAW AND GOVERNMENT, *supra* note 10, at 3-35, & 132-133.

after the first of the United Nations Space Law Treaties had been finalized, that:[17]

> [t]he first instruments that men sent into outer space traversed the air space of States and circled above them in outer space, yet the launching States sought no permission, nor did the other States protest. This is how the freedom of movement into outer space, and in it, came to be established and recognised as law within a remarkably short period of time.

This view as to the possibility of what has sometimes been referred to as 'instant' customary law accords with Haley's own conclusion that there was 'no rule in international law which would require that consent, [for the purposes of determining whether something constituted a rule of customary law] clearly shown, must be fortified by prolonged usage.'[18] As such, virtually immediately after humankind had begun its quest to explore and use outer space, a number of foundational principles of the international law of outer space were born – in particular the so-called 'common interest,' 'freedom,' and 'non-appropriation' principles. In a certain sense, one could classify these as constituting a pure form of Haley's 'natural law' theory for the regulation of outer space, although Haley himself characterized customary law (which these principles represented even before their codification in the Outer Space Treaty) 'as much a positive, man-made law as is treaty law.'[19]

In any event, such principles flowed from humankind's desire that outer space be regarded in such a way as to minimise the potential for conflict and disagreement, and instead serve to facilitate cooperation. As Haley had anticipated, these fundamental rules underpinning the 'new' international legal order for outer space represented a significant departure from the legal rules relating to air space, which from a legal perspective, is categorised as constituting part of the 'territory' of the subjacent

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[17] North Sea Continental Shelf Cases (Federal Republic of Germany v. Denmark and Federal Republic of Germany v. The Netherlands) (Judgment), [1969] ICJ Rep 3, 231 (Dissenting Opinion of Judge Lachs).

[18] SPACE LAW AND GOVERNMENT, *supra* note 10, at 60.

[19] *Id.* at 58.

State, as was reflected initially by way of customary law,[20] and then in the principal air law treaties. For example, reaffirming the principle that had already been codified as early as in 1919,[21] the 1944 Convention on International Civil Aviation[22] provides that:[23]

> every State has complete and exclusive sovereignty over the air space above its territory.

The International Court of Justice has also concluded that this characteristic of air space represents customary international law.[24] As a consequence, civil and commercial aircraft only have certain limited rights to enter the air space of another State,[25] in contrast to the freedom principle relating to outer space.[26]

As noted above, Haley strongly opposed the influence of municipal law on international law. The jurisdictional classification of air space in this way, although practical and an inevitable consequence of national security interests, was 'a concept completely repugnant to the nature of our proposed travels in space [and] . . . the antithesis of natural law.'[27] It was therefore

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[20] *Id.* at 59.

[21] *See* Convention for the Regulation of Aerial Navigation of 1919, Oct. 13, 1919, 11 L.N.T.S. 173.

[22] 15 UNTS 295 (Chicago Convention).

[23] Convention on International Civil Aviation art. 1, Dec. 7, 1944, 15 U.N.T.S. 295, T.I.A.S. 1591 [hereinafter Chicago Convention]. For the purposes of the Chicago Convention, the territory of a State is regarded as "the land areas and territorial waters adjacent thereto under the sovereignty, suzerainty, protection or mandate of such State". *Id.* at art. 2.

[24] *Case Concerning Military and Paramilitary Activities in and against Nicaragua (Nicaragua v. United States)* (Merits) (Judgment), [1986] ICJ Rep 14, 128 (whereby the court noted that "[t]he principle of respect for territorial sovereignty is also directly infringed by the unauthorized overflight of a State's territory by aircraft belonging to or under the control of the government of another State").

[25] *See* Chicago Convention, *supra* note 23, at art.s 5 & 6.

[26] Of course, any space activities requiring a launch from Earth and/or a return to Earth will also involve a "use" of air space. In this respect, the law of air space may be relevant to the legal position if, for example, the space object of one State travels through the air space of another State. *See also*, Convention on International Liability for Damage Caused by Space Objects, art. II, *opened for signature* Mar. 29 1972, 24 U.S.T. 2389, 961 U.N.T.S. 187 [hereinafter Liability Convention] (applies *inter alia* to "aircraft in flight" (i.e. operating in air space)).

[27] *Law of Outer Space – A Problem for International Agreement*, *supra* note 3, at 73.

clearly at odds with what he regarded as the essential element for the proper regulation of outer space.

Yet, his vision was, in other senses, not fully self-contained, nor completely sufficient. Notwithstanding the emergence of these fundamental principles – generated by the consent of the (major) space faring and other nations,[28] and supported by the international community as a whole – it was still considered vital that these principles be (further) elaborated and codified into legal instruments. Thus, the fundamental principles of space law, having first been the subject of a number of United Nations General Assembly resolutions,[29] were later incorporated into the terms of the formal United Nations Space Law Treaties.[30]

As a consequence, there is now a substantial body of international written law dealing with many – although not all – aspects of the exploration and use of outer space. These principles are primarily to be found in these Treaties, but also in subsequent United Nations General Assembly resolutions, bilateral arrangements, and determinations by Intergovernmental Organisations. But there is, of course, even more: over recent years, an increasing number of States have promulgated na-

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[28] *See, generally*, *The Role of Consent in the International Law-Making Process*, *in* SPACE LAW AND GOVERNMENT, *supra* note 10, at 56-62.

[29] *See* International Co-operation in the Peaceful Uses of Outer Space, U.N. GAOR Res. 1721, 16th Sess., 1085th plen. mtg., U.N. Doc. A/RES/1961(XVI) (Dec. 20, 1961); Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space, G.A. Res. 1962 (XVIII), U.N. GAOR, 18th Sess., 1280th plen. mtg., U.N. Doc. A/RES/1962(XVIII) (Dec. 13, 1963) (hereinafter Space Principles Declaration); Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and other Celestial Bodies, U.N. GAOR Res. 2222, 1499th plen. mtg., U.N. Doc. A/RES/1966(XXI) (Dec. 19, 1966).

[30] Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and other Celestial Bodies, *opened for signature* Jan. 27, 1967, 18 U.S.T. 2410, 610 U.N.T.S. 205 [hereinafter Outer Space Treaty]; Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space, *opened for signature* Apr. 22, 1968, 19 U.S.T. 7570, 672 U.N.T.S. 119 [hereinafter Rescue and Return Agreement]; Liability Convention, *supra* note 26; Convention on Registration of Objects Launched into Outer Space, *opened for signature* Jan. 14, 1975, 28 U.S.T. 695, 1023 U.N.T.S. 15 [hereinafter Registration Convention]; and Agreement Governing the Activities of States on the Moon and other Celestial Bodies, *opened for signature* Dec. 18, 1979, 1363 U.N.T.S. 21 [hereinafter Moon Agreement].

tional space law to compliment their space activities, but also as part of an overall regulatory regime. There currently exists a wide (and increasing) range of national legislation, as well as some relevant decisions by national courts regarding space activities, particularly those involving non-State commercial actors.

One would suspect, therefore, that Haley would not be too impressed by this increasing proliferation of municipal space law, even though it represents a logical adjunct from the terms of, in particular, article VI of the Outer Space Treaty, and the precise definititions in, and requirements of the Liability Convention. Moreover, each of these pieces of domestic space law have been drafted to suit the specific national requirements of the particular State – and therefore they differ in scope and effect – although they may share certain common characteristics.[31] There are therefore some important aspects of the legal regulation of outer space that are neither entirely uniform nor universally supported, although the fundamental terms of the Outer Space Treaty itself may well constitute customary international law.

This appears to be at odds with Haley's call for the regulation of outer space to be determined solely by principles of natural law, or at least by a natural law 'lite' approach that sees little, if any, room for national interests in determining what the law should be. Although past experience may have some value, he emphasized that 'novel activities in a new environment [such as outer space] must be dictated by the needs of the future,'[32] Indeed, the national implementation of the international law principles of outer space by various States is very much a matter of municipal influence, notwithstanding Haley's strong objections, and bears specific *ad hoc* characteristics. Yet, this need for codification and, to a certain degree, modification of the initial fundamental principles into a written 'legislative' form –

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[31] In this regard, *see* Steven Freeland, *The Development of National Space Law*, *in* Steven Freeland, Rada Popova & Solomon Passy (eds.), CONTEMPORARY ISSUES FOR NATIONAL AND INTERNATIONAL SPACE LAW: COMMENTARY AND SOURCE MATERIALS 12-35 (2012).

[32] Stephen E. Doyle, *Book Review – "Space Law and Government"*, 208 DUKE L. REV. 214, 216 (1965).

initially at the international level but, increasingly, also at the national level – was and is inevitable. Given the strategic, military and (ultimately) commercial importance of outer space – which may well be different for each space faring State – it was important for the rules of the road not only to be understood, but also to be codified and, at least to the greatest extent possible at the time, clarified into a written form.

Thus, to a large degree, the (to Haley) undesirable influence of positivism has played a significant role in defining the nature of the existing corpus of international space law, and the broader framework of space regulation – albeit for important reasons. Space law has indeed developed as a mixture of fundamental (natural) principles and pragmatism, leading at times to compromise in the adaptation and application of the rules. In certain respects, given the circumstances in which it was formulated – in the midst of the Cold War and with two opposing superpowers as the only major space faring States at the time – it was inevitable that the fundamental principles that were agreed were 'self-serving,' a characteristic associated with international law that Haley vigorously opposed.

Yet, Haley's pessimism about what such an approach to space law-making would mean for humanikind is also somewhat overstated, given that, in many (although, admittedly not all) aspects of space activities, the prevailing legal regime has served us well, and continues to do so. Even though a purist's approach to humankind's use and exploration of outer space – despite Haley's undoubted clarity of reasoning – has not quite eventuated, humankind's endeavors in outer space have generally brought with them many significant benefits to all of us.

This municipal influenece does not, however, (yet) apply with respect to Haley's vision of 'Metalaw,' which he develops in his various writings as 'a workable system of laws applicable to all our relations with alien intelligences,'[33] As described by his former law clerk, Haley believed that:[34]

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[33] New Mexico Museum of Space History, *International Space Hall of Fame – Andrew G. Haley*, http://www.nmspacemuseum.org/halloffame/detail.php?id=12 (last visited Sept. 6, 2013).

[34] Doyle, *supra* note 32, at 215.

> continued reliance on anthropocentric concepts of law could be fatal to the community of mankind if and when contact is established with other sentient societies on distant celestial bodies.

In this regard, Haley might still have his wish, since it appears that the existing *lex specialis* is, and was intended to be limited only to humankind's activities in space, and does not purport to bind, or indeed apply to our interaction with extraterrestrial life. Haley believed that the basic rules of anthropocentric law – 'the law of human beings' – would simply not be applicable to such interactions. This gave rise to his so-called 'Golden Rule' – 'we must do unto others as they would have done unto them.' If and when the need for such extraterrestrial interaction does eventuate, it may well be the case that the appropriate regulatory rules and guidelines will emerge precisely as a process of natural evolution as envisaged by Haley, rather than as man-made law.

III. THE APPLICABILITY OF EXISTING (TERRESTRIAL) INTERNATIONAL LAW TO OUTER SPACE

Haley's call for a completely *sui generis* regime of legal regulation for outer space was, in certain senses, completely logical. The fact that most existing international law at the time had been developed for 'terrestrial' purposes meant that it was not readily or directly applicable in every respect to this new paradigm of human endeavor. Moreover, the non-sovereignty aspect of outer space meant that any then existent national law (which, in any event, did not at that time specifically address space-related issues) would not *prima facie* apply to this frontier, and would not be the appropriate legal basis upon which to establish the initial framework for regulating the conduct of humankind's activities in outer space. It was clear, therefore, that, at the dawn of the development of 'space law.' specific international binding rules would be required to address the particular characteristics and legal categorization of outer space.

Yet, once again, it seems that Haley's vision of the international law of outer space has not come to pass, at least in the

unequivocal terms that he wished for. This appears to be the case in several respects and for a number of reasons.

First, to this author at least, and notwithstanding Haley's pleas, it is clear that the international regulation of outer space is, in fact, 'embedded' within general international law. It is not, and cannot function as an esoteric and separate paradigm, despite its undoubted unique features. In a sense, this is an obvious point, but one that is worthwhile emphasizing. To consider it otherwise would, it is submitted, be to cast off this ever-increasingly significant area of regulation into a singularity that is not in keeping either with the close inter-relationship it has with a whole range of other human activities (on Earth as well as in space), or its importance in the overall maintenance of international peace and security (very much a 'terrestrial,' as well as 'extraterrestrial' concept).

This conclusion is also a logical consequence of the codification of international space law in the United Nations Space Law Treaties, particularly article III of the Outer Space Treaty, which requires that activities in the exploration and use of outer space are to be carried on 'in accordance with international law, including the Charter of the United Nations.' Indeed, Haley himself was opposed to the adoption of such an idea to the regulation of outer space, finding it 'surprising' that the United Nations General Assembly had adopted an earlier resolution to the effect that, *inter alia*, '[i]nternational law, including the Charter of the United Nations applies to outer space and celestial bodies.'[35] He believed that such an approach was illogical, since it purported to 'modify' existing international law – traditionally based on notions of territoriality – by introducing the prohibition against appropriation. Yet, it should be noted that this achieves, in the end, the result that Haley had called for, and it is not entirely clear from his writings what alternate methodology he would have offered to get to that same point.

Secondly, international law is dynamic and evolving, as has been made clear by the International Court of Justice on a

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[35] SPACE LAW AND GOVERNMENT, *supra* note 10, at 29.

number of occasions.[36] It has tremendous breadth and tremendous depth, and extends to include non-traditional areas that are not 'territorial' in nature. One only has to consider the applicability of both UNCLOS[37] to the 'Area,'[38] as well as the terms of the Antarctic Treaty.[39] Both of these instruments regulate areas that are (for the present time at least) characterized in a different way from territory in the 'international law' sense, as is, of course, outer space.[40]

Likewise, public international law principles are (in theory) capable of extending to the regulation of outer space, and many would say that, in doing so, their application should be of an equally dynamic and evolving character. Whilst this is a truism, it also raises some equally difficult questions, some of which are addressed below.

Thirdly, it is obvious that the future will see an even greater range of space activities evolve. This will give rise to considerable opportunities, but also considerable legal challenges. For some of these issues, there might not necessarily be an 'obvious' (natural) answer. Moreover, no-one doubts that, if one were to look solely at the *lex specialis* of space law, there are areas of lacunae. However, this reality cannot deny the need to 'answer the question' when a difficult legal issue arises – one cannot simply say that there is 'no law.' In the absence of appropriate natural or positivist law that directly answers a par-

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[36] *See,* e.g., Legality of the Threat or Use of Nuclear Weapons (Advisory Opinion) [1996] ICJ Rep 226.

[37] United Nations Convention on the Law of the Sea, 1833 U.N.T.S. 3 (hereinafter UNCLOS).

[38] *Id.* at art. 1(1). Article 89 of UNCLOS provides that, "[n]o State may validly purport to subject any part of the high seas to its sovereignty." *Id.* at art. 89.

[39] Antarctica had seen a series of sovereign claims by several States in the period leading up to the finalization in 1959 of the Antarctic Treaty. Antarctic Treaty, 402 U.N.T.S. 71 (1959). Article IV of the Antarctic Treaty has the effect of suspending all claims to territorial sovereignty in Antarctica for the duration of that instrument, as well as prohibiting any "new claim, or enlargement of an existing claim." *Id.* at art. IV. The Protocol on Environmental Protection to the Antarctic Treaty, 30 I.L.M. 1455 (1998) (augments the Antarctic Treaty by protecting Antarctica from commercial mining for a period of 50 years).

[40] *See* Outer Space Treaty, *supra* note 30, at art. II. *See also* Steven Freeland & Ram Jakhu, *Article II*, *in* STEPHAN HOBE, BERNHARD SCHMIDT-TEDD & KAI-UWE SCHROGL (EDS), COLOGNE COMMENTARY ON SPACE LAW, VOLUME I – OUTER SPACE TREATY 44 (2009).

ticular question, it is necessary to seek to apply other legal methodologies and concepts, so as to create (at least some) clarity, if not certainty. There is clearly a need for regulation of such activities in an appropriate way, even by way of applying other notions of law, and there is no doubt that general international law – perhaps also supplemented by national space law – has an important role to play in this continuing evolution.

So, the concept is relatively simple to state – general principles of international law do apply to activities in outer space. In this regard, therefore, it seems that Haley would once again be disappointed. Yet, this is so because it has to be so, particularly since, as is the case in many areas of scientific endeavor, the development of space-related technology has far outpaced both the emergence of natural international space law (as envisioned by Haley), as well as the development of positive international space law (as reflected in much of the practice and space legislation). For example, it is evident that many current and emerging space activities were not even contemplated by the drafters of the space treaties.

However, Haley's astute observation that space is unique is still very valid in this regard, particularly when determining precisely *how* the applicability of general international law may work for specific situations, and whether 'terrestrial' international law is sufficient, adequate and appropriate for this purpose, notwithstanding our need to use it anyway when the circumstances dictate. In this regard, two brief examples may serve to at least highlight this point. There has already been considerable discussion in relation to the applicability of the *jus in bello* to armed conflicts involving space assets,[41] as well as the incorporation of general principles of international environmental law to address increasingly pressing issues associated with the problem of space debris.[42] Whist it is beyond the scope

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[41] *See*, *e.g.*, Steven Freeland, *In Heaven as on Earth? The International Legal Regulation of the Military Use of Outer Space*, 8:3 US-CHINA L. REV. 272 (2011), and the references therein.

[42] *See, e.g.*, Ulrike M. Bohlmann & Steven Freeland, *The Regulation of Space Activities and the Space Environment*, *in* SHAWKAT ALAM, ET AL. (EDS), ROUTLEDGE HANDBOOK OF INTERNATIONAL ENVIRONMENTAL LAW 375 (2013), and the references therein.

of this brief article to discuss those issues in detail, suffice to say that in both of those instances, important and difficult questions arise as to whether it is possible simply to transpose those principles to space-related situations in an entirely seamless way.

Yet, on the other hand, and despite Haley's reluctance to do so, it is submitted that there is value in considering those regulatory models, which, although not necessarily appropriate for total application by analogy, may be important by way of experience and adaptation. Sometimes, it may not be the most appropriate strategy to have to 'reinvent the wheel' when it comes to legal rule-making – particularly when the situation calls for an answer, even if one does not appear self-evident from the existing *lex specialis* (including customary, as well as conventional space law) body of law.

One possible example of this is the issue of commercial space tourism, which is forecast by some to become a significant space activity in the not-too-distant future, but which is not contemplated by the United Nations Space Law Treaties. In this regard, it may be useful to at least consider those elements of the air space regime that deal with aspects of commercial air travel, to perhaps gauge some possible inspiration for the creation of regulations that will address complimentary questions for commercial space travel, such as safety standards, liability issues, and the rights and legal status of commercial space tourist passengers.[43]

In any event, there may well be important lessons to learn from our experience in regulating other regimes, so as *not* to repeat prior mistakes when it comes to formulating and implementing the international regulation for outer space. Prior practice may also represent a precedent of what *not* to do.

Haley's call for a pure legal regime designed for the unique environment of outer space is, to a certain degree, seductive. Overall, however, there are various important and practical

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[43] For a discussion of the various legal issues that arise with respect to commercial space tourism, and various possible legal frameworks for such activities, see Steven Freeland, *Fly Me to the Moon: How Will International Law Cope with Commercial Space Tourism?*, 11:1 MELBOURNE J. OF INT'L. L. 90 (2010).

reasons why terrestrial principles of international law do also play an important part in the regulation of the use and exploration of outer space. Haley's vision represents the ideal scenario when it comes to the evolution of international space law, but it does not completely reflect reality, nor the cold hard fact that, in the end, international law will primarily (though not always) be 'reactive' rather than 'proactive' in areas where the scope of human endeavour is moving so quickly.

This latter point is highly relevant to the creation of international space law. One important question that comes to mind when reading Haley's work is whether the law-making processes for international space law should seek to establish rules beforehand to meet certain, perhaps unforeseen, situations that have not yet arisen. To a certain degree, it could be said to have done so; for example, some of the fundamental customary law principles that were codified in the Outer Space Treaty – including those that were aimed at minimising the possibility of conflict and the risk of contamination[44] – were designed to *prevent* certain situations from arising. In this sense they were proactive in design and intent.

Yet, this is probably an exception rather than a rule. With reference to the plethora of new and emerging space activities, the question arises as to whether, even if we wanted to, we are in a position to be proactive in relation to areas where we still do not fully understand the technology, and the risks and consequences of utilising that technology. Again turning to the area of commercial space tourism, are we really able to 'create' international legal standards at this point, before the fact? Isn't there a risk that, if we attempt to do so, we may be setting standards that subsequent experience will show were not appropriate? Nothing could be worse from a regulatory perspective, for example, than a tragic accident occurring in circumstances where a commercial space tourism operator complied fully with the prescribed standards, only for those standards to be shown to be woefully inadequate, perhaps even constituting as a contributing factor to the accident.

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[44] *See* Outer Space Treaty, *supra* note 30, at arts. II, III, IV& IX.

To a large degree, therefore, we will need to 'wait and see' – and when the broad parameters of what is required becomes apparent, that is the time to draw upon both past experience and creative adaptability to design international law that is apposite, relevant, and effective (although, of course, those terms themselves have elements of subjectivity associated with them). This may no doubt lend itself to some *sui generis* legal principles, but will also build upon existing legal principles and standards. In the end, space law has been, is, and will remain a combination of Haley's pure vision of law coupled with current principles that have been seen to work in other contexts. This is not the ideal corpus of law that Haley envisioned, but perhaps the only one that can best deal with the undoubted challenges that are yet to arise.

IV. THE TREND TOWARDS 'SOFT LAW' IN THE REGULATION OF OUTER SPACE[45]

As noted above, Haley was somewhat of a traditionalist when it came to international law. He was primarily concerned with the law-making process, and focused on the role of consent (either by way of custom or through the finalization of a treaty) to formulate rules that 'are regarded as binding by the community and which perform the functions of law in regulating human and national relationships.'[46] Moreover, his vehement opposition to a basis for law formulation that he thought would, in practical terms, allow States to shift in and out of compliance depending upon their respective national interests (either real or perceived) highlighted further his quest for binding rules that were both suited to the unique characteristics of outer space, and were 'conceived and developed in an atmosphere of interna-

[45] For the purposes of this article, 'soft law' instruments are intended to refer to written instruments that might purport to specify rules of conduct, but do not emanate from the traditional 'sources' of public international law. This qualification is itself not unanimously supported; however, it is beyond the scope of this article to discuss what might be encapsulated in the various alternate theories of soft law.

[46] SPACE LAW AND GOVERNMENT, *supra* note 10, at 38.

tional consent and practiced as a customary usage' in relation to space activities.[47]

It is therefore unlikely that Haley would approve of the emergent trend in the regulation of space law that has increasingly involved resorting to so-called 'soft law' instruments to set standards and guidelines for specific activities in outer space. To Haley, this might appear unacceptable for a number of reasons, including the (apparent) lack of a truly 'binding' framework for such rules,[48] and also its *ad hoc* 'hit or miss pattern' that he feared would distort the law-making process for outer space through the functioning of the United Nations.[49]

Yet, it is clear that non-binding mechanisms were already used to develop the initial codification of the fundamental principles of space law, even as Haley was writing on the appropriate legal structures. When the United Nations Committee on the Peaceful Uses of Outer Space (UNCOPUOS) began deliberations on the legal principles applicable to space activities shortly after the space race had begun in earnest with the launch of *Sputnik I*, it was evident that a comprehensive legal code governing space activities would not be appropriate, or possible, at that stage.[50] Instead, the UNCOPUOS Legal Sub-Committee opted to undertake a progressive approach to remain in step with the development of space technology and applications.[51] It was considered that, in relation to specific satellite applications, for example, it was more appropriate to adopt an instrument containing legal principles in the form of a United Nations General Assembly Resolution, before completing the negotiations on multilateral treaties.[52]

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[47] *Id.*

[48] For a discussion of the concept of 'soft (space) law' and the legal status of the various relevant 'soft law' instruments, see Steven Freeland, *For Better or For Worse? The Use of 'Soft Law' within the International Legal Regulation of Outer Space,* XXXVI ANNALS OF AIR AND SPACE L. 409 (2011).

[49] *Law of Outer Space – A Problem for International Agreement*, *supra* note 3, at 76.

[50] Vladimir Kopal, *The Role of United Nations Declarations of Principles in the Progressive Development of Space Law* 16 J. OF SPACE L. 5, 6 (1988).

[51] Report of the Ad Hoc Committee on the Peaceful Uses of Outer Space to the United Nations General Assembly, U.N.Doc. A/4141, Part III (1959).

[52] *See* MANFRED LACHS, THE LAW OF OUTER SPACE: AN EXPERIENCE IN CONTEMPORARY LAW MAKING 27-41 (1972).

As noted above, this gave rise to a number of such resolutions prior to the finalization of the Outer Space Treaty. Probably the most significant of these was the Space Principles Declaration. Yet, even though it was undoubtedly a very important instrument in the evolution of the formal rules governing the exploration and use of outer space, it was clear that the Space Principles Declaration was regarded as a non-binding set of principles that should merely 'guide' States in their space activities.[53] This is further emphasized by the very next resolution passed on the same day by the United Nations General Assembly, dealing with 'International co-operation in the peaceful uses of outer space', which recommended to Member States that:[54]

> consideration should be given to *incorporating in international agreement form*, in the future as appropriate, legal principles governing the activities of States in the exploration and use of outer space

Indeed, the terms of the Space Principles Declaration sets out a series of nine general principles that were, with only relatively minor amendment, included in a binding international instrument, the Outer Space Treaty, some four years later.

Moreover, as is well known, in the context of the regulation of the exploration and use of outer space, a further series of resolutions were also adopted in the period following the finalization of the five United Nations Space Law Treaties to address certain specific activities.[55]

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[53] *See* Space Principles Declaration, *supra* note 29, at preamble para. 8.

[54] International Co-operation in the Peaceful Uses of Outer Space, *supra* note 29, at para. I (1) (emphasis added).

[55] These include: Principles Governing the Use by States of Artificial Earth Satellites for International Direct Television Broadcasting, G.A. Res. 37/92, U.N. GAOR, 37th Sess., 100th plen. mtg., U.N. Doc. A/RES/37/92 (Dec. 10, 1982); Principles Relating to Remote Sensing of the Earth from Outer Space, G.A. Res. 41/65, U.N. GAOR, 41st Sess., 95th plen. mtg., U.N. Doc. A/Res/41/65 (Dec. 3, 1986); Principles Relevant to the Use of Nuclear Power Sources in Outer Space, G.A. Res. 47/68, U.N. GAOR, 47th Sess., 85th plen. mtg., U.N. Doc. A/Res/47/68 (Dec. 14, 1992); and Declaration on International Cooperation in the Exploration and Use of Outer Space for the Benefit and in the Interest of All States, Taking into Particular Account the Needs of Developing Countries, G.A. Res. 51/122, U.N. GAOR, 51st Sess., 83d plen. mtg., U.N. Doc. A/Res/51/122 (Dec. 13, 1996).

More recently, voluntary 'guidelines' have also been agreed that are intended to address the problematic issue of space debris and with respect to other space-related areas of concern.[56] There is a clear trend towards the use of such instruments, continuing the long-established understanding that the soft law 'process' is a well-accepted methodology for furthering an understanding of how humankind should continue its endeavours in outer space. This tendency shows no sign of abating.

Whilst the legal status of such instruments may vary depending on the precise circumstances, it is clear that this process of regulation of space activities offers significant flexibility to all relevant stakeholders. One would suspect that Haley would find it most unnerving that many space activities only have informal 'rules of the road' as the guiding standard, and that States are free, from a strictly legal perspective, to decide not to follow such standards as and when it suits them, without the possibility of legal sanction under the general international law principles of State Responsibility.

Yet, perhaps the situation may not be quite as dire as Haley would suggest in this regard, bearing in mind the observation of Sir Robert Jennings who, in 1980, when discussing United Nations General Assembly Resolutions, wrote that:[57]

> recommendations may not make law, but you would hesitate to advise a government that it may, therefore, ignore them, even in a legal argument

V. CONCLUDING COMMENTS

Andrew Haley was, without doubt, a remarkable thinker and a true space law pioneer. He, more than many of his contemporaries, was able to very quickly identify the crucial and difficult legal issues that arose as soon as humankind's ventures into outer space became a reality. His foresight, practical ex-

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[56] For details and an analysis of these various instruments, *see* IRMGARD MARBOE (ED), SOFT LAW IN OUTER SPACE: THE FUNCTION OF NON-BINDING NORMS IN INTERNATIONAL SPACE LAW (2012).

[57] Robert Y. Jennings, *What is international law and how do we tell it when we see it?*, *in* DAVID HARRIS, CASES AND MATERIALS ON INTERNATIONAL LAW 57 (7th ed, 2010).

perience, commercial knowledge and attention to detail placed him in an ideal position to posit the appropriate way forward in terms of the development of the international regulation of outer space.

In addition, Haley was conversant with the historical antecedents of international law and the various legal philosophies that sought to explain both its evolution and function. Yet, he was somewhat skeptical about the role that what he regarded as anthropocentric law could play in the regulation of the new frontier of outer space, particularly as he saw that national interests had historically prevailed over some of the fundamental tenets that underpinned (in theory) the 'agreement among nations.' It was for this reason that he strongly argued for the creation of a new set of laws for outer space that were developed primarily through a 'natural law' process and which would be specifically applicable to the unique challenges and opportunities that the use and exploration of space presented.

In the end, however, Haley's vision of a natural system of space law did not crystallize entirely as he would have wished. For a whole range of reasons, the international legal order for outer space is at least partially influenced by 'municipal' concerns, even though the underlying principles do emphasize the common interests that all stakeholders have in adhering to the fundamental principles. Yet, as space technology continues to expand at what appears to be an ever increasing rate, and the realm of space fantasy very quickly becomes space reality, there are undoubted challenges, and even threats, to the stability of this legal order. Issues such as the military uses of outer space, its (possible) future weaponization, the problems of space debris and our sometimes apparent disregard to the integrity of outer space, mean that those with space capability find themselves faced with difficult decisions as to how to prioritize their technological prowess.

As we celebrate the 50th anniversary of his seminal work, *Space Law and Government*, therefore, it is very timely that we heed Haley's strong convictions concerning the fundamental sentiments of 'humanity' that should underpin the legal regulation of outer space, in order to avoid the possibility of alternate 'nefarious' scenarios that may be too frightening to contemplate.

ARCHIVED DOCUMENTS AS EVIDENCE AND LEGAL AUTHORITY: LESSONS LEARNED APPLICABLE TO THE LAW OF OUTER SPACE

*Ryan T. Noble**

The Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (OST) contains merely 2,200 words, approximately. The aerospace lawyer attempting to interpret the OST faces the great challenge of constructing persuasive, legally defensible arguments from this relatively scant body of material. To overcome this challenge, the aerospace law profession must expand the body of material beyond the four corners of the OST, consider more than its abstract principles, more than the familiar axioms and corollaries of Oliver Wendell Holmes' cautionary introduction to his students,

> The life of the law has not been logic: it has been experience. The felt necessities of the time, the prevalent moral and political theories . . . have had a good deal more to do than the syllogism in determining the rules by which men should be governed. The law embodies the story of a nation's development through many centuries, and it cannot be dealt with as if it contained only the axioms and corollaries of a book of mathematics.[1]

Resolving ambiguities and abstractions within the law of outer space into useful rules of law requires an investigation into the experiences of the founders. The experiences of the

* The author extends his eternal gratitude to Audrey Uffner Lau, former archivist for the National Center for Remote Sensing, Air, and Space Law, whose friendship and wisdom guided him through both the archives and law school. The author also extends special thanks to James Dunstan whose initiative and generosity led to this commemorative edition of the Journal of Space Law.

[1] OLIVER WENDELL HOLMES JR, THE COMMON LAW 5, 1881 (Paulo Pereira, eds. 2011).

founders provide context to the language of the OST, and provide aerospace lawyers the additional material to support interpretations of the OST. These formative experiences reveal why the present ambiguities arose in the first place and, likely, will provide invaluable wisdom in putting those ambiguities to rest. Through the experiences of the founders, the present aerospace law profession can understand the life of the law of outer space.

Fortunately, the experiences of many of these founders have been preserved in archives. Some sources have been catalogued, and even digitized with optical character recognition, to enable highly productive research.[2] How to locate these collections, how to research these collections, how to employ archived materials as legal authority, and how to avoid issues of copyright and client confidentiality will be explored below.

I. INTRODUCTION TO ARCHIVE RESEARCH METHODS

There are generally three pathways into archive research, the Subject Guide, the finding aid, and the hard-earned omniscience of the archivist over their collection. Jargon unique to archive management is used to categorically describe the kinds of materials housed in the archive, which can be not only paper documents, but also audio or video recordings, and other forms of documentation. Common archive terms of art are necessary to understand how to use "subject guides" and "finding aids", and to help communicating with the archivist. Familiarity with these topics will accelerate the productivity of legal research in archives, and hopefully reduce frustrations for those accustomed to more expeditious databases like WestLaw and LexisNexis.[3]

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[2] Optical character recognition software allows a researcher to search the full text of a document by turning an image of the document into a text file. For more information see, Rose Holley, *How Good Can It Get? Analysing and Improving OCR Accuracy in Large Scale Historic Newspaper Digitisation Programs*, 15 D-LIB MAGAZINE (2009).

[3] Jenni Parrish, *A Guide to American Legal History Methodology with an Example of Research in Progress,* 86 LAW LIB. J. 105, 109 (1994)("Similarly, the first time a lawyer or law student ventures into an archival facility, he or she is typically quite distressed at the paucity of available indexing, relative to the indexing typical of legal publications.").

A. Archive Terminology

Archives are frequently organized into collections of "manuscripts." A "manuscript" is a body of personal materials with an organic unity, for example the Andrew G. Haley (Haley) collection[4] addressed in this article is, strictly speaking, a "manuscript."[5] The content of a manuscript is referred to as "papers."[6]

Where an institution retains documents in the course of its official operations these documents are called "records" and when collected comprise an "archive."[7] In this way archivists distinguish between institutional records and personal papers compiled without regard to a specific recordkeeping protocol. The International Telecommunication Union (ITU) Library and Archives collection is a proper archive as it houses the official records of the ITU.[8]

The organization of the papers or records can be according to "provenance" or with "sanctity of original order." Organization by "provenance" indicates that an archivist or administrator has performed some intentional reorganization of the papers or records, perhaps for ease of researching popular subjects or to separate them by author.[9] "Sanctity of original order" refers to the arrangement created by the author of the papers and the desire to maintain this natural organization.[10] Even where a collection has been reorganized by an archivist there will often be a careful log preserving each paper's original location. How Haley chose to organize his papers can tell us what he thought

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[4] The National Center for Remote Sensing, Air and Space Law, *Andrew Hayley Collection*, http://www.spacelaw.olemiss.edu/archives/haley/ (last visited Sept. 6, 2013).

[5] Marsha Trimble, Archives and Manuscripts: New Collecting Areas for Law Libraries, 83 LAW LIB. J. 429, 436 (1991).

[6] *Id*.

[7] *Id*. (Hence the term "archive" can be used in a general sense to describe collections of historic documents, or used more specifically to describe institutional recordkeeping.).

[8] ITU, *History of ITU Portal*, http://www.itu.int/en/history/Pages/LibraryAndArchives.aspx (last visited Sept. 6, 2013).

[9] 83 LAW LIB. J. 429, 436.

[10] *Id*.

was important, what he thought was related, what papers he referenced frequently.[11]

Practically speaking, most collections are physically organized into "boxes," "folders," and "items". An "item" describes the individual document, letter, or other documentation. These items are gathered into "folders," generally according to how the author gathered the items together, or according to the archivist's design. Folders are then stored in "boxes" for security and preservation. There may not be a substantive rationale behind each box, instead boxes can be organized purely to promote preservation and security of the historic documents.

When a collection is housed in boxes the archivist will measure the collective length of all boxes in "linear feet." The number of linear feet is then used as an indication of the expansiveness of that collection compared to others. For example, the Haley Collection measures 24.6 linear feet while the Stephen Gorove Collection[12] measures 15 linear feet and the Eilene M. Galloway Collection[13] measures 13.8 linear feet.

B. Subject Guides

The "subject guide" is a research tool functionally similar to the West Key Note System. Subject guides are organized into a list of substantive topics, or subjects. For each subject the guide will list all the box or folder numbers in which that subject appears. When the specific topic of research is known, for example the ITU Plenipotentiary Conferences, for which documentation frequently is found in the Haley Collection, the researcher can find that subject in the subject guide and see all of the folders in

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[11] *Id*. ("The point of maintaining groups of records or collections of papers discretely and retaining the office's or creator's order is to provide the researcher evidence of the way the files were originally used . . . The arrangement reveals something about the person or office that created it, and the researcher is more interested in the creator's thought processes than in the archivist's.").

[12] National Center for Remote Sensing, Air and Space Law, *Stephen Gorove Collection*, http://www.spacelaw.olemiss.edu/archives/gorove/ (last visited Sept. 6, 2013).

[13] National Center for Remote Sensing, Air and Space Law, *Eilene M. Galloway Collection*, http://www.spacelaw.olemiss.edu/archives/galloway/ (last visited Sept. 6, 2013).

the Haley Collection where the International Telecommunication Union Plenipotentiary Conferences appear.

Unfortunately subject guides are frequently far less thorough than the West Key Number System. Additionally, subject guides do not always exist for an archive collection. In that case, the researcher can turn to the "finding aid."

C. Finding Aids

The "finding aid" is a combination of inventory and summary of a collection's contents. A finding aid's introductory pages generally provide information about the collection as a whole. This often includes administrative information like contact information for collection managers, preferred formats for citing to the collection, protocols to gain access to the archive, or certain restrictions on access to or use of the materials.[14] Substantive information is often included such as the timespan covered by the collection, the originating person or entity that collected the materials, whether the collection includes non-document formats like audio or visual recordings or memorabilia, subject areas covered by the collection, and biographical sketches of prominent persons involved in the collection.[15]

The majority of the finding aid is then an inventory of the collection. This inventory can be made at the box, folder, or even item level. The more detailed and descriptive the inventory, the more useful it will be to the researcher. At a minimum, the finding aid will provide the title of a box or folder and its location. The dates or years covered, subject area, and even summary or brief description of the contents may also be provided.

As a research tool the finding aid is most useful in electronic format. This allows the researcher to electronically search the lengthy, comprehensive inventory for occurrences of subjects, names, locations, dates, whatever terms the researcher has identified as relevant. Some finding aids include a list of

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[14] 83 LAW LIB. J. 429, 437. *See, for example*, National Center for Remote Sensing, Air and Space Law, *Andrew Haley Finding Aid*, http://www.spacelaw.olemiss.edu/archives/haley/finding.html (last visited Sept. 6, 2013).

[15] *Id.*

commonly occurring subject terms that the researcher can use in selecting his or her own search terms. The subject terms list is a good place to start, especially where nomenclature or conventional terminology of the present day differs significantly from the terminology of the collection's era. For example, prior to 1934 the now well-known International *Telecommunications* Union was officially known as the International *Telegraph* Union.[16] Therefore, the history of early radio communication as well as several major ITU conferences on radio communication are catalogued under the International Telegraph Union.[17] The Haley Collection contains inconsistent translations of Russian Cyrillic into English characters so the finding aid should be consulted for the specific translation used in that location and for alternate translations.

Archivists also avoid the use of acronyms, abbreviations, and jargon in finding aids to ensure that the collection will be universally accessible to researchers of various academic and professional backgrounds. Legal researchers should think in more general terms when devising search terms and relevant subject areas. Avoid specialized industry jargon, abbreviations, and especially contemporary terms. When researching a very narrow or specific topic it may be worthwhile to translate the contemporary topic into its archival counterpart. For example, the Haley Collection frequently uses Latin language legal terms of art that today would be more commonly known by their English language translation.

A quick reference for archival terminology is available online from the National Archives.[18] Various handbooks and texts are available to further educate lawyers on archive research.[19] But perhaps the best source is an archivist's personal

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[16] ITU, *Overview of ITU's History*, http://www.itu.int/en/history/Pages/ITUsHistory.aspx (last visited Sept. 6, 2013).

[17] *Id.*

[18] Excerpted from Maygene F. Daniels, *Introduction to Archival* Terminology (1984), http://www.archives.gov/research/alic/reference/archives-resources/terminology.html.

[19] As an introduction to archives and how to research them see, MAYGENE F. DANIELS, A MODERN ARCHIVES READER: BASIC READINGS ON ARCHIVAL THEORY AND PRACTICE (Natl. Archives Trust Fund Board, Aug. 1984). For general information on how to research historical topics, see JULES R. BENJAMIN A STUDENT'S GUIDE TO HISTORY (5th ed. 1990) and Francis PAUL PRUCHA, HANDBOOK FOR RESEARCH IN

expertise regarding the collection for which they are responsible.[20]

What one does with a particular document, having found it using the methods outlined above, will be highly dependent on the researcher's unique circumstances. General advice on extracting useful information from personal manuscript papers is problematic, so only a few thoughts will be offered here to encourage researchers to reflect on their unique needs.

Valuable information can be gleaned from the context of personal manuscript papers by a meta-analysis that the whole of a manuscript can be greater than the sum of its parts. Consider the frequency of appearance of people or publications and what is implied by the originator's focus on them. An entire collection in perspective can reveal negative space. What is implied by the originator excluding coverage of a subject otherwise popular among contemporaries? Organizational cues such as which subjects the originator grouped together, or treated as disparate units, which materials show signs of being frequently referenced by the originator and which were kept readily available, can all provide insight to the originator's contemporary understanding of their profession.[21] The originator's correspondence with contemporaries, through letters, telegrams, and other modes, can be very fertile. Humor often serves as a window into the frightening truths we cannot confront directly.[22] Watch for repeated occurrences of humor among correspondence.

With useful information in hand the researcher reverts to the role of lawyer. The following sections present how to use

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AMERICAN HISTORY: A GUIDE TO BIBLIOGRAPHIES AND OTHER REFERENCE WORKS (1987). When interested in government sources specifically, see JUDITH SCHIEK ROBINSON, TAPPING THE GOVERNMENT GRAPEVINE: THE USER-FRIENDLY GUIDE TO U.S. GOVERNMENT INFORMATION SOURCES (3rd ed., 1998).

[20] *A Guide to American Legal History Methodology with an Example of Research in Progress*, *supra* note 3, at 114 ("The scholar must rely much more on the knowledge of the archivist or librarian about a collection, as well as that professional's knowledge of, and interest in, legal history.").

[21] 83 LAW LIB J 429, 436.

[22] John M. Conley & Scott Baker, *Symposium: Empirical Studies Of The Legal Profession: What Do We Know About Lawyers' Lives?: Introduction To The 2005 North Carolina Law Review Symposium*, 84 NC L. REV. 1415, at 1416-1417 (June, 2006).

archived documents as persuasive authority in legal argumentation and how to admit archived documents as evidentiary exhibits.

II. ARCHIVED DOCUMENTS IN STATUTORY CONSTRUCTION

Sharp litigators recognize the potential for extremely persuasive exhibits drawn from metadata, big data, and other e-discovery records. However, the relevancy of decades-old archived letters and reports may be less apparent. The following cases show the very real value archives can have for litigants; they can win the case.

A forty-nine year old letter between the U.S. Attorney General and the U.S. Secretary of Commerce and Labor overturned decades of consistent practice by the U.S. Department of Justice. In US v. Zucca, the Department of Justice sought to denaturalize Ettore Zucca but failed to provide an affidavit showing good cause for the denaturalization proceeding, as in their estimation Ettore's former membership in the Communist Party was a sufficient cause.[23] At the mercy of 1950s anti-communist sentiment Ettore turned to a procedural nuance. The Immigration and Nationality Act of 1952[24] could be read to require an affidavit showing good cause as a prerequisite to maintaining his denaturalization proceeding.[25]

The U.S. National Archives held the key to Ettore's case.[26] In 1907 U.S. Attorney General Bonaparte opined in a letter to the U.S. Secretary of Labor and Commerce that a good cause affidavit would be necessary under the then newly enacted Immigration and Nationality Act of 1906 (Act).[27] Attorney General Bonaparte had been a "leading spirit" behind the Act and the

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[23] United States v. Zucca, 351 U.S. 91, 92 - 94.

[24] Immigration and Nationality Act of 1952, PUB.L. 82–414, 66 STAT. 163 (1952),

[25] "The sole question is whether s 340(a) makes the filing of the 'affidavit showing good cause' a prerequisite to maintenance of the suit." *United States v. Zucca.* at 92.

[26] *Id.* at n. 10 ("Letter of Attorney General Bonaparte, March 26, 1907 (unpublished, National Archives)").

[27] *Id*. at 96 ("Shortly after its enactment, the same Attorney General rendered an opinion to the Secretary of Commerce and Labor to the effect that the filing of an affidavit was 'necessary to give a United States attorney authority to institute proceedings in any court for the cancellation of a naturalization certificate.'").

Court honored his forty-nine year old construction of the statute.[28] The three dissenting Justices highlight the singular power of the archived letter in overturning decades of agency practice and court precedent,

> The only authority for the Court's action is an unpublished, informal, and somewhat ambiguous inter-departmental letter of the Attorney General written in 1907. While any Attorney General might well be proud to see his views given such lasting effect, he undoubtedly would be surprised to learn that the authority of such an informal statement could overrule later court decisions and a thirty-year, firmly established position of the Department of Justice.[29]

Nevertheless, the Court added another decision to the long line of cases holding that, "a contemporaneous construction of a statute by the officer charged with its enforcement is entitled to great weight."[30]

An archived document was similarly used to overturn decades of consistent practice by the California State Highway Commission in *U.S. v. Certain Parcels of Land in Riverside County*.[31] The California State Highway Commission administered two roads as state highways and not as county roads for several decades. However, an archived record of the State Highway Commission contained resolutions designating the two roads to be county roads. The consistent practice by the State Highway Commission in administering the roads could not be used to establish the roads as state highways in the face of the archived resolutions to the contrary. The court found,

> This Court does not doubt for one moment that the State Highway Commission … assumed over a period of years that these highways 77 and 192 were actually State highways and treated them as such, while these resolutions of the State

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[28] *Id*.

[29] *Id*. at 101 (Dissent Clark).

[30] *Id*. at 96 (*citing*, Fawcus Machine Co. v. United States, 282 U.S. 375, 378, 51 S.Ct. 144, 145, 75 L.Ed. 397; Norwegian Nitrogen Products Co. v. United States, 288 U.S. 294, 315, 53 S.Ct. 350, 358, 77 L.Ed. 796).

[31] U.S. v. Certain Parcels of Land in Riverside County, 67 F. Supp. 780 (S.D. Cal. 1946).

> Highway Commission (parts of Exs. E, F and H) fixing their status as county roads, remained in the archives of the State Highway Commission and probably forgotten…
>
> The actions of the State Highway officials in assuming highways 77 and 192 to be State highways over a period of years are, of course, entitled to great weight by the court; but, in the fact of documentary evidence to the contrary, and the resolutions of the State Highway Commission therein (Exs. E, F and H), presumptions must fall.[32]

Notably, the court expressly recognized that the archived resolutions had been "probably forgotten" by the State Highway Commission. And while the consistent practice by the State Highway Commission was entitled to great weight, any presumptions the State Highway Commission made about the status of the two roads were overturned by the archived resolutions. Accordingly, an agency may be bound by resolutions of which it has no actual knowledge. However, where the court is considering the *subjective intent* of an agency at a particular time, the court may limit its consideration to only sources of information available to that agency at that time.[33]

The 10th Circuit has recognized the necessity, and challenge, of archived sources in frank terms. In *Southern Utah Wilderness Alliance v. BLM*, the court addressed the issue of century old, undocumented rights of way across federal lands. For over 100 years a federal statute allowed states to obtain rights of way over federal land without any documentation, as part of the pro-development policy for the American West in the 1800s. Retroactively, states are now defending their undocumented rights of way requiring courts to return to the law and the factual records of the mid-1800s. The opinion in *Southern Utah Wilderness Alliance v. BLM* makes prolific references to treatises and letters from the 1800s demonstrating the ability, and necessity, of lawyers delving into archives. The court stated in frank terms

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[32] *Id.* at at 781, 800.

[33] State of New York v. Westwood-Squibb Pharmaceutical Co., 981 F. Supp. 768, at 781 ("Although the court has before it over twenty-five years of financial records, a much more limited record would have been available to the PSC in 1917. The intent of the parties on that date would have been significantly more obscure than it is today.").

that, "rights of way across federal land, which used to be a non-issue, has become a flash point, and litigants are driven to the historical archives for documentation of matters no one had reason to document at the time."[34]

In addition to looking to archives to resolve factual questions of land use, the court also looked to archives to resolve questions of law. The meaning of "construction," as a legal term of art of real property law, was interpreted using treatises, cases, and reports from the mid 1800s to determine what meaning the term had in the context of settlement of the U.S. American West. In its unique tone, the 10th Circuit stated it was "not persuaded. First, it would take more semantic chutzpah than we can muster to assert that a word used by Congress in 1866 has a 'plain meaning' that went undiscerned by courts and executive officers for over 100 years."[35]

The above cases demonstrate the power archived documents can have, even in the face of longstanding and consistent practice to the contrary. The formal position of an agency can be reversed by both opinions and formal resolutions discovered in archives by sharp litigants. The Haley Collection contains many letters from the U.S. National Aeronautics and Space Administration, the Federal Communications Commission, and various Executive Administrations that express contemporary opinions on the law of outer space. These sources can be persuasive for positions adopted in scholarly publications, opinion letters, and other out-of-court legal opinions. Means for authenticating these archived documents for use before a court, or other proceeding requiring authentication, are explored next.

III. ADMISSIBILITY AND EVIDENTIARY RULES OF ARCHIVAL SOURCES

The genesis of archival practices lies in ancient law and early administrative procedures.[36] The need for reliable docu-

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[34] Southern Utah Wilderness Alliance v. BLM, 425 F. 3d. 735, 742 (10th Cir. 2006) (abrogated in part as stated in, Wilderness Soc'y v. Kane County, 560 F. Supp. 2d 1147 (2008)).

[35] *Southern Utah Wilderness Alliance v. BLM, supra* note 34, at 778-779.

[36] 37 ARCHIVARIA 122 (Spring 1994).

mentary evidence leads to a desire to preserve records of history and for the ability to authenticate those documents.[37] The symbiotic development of archive practices and the rules of evidence continues to the present day as the U.S. Federal Rules of Evidence make special accommodation for the exigencies of authenticating ancient documents. These rules are then integrated into archival practices to ensure the future admissibility of archived content.[38] A brief survey follows of methods for authentication that are particularly useful for archived materials relevant to the law of outer space. Authentication for these documents can be supported by their location in an archive, by expert testimony from archivists, by historians placing trust in the documents and routinely using them in scholarship, or by external sources that corroborate the archived documents.

A. Authentication of Archived Business Records

Aerospace corporations have been playing a seeming game of musical chairs throughout the twentieth century, steadily consolidating as there are fewer and fewer chairs around the defense contractor table.[39] Consolidation can concentrate not

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[37] *Id.*

[38] *Archives and the Law*, 18 ARCHIVARIA 21-22 (Summer 1984) (from the editorial statement of an edition of Archivaria dedicated exclusively to archives and law, "Three articles turn the whole legal question around and show how archival records themselves may be used as evidence before courts of law or other legal bodies. In a piece of detailed legal research and law reform advocacy, Ken Chasse analyzes how the requirements of various evidence acts and court precedents concerning the admissibility - or otherwise - of documents as evidence depends to a great degree on the careful control by records managers or archivists of the creation of records and the integrity of their storage and use . . . Mark Hopkins argues similarly that the judicial implications of records keeping are grave indeed; significant changes are needed if records are to have any weight in court and their custodians any status as expert witnesses. Rod Young looks at the same problem in his case study of the evidentiary and probative value of trade union records, and clearly draws out the implications such legal realities have for records management and archival practices. Chasse, Hopkins, and Young warn archivists, in short, that they can no more ignore the legal implications of the records in their care than they can the conservation, arrangement, description, or research aspects of records keeping.") Archivaria is a Canadian publication. Jurisdictions in the United States may reference it to provide context for general legal principles.

[39] John Deutch, *Consolidation of the U.S. Industrial Base*, ACQUISITION REV. Q. (2001). William J. Perry, Deputy Secretary of Defense, said as much during a meeting now known as the "Last Supper" Consolidation of the U.S. Industrial Base, ("Between 1993 and 1998, there was a burst of defense industry mergers and acquisitions. Some

only the assets, but also the liabilities of subsumed entities into the parent corporation.[40] Litigation of those liabilities requires the court to untangle the long history of corporate acquisitions and mergers, often revealed through corporate archives, as was done in *New York v. Westwood-Squibb Pharmaceutical Co*., hereinafter *Westwood-Squibb*.[41]

Westwood-Squibb concerns Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) responsibility over a natural gas manufacturing site in New York.[42] To determine the proper successor liability the court had to trace ownership of the site back to 1898 when the gas manufacturing facility was originally constructed.[43] Beginning with 1898 the court used archived business records to observe, and sometimes decrypt, the chain of ownership and therefore liability.[44] A 1912 engineering report was of particular importance in proving the intent to purchase the gas manufacturing facility and was authenticated using the ancient document exception to hearsay.[45]

Rule 901 of the U.S. Federal Rules of Evidence requires that to, "satisfy the requirement of authenticating or identifying an item of evidence, the proponent must produce evidence sufficient to support a finding that the item is what the proponent

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companies were sellers, for example, General Dynamics, Loral (after 1996), Ford Aerospace, Texas Instruments, and North American Rockwell. Other companies were buyers, notably Raytheon, Martin-Marietta, Lockheed, Loral (before 1996), and Boeing. There was a significant decline in the number of prime contractors and top system integrator companies in the defense-aerospace sector.").

[40] *State of New York v. Westwood-Squibb Pharmaceutical Co., supra* note 33, 786 ("The general rule is that where a company sells or otherwise transfers all its assets to another company, the latter is not liable for the debts and liabilities of the transferor. There are four exceptions to this rule: (1) the successor expressly or impliedly agrees to assume the liability of the predecessor; (2) the transaction is a de facto merger or consolidation; (3) the successor is a "mere continuation" of the predecessor; or (4) the transaction is fraudulent.")(citations omitted).

[41] *Id.*

[42] *Id*. at 768 ("In litigation under Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) concerning site of former manufactured gas facility, purchaser and successor to prior owner of facility filed cross-claims on issue of successor liability for costs of remediation.").

[43] *Id.* at 772-773.

[44] *Id*. at 772 ("The events of this case involve a complicated cast of corporations and individuals engaged in a tangled series of transactions stretching back nearly one hundred years.").

[45] *Id.* at 780.

claims it is."[46] Subsection (b)(8) provides for authentication of ancient documents by "evidence that it:

> **(A)** is in a condition that creates no suspicion about its authenticity;
>
> **(B)** was in a place where, if authentic, it would likely be; and
>
> **(C)** is at least 20 years old when offered."[47]

The *Westwood-Squibb* court determined these elements to be satisfied by the 1912 engineering report because the "document is more than twenty years old and was found in the NFGC archives among similar papers, and thus is in a condition which creates no suspicion as to authenticity and was found where one would expect to find such a document."[48]

The Haley Collection holds materials from his time at the Aerojet-General Corporation, including an *Agreement between Aerojet Engineering Cooperation and the International Association of Machinists*, correspondence from Theodore Von Karman and Robert W. Walters, and materials related to an *Aerojet Booster*.[49] Because Haley served as President and Managing Director of Aerojet-General, his personal files may be "a place where, if authentic, [these records] would likely be."

B. Authentication by Expert Testimony of an Archivist

Where the application of Rule 901(b)(8) is not straightforward, testimony from an archivist can aid the court in determining whether the rule is satisfied. For example, if it is unclear whether a document is at least twenty years old because the document does not contain a date then an archivist can testify

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[46] FED. R. EVID. 901. Once authenticated according to Rule 901, statements within ancient documents are specifically admissible as exceptions to hearsay under F.R.E. 803(16), "Statements in Ancient Documents. A statement in a document that is at least 20 years old and whose authenticity is established."

[47] FED. R. EVID. 901(b)(8).

[48] State of New York v. Westwood-Squibb Pharmaceutical Co., *supra* note 33, at 780 (NFGC is one of the natural gas companies at issue in the case).

[49] *Andrew Haley Finding Aid*, *supra* note 14.

to the document's probable age.[50] If the document has been moved from its origin or has changed hands then an archivist can testify as to whether the document's present location is "a place where, if authentic, it would likely be."[51] Authenticating ancient documents does not require proving the chain of custody.[52] Further, changing hands or relocating ancient documents does not necessarily defeat authenticity if the relocation is a natural occurrence for that type of document.[53] Authenticity is further supported where historians rely on or use the document in their profession and do not question its authenticity for the purposes of scholarship.[54]

However, using archivists and experts to support authenticity has been strongly criticized because the usual *Daubert* test is not always adequate to asses archivists and historians. Limited resources frequently do not allow for lengthy hearings on the qualifications of an archivist for the relatively routine purpose of authentication.[55]

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[50] US v. Firishchak, 468 F. 3d 1015, 1021-1022 (7th Cir. 2006).

[51] US v. Stelmokas, 100 F. 3d 302, 312 (3rd Cir. 1996).

[52] *Id.*

[53] *Id.*

[54] US v. Firishchak, *supra* note 50, at 1021, US v. Szehinskyj, 104 F. Supp. 2d 480, 491.

[55] For a thorough study of the pitfalls of expert archivists and historians as it relates to the Holocaust, *see* Maxine Goodman, *Slipping Through The Gate: Trusting Daubert and Trial Procedures to Reveal the "Pseudo-Historian" Expert Witness and to Enable the Reliable Historian Expert Witness -- Troubling Lessons From Holocaust-Related Trials*, 60 BAYLOR L. REV. 824, 829 (2008) (David Irving "believes Nazis did not use gas chambers to murder Jews at Auschwitz. At the end of the ten week trial, presiding judge Charles Gray ruled that Irving had intentionally contorted the historical evidence to align it with his politics. David Irving, revealed by Judge Gray as a phony for his faulty interpretation of the history of gas chambers at Auschwitz, had testified a few years earlier in a lawsuit by the Canadian government against Holocaust denier Ernest Zundel. Irving, admitted as an expert historian in that case, testified that the Nazis did not use gas chambers to murder Jews at Auschwitz. Thus, the same historical interpretation that led Judge Gray to rule Irving had deliberately falsified history was admitted as expert testimony on the same historical issue in an earlier case in Canada. Herein lies one possible danger of inadequate gatekeeping; unless flaws in methodology are revealed at the outset, these flaws are difficult to uncover absent a lengthy hearing or trial focused on historical methodology.").

C. Authentication by Corroboration from External Sources

Other documents, having been authenticated, can be used to authenticate an ancient document when these documents corroborate the content or nature of the ancient document at issue. This narrow technique may be particularly useful for aerospace documents because of the extensive body of government documents relating to aerospace that will generally be more easily authenticated.

A survey map found in the collection of a historical society was authenticated as an ancient document because the map was referenced by deeds.[56] The reference to the map in authenticated deeds provided enough corroboration to authenticate the map itself. Similarly, congressional records, agency commissioned reports, and other documents generated by the government relating to aerospace may make reference to contemporary external documents, thereby providing a means for authentication.

IV. ARCHIVED DOCUMENTS IN INTERNATIONAL LAW

A Nation-State can create binding obligations through the statements of Nation-State officials. Drawing from the opinions of the International Court of Justice, the United Nations International Law Commission has drafted and adopted the *Guiding Principles applicable to unilateral declarations of States capable of creating legal obligations*.[57] The Guiding Principles assert that,

> Declarations publicly made and manifesting the will to be bound may have the effect of creating legal obligations…
>
> States concerned may then take [Declarations] into consideration and rely on them; such States are entitled to require that such obligations be respected…

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[56] Burns v. U.S., 160 F. 631 (C.A.2. N.Y. 1908).

[57] Guiding Principles applicable to unilateral declarations of States capable of creating legal obligations, with commentaries thereto, A/61/10 (2006) [hereinafter Guiding Principles].

> A unilateral declaration binds the State internationally only if it is made by an authority vested with the power to do so. By virtue of their functions, heads of State, heads of Government and ministers for foreign affairs are competent to formulate such declarations. Other persons representing the State in specified areas may be authorized to bind it, through their declarations, in areas falling within their competence…
>
> Unilateral declarations may be formulated orally or in writing.[58]

The relevance of written communications between Nation-State officials, and personal records of their oral communications, was made abundantly clear in the decision on the Legal Status of Eastern Greenland.[59] Denmark and Norway were engaged in discussions over which State had rightful claim to territory in Eastern Greenland. The Minister for Foreign Affairs of Denmark and the Norwegian Ambassador to Copenhagen exchanged demarches and oral remarks during a meeting. The Norwegian Ambassador represented "that the Norwegian Government would not make any difficulties in the settlement of this question [on Greenland]."[60] Those communications are now commonly referred to as the *Ihlen Declaration*[61].

Regardless of whether the Norwegian Minister for Foreign Affairs was empowered, under the domestic laws of Norway, to unilaterally assess the merits of the Danish claims to

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[58] *Id.* at arts. 1, 4, 5.

[59] Legal Status of Eastern Greenland (Norway V. Denmark), [1933] P.C.I.J. Ser. A/B, No. 53, 71

[60] *Id.* at 58.

[61] *Id.* On July 14th, 1919, the Danish Minister saw M. Ihlen, the Norwegian Minister for Foreign Affairs, who merely replied on this occasion "that the question would be considered". The Norwegian Minister recorded his conversation with the Danish representative in a minute, the accuracy of which has not been disputed by the Danish Government. On July 22nd following, M. Ihlen made a statement to the Danish Minister to the effect "that the Norwegian Government would not make any difficulties in the settlement of this question" (i.e. the question raised on July 14th by the Danish Government). These are the words recorded in the minute by M. Ihlen himself. According to the report made by the Danish Minister to his own Government, M. Ihlen's words were that "the plans of the Royal [Danish] Government respecting Danish sovereignty over the whole of Greenland .... would meet with no difficulties on the part of Norway". It is this [p37] statement by the Norwegian Minister for Foreign Affairs which is described in this judgment as the "Ihlen declaration".

Greenland, or empowered to unilaterally cede Norway's claims to Greenland, the ICJ held that it was, "beyond all dispute that a reply of this nature given by the Minister for Foreign Affairs on behalf of his Government in response to a request by the diplomatic representative of a foreign Power, in regard to a question falling within his province, is binding upon the country to which the Minister belongs."[62]

While the *Ihlen Declaration* may be a cautionary tale for Heads of State, it demonstrates the value for archival legal research.

V. CONFRONTATION WITH THE RULES OF PROFESSIONAL RESPONSIBILITY

The rules of professional responsibility can threaten the ability of archives to collect the papers of lawyers, and so threaten the availability of content to research. When a university archive requested that a D.C. attorney donate his personal papers relating to his long career in U.S. foreign policy the District of Columbia Bar intervened.[63] Despite the long passage of time between the attorney's practice and the requested donation, and even regardless of any passage of time no matter how long, the Bar determined in an ethics advisory opinion that, "the protections accorded client 'confidences' and 'secrets' . . . precludes an attorney from donating to a university archive papers that might reveal the confidences or secrets of the attorney's private or governmental clients without either obtaining the prior informed consent of those clients or deleting those portions of the attorney's papers that contain confidences or secrets."[64] The transactional cost of reviewing an attorney's entire collection of papers accumulated over a life long career is likely immeasurable. Ethics opinions that are written overly broad and without limitations can foreclose an important source of legal research. Client confidences must be rigorously defended, but

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[62] *Id.* at 192.

[63] D.C. Bar Comm. On Legal Ethics, *Donation to University Archive of Papers That Could Contain Client Confidences or Secrets*, Op. 128, Canon 4, DR 4-101 (1983).

[64] *Id.*

this goal can be accomplished without unqualifiedly prohibiting the donation of a retired attorney's papers.[65]

As a practical matter, the archival researcher may not be exposed to the risk of reprisals from a state bar ethics board as it is the donating attorney that violated the professional rules. The archival researcher probably does not owe a duty of confidentiality to the donor attorney's past clients. However, the archival researcher does have to respect copyrights.

Institutions housing archives frequently have some copyright compliance policy or direction to assist the researcher with obtaining permissions where necessary to publish archive content. The Fair Use doctrine is frequently a powerful tool for scholarly purposes.[66] However, unpublished manuscripts, which are likely to be found in collections donated by attorneys, require an especially difficult Fair Use determination as court precedents are less than helpful.[67] More detailed discussions of the doctrine of Fair Use, and general copyright law, can be found in other publications more qualified to opine on this complex topic.[68]

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[65] 83 LAW. LIBR. J. 443 ("Archivists and librarians who support historical legal research can work with donors to create access arrangements in which confidentiality is protected while legitimate research is allowed. The Huntington Library, which has a large number of law related collections, leaves the question of access completely to the donor; if the donor imposes no restriction, the library imposes none. This procedure has worked quite satisfactorily for the Huntington.").

[66] 17 U.S.C. 107(l)-(4).

[67] Robert Spoo, *Copyright Law and Archival Research*, 24(2) J. MODERN LIT. 210-211 (Winter, 2000-2001) ("Given such a flexible test and the fact-intensive nature of many copyright disputes, it is hard to predict where a court will draw the line between fair use and infringement. In one famous case, the Supreme Court found that the quoting of three hundred words from a two hundred thousand word manuscript constituted infringement, because the nature of the copyrighted work - unpublished memoirs - favored the copyright owner, and the portion quoted, although quantitatively minuscule, was qualitatively the 'heart' of the copyrighted work. [Harper & Row Publishers, Inc. v. Nation Enters., 471 U.S. 539, at 565 (1985).]" More recently, the Fourth Circuit held that a defendant's copying of the entire manuscript of an unpublished novel for archival and scholarly purposes was a fair use, as were substantial quotations and paraphrases of the novel in a paper that she delivered at a scholarly symposium. [Sundeman v. The SeaJay Soc., Inc., 142 F.3d 194 (4th Cir. 1998). The disputed work in this case was an unpublished novel written by Marjorie Rawlings, author of The Yearling.] Less encouragingly, the court added that if the identical paper were to be published, fair use might not apply."

[68] *See*, *id.*; 83 LAW LIB. J. 429; Alexandra Mackey, *Largest Copyright Infringement in History: Five US Universities Sued for Copyright Infringement*, 3 INTELL. PROP.

VI. CONCLUSION

Archives are a valuable, if sometimes overlooked, asset to aerospace law professionals and scholars. The value that archives can hold outweighs the cost of the admittedly significant learning curve to their use. Hopefully, this article has achieved its goal of easing that learning curve for the reader.

The following annexes contain samples from the Frank J. Malina collection housed at the U.S. Library of Congress. Haley and Frank Malina were good colleagues and corresponded regularly on professional and personal matters. These annexes provide a glimpse of the intrigue, and even nostalgia that can be found in archives.[69]

Letter from Andrew G Haley to Frank J Malina, June 1950

The excerpts below are from a collegial letter AGH sent to several of his colleagues to inform, and maybe entertain, them with an account of his travels during the year of 1949 and AGH does this with an eloquence absent from today's social media.

> "I will give you a brief resume of my activities, starting with September 7, 1949 when I left for Montreal as Unites States Delegate to the Third North American Regional Broadcasting Conference. Previous to leaving, we contracted to sell the station in Pasadena and we had sold the house on South Orange Grove Avenue [tears and sighs]. We got a furnished apartment on Cote des Neiges Road in Montreal and put the two children in very fine boarding-schools. During the year they have learned more in those schools than they had done here during the previous three years. The Conference adjourned about December 15, 1949, having accomplished nothing in particular and we learned at that time that bilateral talks would be taken up at Havana starting February 1, 1950. So we yanked the kids out of school and took them down to Kentucky for the

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BRIEF, 66 (Fall 2011); Ben Fernandez, *Digital Content Protection and Fair Use: What's the Use?*, 3 J. ON TELECOMM. & HIGH TECH. L., 425 (2005); Karyl Winn, *American Archivists' Experience with Copyright*, 18 ARCHIVARIA, 99 (Summer 1984); Doug Whyte, *The Acquisition of Lawyers' Private Papers*, 18 Archivaria, 142 (Summer 1984).

[69] Copies of the original letters are available from the author upon request.

> Christmas vacation. They returned to school in Montreal January 6th and Delphine stayed with her mother for a few weeks while I came back to Washington to get some work done. On January 27, 1950, Delphine and I sailed on the United Fruit boat, S.S. Veragua, for Havana. Thinking that liquor prices would be high in Cuba [as they were in Canada where you can't even buy bourbon whiskey], we carried along too much of the fire water only to find that whiskey is a lot cheaper in Cuba because of lower taxes. We should have taken a few gross of matches as they cost five cents for a small packet. We arrived in Cuba on time for the inauguration of the so-called bilateral talks and kept on talking until March 7, 1950 . . . However, there is a tremendous amount of brotherly love and double-talk in any language you want to speak at any time and at no cost other than the overhead on hookers of scotch, bourbon or rum. When you believe you have a deal all settled you find the boys were talking about Martin and the early glories of the first revolution and had no idea you were talking about the radio business, which they say should not be discussed informally because its national sovereignty makes radio the exclusive world property of this gem of the Caribbean. So there you are – you can have it either with mustard or paprika – but you can be damned sure of winning your point with a few dusty pesos stacked end on end like so many Dollar pancakes served by that famous restaurant on the main drag of Olympia."

Letter from Andrew G Haley to Frank J Malina, June 25 1957

The excerpts below are from a letter whereby Andrew G Haley reports to Frank J Malina on the progress of establishing a trust fund. Haley also mentions a proposal for the demarcation of sovereign airspace and outer space.

> "I received your letter of June 21, 1957 along with the check for $10,000 for the Trust Fund. We have noted the instructions contained in your letter. I am not proceeding very fast with the Trust Fund until I have a chance for a very thorough talk with Dr. von Karman. I reached him in Ithaca and he left Ithaca for Woods Hole where he is now located. He has promised to come down to see me one day this week. We will make a thorough final investigation of all aspects of the situation – and if we find any real trouble or doubt we will still not proceed and I

> will return your money to you. However, there is every present indication that we should proceed and I hope that we will have a nice success in this enterprise . . . I would very much like to receive a diagram from you covering the subject matter of my article, namely, Earth Jurisdiction, and also your own concept of the field covered by Sänger."

Letter from Andrew G Haley to Frank J Malina, October 17 1956

This short excerpt reports a successful sale of stock and records the meeting of the board approving of the sale.

> "NDRC has definitely decided to sell you $2000 worth of stock. Please send your check payable to the order of National Design and Research Corporation, and I will have the stock issued to you. This action was taken at the meeting of the Board of Directors on Friday evening, October 12, 1956. I am glad you are now to become a fellow stockholder."

REFLECTIONS ON *SPACE LAW AND GOVERNMENT*

William J. Potts, Jr.[*]

Space Law and Government[1] was, first and foremost, the product of the mind of a remarkable person who brought to the task his broad experience in the law, in industry, and particularly, his keen knowledge of the physical sciences. It was also the product of a number of other minds and hands over a period of several years. The story of why and how it was written is an illustration of the fact that the knowledge and experience of persons who are specialists in known areas of the arts and sciences are essential to their ability to function in new areas of activity where there are no charted pathways.

By the time the actual writing of *Space Law and Government* had begun, a number of nations were already well into the Space Age to the extent that they had launched vehicles capable of traveling into outer space or had commenced plans to do so. A major problem with such efforts and plans was that there were no established definitions of what body of law would cover activities beyond the Earth's atmosphere. It was indeed questionable whether time-tested rules governing Aeronautical flight within the earth's atmosphere would serve as an adequate guide to future activities in outer space. But it would be incorrect to conclude that *Space Law and Government* was Haley's reaction to Sputnik. The seeds, and many of the major concepts espoused in the book, are the product of decades of thought, dialog, and writing by Haley and the team he put together to help chart the course for space law. The story of *Space Law and Government* actually begins some three decades earlier, in the early 1930's.

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[*] Bill Potts joined Andrew G. Haley's firm in 1957, and the firm eventually become known as Haley, Bader & Potts. Bill remained at Haley, Bader & Potts until his retirement in 1995.

[1] ANDREW G. HALEY, SPACE LAW AND GOVERNMENT (1963).

Andrew G. Haley was by profession an attorney, who beginning in the late 1920s, had practiced in Washington, D.C., first on Capitol Hill as a legal assistant to Senator C.C. Dill of the State of Washington, where Haley was born in 1904. Senator Dill was a long time member and eventually the Chairman of the Senate Commerce Committee. As his legal aide, Haley worked on the drafting and enactment of what became known as the Communications Act of 1934[2]. Having the benefit of his experience with Senator Dill, Mr. Haley became one of the original staff of the Office of Legal Counsel of the Federal Communications Commission, which was created by the 1934 Act. While in that position, Haley took particular interest in the administrative problems related to the international regulation of radio communications, the functions of the United States as a member of the International Telecommunications Union and, overall, on issues involving the need to base legal standards on the realities of physical laws. Mr. Haley had come to learn that progress in international radio and telecommunications very much depended on creating harmony between the realms of the law and the sciences. For all the political differences that fragmented the world prior to World War II, the fact was that the laws of physics applied equally to democratic, communist, or fascist regimes. Radio signals propagate the same, whether the messages carried on those radio waves call for peace or for war. It was on the early stage of ITU negotiations, as part of the FCC's team, that Haley saw first-hand the workings of international diplomacy, and the time it took to accomplish even the most mundane tasks for international regulations. This experience colored his approach to space law. He fundamentally understood that space law was by definition part of international law, and no amount of superpower bullying was going to establish norms for space law, even something as simple as "where does space begin?"

Late in the 1930s, Mr. Haley left the FCC to form his own private law firm in Washington, D.C., specializing in what has come to be known as Administrative Law, including communi-

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[2] Communications Act of 1934, Pub. L. No. 73-416, 48 Stat. 1064 (1934).

cations and related governmental and intergovernmental issues. It was then that he first met the noted Hungarian physicist Dr. Theodore Von Karman, a recently arrived refugee from Hitler's Europe in need of advice on immigration and other legal issues. Through his pioneering work on the practical application of the power of jet propulsion, Dr. Von Karman soon became active in the exploitation of small external rocket engines as a means for assisting aircraft in the use of short runways. With the entry of the United States into the Second World War, Dr. Von Karman's patents, skills and experience were noticed by Army General (and future first commander of the U.S. Air Force) Henry H. (Hap) Arnold.[3] Arnold convinced the army to provide the basic procurement contracts through which the newly formed Aerojet Corporation was able to mass produce jet-assist take-off (JATO) modules for use by the United States' military air forces, principally in the Pacific theater of operations, where they allowed cargo planes to take off from the short, rough runways with far greater payloads. Mr. Haley, who had enlisted in the Army Judge Advocate General's Corps at the beginning of the war, became the first President and eventually General Counsel of Aerojet with which he served until peace came and he returned to his Washington practice. Von Karman went on to found the Jet Propulsion Lab (JPL), and he and Haley remained lifelong friends.[4] While working day to day with the specific legal problems at Aerojet, Mr. Haley had to give serious thought to the post-war era in which that corporation would certainly look to the further development of technologies for faster airflight, and eventually, spaceflight. In planning for such a future, the unanswered questions of where terrestrial aeronautical law ended, what would be the international and domestic legal status of objects placed into orbit and eventually deep space, all demanded answers. It was then that Haley foresaw

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[3] Walter J. Boyne, *Von Karman's Way*, 87(1) AIR FORCE MAG. (Jan. 2004), http://www.airforcemag.com/MagazineArchive/Pages/2004/January%202004/0104vonkarman.aspx (for an excellent article on the relationship between von Karman and Arnold).

[4] It is interesting to note that 2013 represents not only the 50th anniversary of *Space Law and Government,* but also the 50th anniversary of the death of von Karman, who died in May of 1963, as *Space Law and Government* was undergoing its final edits.

the need for the formulation and study of a new legal system which he called Space Law.

International interest in future travel beyond the limits of the Earth's atmosphere and other uses of outer space was growing throughout the late 1940s. Older organizations such as the American Rocket Society (ARS) (which Haley served as General Counsel from 1955 to 1963, and president in 1954) and similar groups in Europe and elsewhere had begun focusing on the scientific aspects of the peaceful uses of rocketry. In London in 1951, the International Astronautical Federation (IAF) was founded under United Nations auspices from among the world's larger rocket-centered organizations such as the ARS. During the time leading up to the formation of the IAF, Mr. Haley had been active through articles submitted to ARS meetings and his travels abroad, in emphasizing that the legal problems presented by the future uses of outer space were just as grave and complex as those of the science involved.

Here again, Haley understood that while space technology was evolving at an almost unbelievable pace (President Kennedy handed down the famous Moon challenge in 1961 just a few years into the space age!), it was going to take the international legal community far longer to agree to any legal norms for space activities. Haley tried to harness the laws of physics to hasten the process, at least in regard to one issue: where outer space begins. Working with von Karman, Haley came up with what became known as "The von Karman Line," which is actually not a single line, but rather a set of equations that bound an area whereby any body travelling through this regime loses the ability to continue using aerodynamic lift, and must instead rely on propulsion alone to not fall back to Earth. The "line" averages out to be about 52 miles.[5] Haley formally introduced The von Karman Line as a practical answer to the vexing question of where national sovereignty to airspace ends at the VIIIth Annual Congress of the International Astronautical Federation in October, 1957, at Barcelona, Spain. Much to his chagrin, what he thought to be a completely logical and supportable

[5] *See* SPACE LAW AND GOVERNMENT, *supra* note 1, at 78 (for a visual depiction and explanation of the von Karman line).

definition of the beginning of outer space was met with derision from the international legal and engineering community. He took out his frustration in *Space Law and Government*:

> In arriving at a level-headed statement of the jurisdiction of space law, the lawyer must obtain help from the physicist to determine just where 'airspace' ends. We must ascertain this outer boundary because hundreds of local laws of more than a hundred nations, and the restrictions of a score of international treaties, are bound tightly to the physical concept of airspace. And, as C. Wilfred Jenks has stated, 'no lawyer should indulge in abstract speculation on the subject without first familiarizing himself with the scientific background and outlook.'
>
> Ironically enough, the lawyer finds the main crackpots and nuisances among engineers and sociologists who assume the role of amateur lawyers and give vent to rather silly if harmless rhapsodies in a field wholly unfamiliar to them. To them the very real task of delimiting airspace is wholly unnecessary. The sound scientist, on the other hand, avoids legal interpretation while at the same time making an essential contribution by staying within his technical expertise and keeping the lawyer well advised on appropriate physical phenomena. Such was the most helpful role of Dr. Theodore von Karman.[6]

It is a testament to both Haley's analysis and frustration that 50 years after the publication of *Space Law and Government*, there still is no official demarcation of space, yet most agree that outer space begins somewhere around 50 miles (very close to the mean equations that make up the von Karman Line).[7]

With the successful launch of the Soviet Union's *Sputnik* satellite in 1957, the concerns with the legal status of such objects and the need to study the legal aspects of their utilization

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[6] *Id.* at 97, *quoting* C. Wilfred Jenks, *The International Control of Outer Space*, *in* 3rd PROC. COLLOQ. L. OUTER SPACE 3, 7 (Stockholm: Swedish Astronautical Society, 1961).

[7] *See, e.g.,* John Schwartz, *Now Earning Wings, a New Kind of Astronaut,* N.Y. TIMES (Oct. 12, 2004), http://www.nytimes.com/2004/10/12/science/space/12astr.html?_r=0 (describing how the Federal Aviation Administration had special commemorative "wings" created to be awarded to any pilot or co-pilot that flew higher than 50 miles).

had become obvious to all. Equally obvious at that time was the tension between the United States and the Soviet Union, and a palpable fear that outer space could become "the high ground" of the next world war, with each of the superpowers placing nuclear weapons into outer space. The militarization of space was a very real possibility at the time, and Sputnik generated the so-called "missile gap" that plagued the remaining years of the Eisenhower administration, and gripped the nation in fear. Because of his position in a number of prestigious international organizations such as the International Astronautics Federation (IAF), International Academy of Astronautics (IAA), and ultimately the International Institute of Space Law (IISL), Haley was able to travel to parts of the world, especially within the Soviet Block, where most westerners were not welcome. Wherever he travelled, Haley would speak of the need to reserve outer space for peaceful purposes only. His travels also gave him some hope that the Soviets were just as fearful of the militarization of space as were Americans, and that, ultimately, cooler heads would prevail. Haley knew, however, that just below the surface of any discussion of establishing international norms for space operations the "bombs in orbit" issue lurked, and dominated any discussions of a global treaty on space law.

By the late spring of 1957, Haley had already completed drafts of several chapters for a proposed book on space law. When I joined Mr. Haley's law firm in the summer of that year, it consisted of Haley, his nephew Michael Haley Bader (who went on to help found MCI and be instrumental in the breakup of the AT&T telephone monopoly), J. Roger Wollenberg and Edward F. Kenneham. Obviously, we were a very small shop, and at that point, Haley was in the midst of a tour of 30 U.S. and 13 European universities, speaking on the issue of outer space law with his friend and jurist Welf Heinrich, Prince of Hanover.

One of my initial assignments was to prepare a paper on the legal status of *Sputnik* and, in particular, the lawfulness of the Soviet use of the radio frequency of 20.0 MHz which had been specifically reserved by the rules of the UN's International Telecommunications Union (ITU) for emergency uses only. Within the staff of Mr. Haley's firm, my paper was greeted as an

initiation to the "Team." It was clear to me that many hands had worked on "The Book" under Mr. Haley's close supervision

Over the next few years after my initial introduction in 1957 to what is now termed Space Law, Mr. Haley and the team continued to work on *Space Law and Government*. That team was comprised not only of lawyers but of physicists and engineers, the steady stream of whom became a common feature of our small offices, library and conference room. Actually, *Space Law and Government* wasn't even Haley's first book. During my early years at Haley's firm, he was writing *Rocketry and Space Exploration: the International Story* a historical and technical look at the development of rocketry.[8]

On the legal side of the Team, much of the subsequent work was led by Steven Doyle, who, at the time was an attorney with the firm, and who had the difficult task of whipping a growing pile of draft materials into a coherent volume. In the next section of this preface, Steve will describe how that task proceeded. For myself and my longtime friend and partner Mike Bader, we were left to manage the day-to-day operations of the firm and make sure that our work in telecommunications regulation was bringing in the revenues necessary to support the firm, and Haley's quest to provide a legal framework for future human activities in space.

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[8] ANDREW G. HALEY, ROCKETRY AND SPACE EXPLORATION: THE INTERNATIONAL STORY, (Van Nostrand 1958).

BRAVE NEW WORLD OF HOSTED PAYLOADS

James D. Rendleman, JD, LLM[*]

Arguments in favor of flying government-sponsored hosted payloads aboard commercial satellites have gained significant traction in recent years. The space community seeks to satisfy the increasing demand for space-based information with robust systems and also reduce the costs of supplying that capacity. Hosted payload solutions can fill the programmatic seams between flagship and small size satellites system and hold great potential to enhance the resilience of US national security space systems architectures and achieve desired cost savings. Integrating these capabilities with existing commercial systems will present significant challenges and involve accepting new programmatic risks. Despite the advantages, integrating national security and intelligence hosted payloads aboard commercial satellites raises unique contracting, policy, and Law of Armed Conflict issues.

MULTIPLE FORCES ARE WORKING TO DESTABILIZE THE US AND ITS SPACE SYSTEMS ADVANTAGES

Over the last 20 years, systems relaying data and providing information from space have become critical to the conduct of wars and peacekeeping, not just in our everyday life. Very simply, space has become an integral part of modern life and all

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[*] Supervising Attorney, Operations, Space, and International Law, US Strategic Command's Joint Functional Component Command for Space. Member, State Bar of California and International Institute of Space Law. The views expressed in this paper are those of the author and do not reflect the official position of the US Government, US Air Force, or US Strategic Command. The author thanks past and future hall-of-fame winners in space law, policy, acquisition, and operations for their very kind assistance, insights and patience: Maj Gen Thomas "Tav" Taverney (Ret.); Colonel Robert "Rails" Ryals (Ret.); Milton "Skip" Smith; Colonel Andy Williams; J. Walter Faulconer; Allen Coe; Major Erik Mudrinich; Chris Hearsey, and Ryan Noble.

military operations. Its systems provide an array of capabilities that offer the United States (US), its allies, and coalition partners tremendous asymmetric advantages in terms of intelligence, surveillance, reconnaissance, communications, missile warning, precision navigation and timing. These capabilities give an awareness and understanding that enhances US capabilities to conduct operations the way no other armed forces can today.

There are multiple forces working in parallel to destabilize these important asymmetric advantages:

- The US economy
- A congested, competitive and contested environment
- Aggregated and complex satellite systems, and soaring costs
- Important new space systems have completed developments and are just beginning to deliver wanted capabilities
- Next generation systems, while able to reduce costs in the long run, will cost money in the short run

The US economy – Ongoing fiscal policy disputes between the executive and legislative branches are making it likely the US national space budget will decrease. The economy has floundered over the last half decade and funds are not readily available to be spent on discretionary accounts. While the national security space community and its manned spaceflight and civil space exploration cousins did not spawn these problems, they all will be dramatically affected by expected reductions in program resources. As to the overall space industry, even moderate growth in commercial missions will not be enough to offset the crippling effects of lower government spending. This, in turn, may lead to even higher prices for US national security systems.

Congested, competitive, and contested environment – Compounding the fiscal problems, managers are challenged by "the three C's" of the space domain: congested, competitive, and con-

tested.[1] There are huge incentives for states to invest in and use space, and the spread of space-enabled technologies has accelerated and new players have gained access to the domain. Added to this, an ominous number of new kinetic and non-kinetic anti-satellite (ASAT) technologies have been developed, tested, deployed, and employed in recent years. States with sufficient resources can now reach out to space and "touch" satel-

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[1] In an April 14, 2010 speech at the National Space Symposium, Deputy Secretary of Defense William J. Lynn said the US Space Posture Review proceeded under the premise space has become "congested, competitive, and contested." He then elaborated:

> Space has become congested with both satellites and debris. More than 60 nations operate 1,100 systems on orbit. And satellites are not the only thing crowding space. 20,000 known pieces of orbital debris also clutter the skies over earth. Tens of thousands more pieces are too small to reliably track, but are still dangerous to spacecraft operations. The increase in orbital debris and working satellites poses operational challenges to both military and civil space. Space has also become more competitive. More nations work in space than ever before. Numerous and diverse commercial actors offer rival systems and services. By one count, more than 9,000 satellite transponders will be active by 2015. Some satellites work together in systems that many different nations cooperatively run or benefit from. GPS is an example of a space technology with widespread benefits. But most satellites operate on their own, serving the needs of their client rather than the common good. Whatever their purpose and ownership, the sheer number of communication satellites raises the specter of interference. We are approaching a point at which the limitless frontier no longer seems quite so limitless. Finally, space is becoming contested. We can no longer take access to space for granted. Some nations have jammed satellite signals to prevent their people from watching coverage of protests. Other nations have developed the ability to destroy satellites in low-earth orbit. And still other nations have technologies that can disable or permanently damage space platforms. Our space assets could be targeted as part of a deliberate strategy to deny us access to the space domain. By crippling key sensors and platforms, such anti-access tactics could offset the tremendous conventional dominance our space assets enable us to bring to bear. Never before have our space assets been so vulnerable to disruption. Since the environment in space has changed, our approach must change as well. We need a new strategy that takes into account the congested, competitive, and contested space environment that we operate in.

William J. Lynn, Remarks at National Space Symposium, Broadmoor Hotel, Colorado Springs, Colorado (Apr. 14, 2010), http://www.defense.gov/speeches/speech.aspx?speechid=1448.

At a November 30, 2010, NDU Conference on "Securing Space Assets for Peace and Future Conflict," Ambassador Gregory L. Schulte, Deputy Assistant Secretary of Defense (acting) for Space Policy, characterized congested, competitive and contested as "the Three C's." *See*, http://www.defense.gov/home/features/2011/0111_nsss/docs/20101130%20DASD%20Remarks%20on%20Securing%20Space%20Assets%20at%20NDU.pdf.

lites through a variety of means, and achieve one and even more of "the five Ds": deception, disruption, denial, degradation, and destruction.[2] So much for the "ultimate high ground."

The January 11, 2007 test of a Chinese ground-based, direct-ascent anti-satellite (ASAT) interceptor against one of their own defunct Feng Yun-1C weather satellites sparked marked unease across the US space community, indeed, across all space-faring nations and the international commercial satellite marketplace. The test was deplorable as China had emerged as global military and economic superpower less than 30 years after it was only considered a basket case, incapable of functioning. Nevertheless, with its test, China sadly signaled a willingness to put at risk the very systems vital to global economic success and its own success, and halt the progress achieved by it and other space-faring nations. The test also demonstrated the broad strategic importance of space capabilities is also their deadly weakness – it is far too easy to neutralize satellites because their predictable orbits make them easy targets for those with advanced weapon systems. Satellites suffer from their own set of unique, inherent vulnerabilities, which are largely the consequence of orbital mechanics. These weaknesses are well recognized and invite destruction, damage, and even just mischief delivered by even the least significant adversary; state and

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[2] Deception involves those measures designed to mislead by manipulation, distortion, or falsification of evidence to induce one to react in a manner prejudicial to his or her interests. Disruption encompasses the temporary impairment of the utility of space systems, usually without physical damage. These operations can include the delaying of critical, perishable operational data. Denial means the temporary elimination of the utility of the space system, usually by stopping access to a system without creating any physical damage. This can be accomplished by such measures as cutting electrical power or network connectivity to the space terrestrial nodes, or to computer centers where data and information are processed and stored. Degradation entails the permanent impairment of the utility of space systems, usually with physical damage. This can include attacks against terrestrial nodes and capabilities, and may also include the use of information operations attacks. Destruction features the permanent elimination of the utility of space systems. This includes any means to interdict critical terrestrial nodes; use of attacks to destroy uplink and downlink facilities, electrical power stations, and telecommunications facilities; and attacks against the satellites themselves.

James D. Rendleman, *Strategy for Space Assurance*, *in* SPACE STRATEGY IN THE 21ST CENTURY: THEORY AND POLICY 111, fn. 5 (Routledge, Eligar Sadeh, ed., 2013) (*citing to DOD Strategic Deterrence Joint Operating Concept (SDJOC)*, 44-45 (Feb. 2004)) [hereinafter *Strategy for Space Assurance*].

non-state actors may purposefully seek to deny US advantages in space through a variety of negation and prevention acts.

Aggregation – The US Government contracts to build and fly only a very few space systems. As a result, its acquisition offices want to wring every mission advantage they possibly can out of each satellite. That has also meant managers tinker with their programs in an attempt to bundle capabilities. With bundling, the government consolidates as many requirements as possible onto a single "flagship" satellite. Bundling is also called "aggregation."

Aggregation is used to build stronger cross-mission advocacy and secure additional funding because satellite systems are often difficult to resource. This has an undeniable downside. It saddles a program with tremendous technical and resource management risks. Establishing and maintaining the necessary exacting engineering baselines responsive to those risks is exceedingly complex and often undoable. Immense "flagship" class satellites are burdened also by equally extensive and labyrinthine ground systems. As a result of this confluence of factors, flagship systems come with crushing multi-billion dollar price tags. The technical, resource, and complexity attributes of flagship systems effectively limit the type of organizations that can acquire them to governments, militaries, and very large, multinational satellite service providers. The US Government acquired a number of these systems during recent decades, as it could draw on a vast national economy to secure resources needed to do so, but with recent economic, fiscal, and monetary troubles, this approach is fast becoming unpracticable .

Delivery of current generation of systems – New satellites, having survived years of acquisition activities, are beginning to be delivered in earnest to operators. The capabilities these systems deliver to operators are far superior to those provided by earlier generations. Unfortunately, the fact that their acquisition took so long, makes them, in a sense, obsolete upon delivery. With delays, insidious failures emerge; especially as the crushing attributes of Moore's Law come into play — long-

delayed programs deliver decades-old technologies to a mission.[3] As an example, the latest US Government satellite communications (SATCOM) system, the Wideband Global SATCOM (WGS) system, is an important acquisition, but one should despair because WGS only offers one-tenth of the capacity of recently deployed commercial systems. Then, with all the pain endured in producing these flagship systems, many feel the US space community should just pause as they begin to enter the US inventory and cherish whatever success achieved by them before moving on to new, painful follow-on programs.

The hunger to acquire and operate bloated flagship systems is typical of government acquisition process that has gone truly mad. Decades of government-charted studies of the defense industrial base have documented the serious, interrelated systemic factors causing space acquisition to go awry; nearly all highlight the same institutional and resource shortcomings. And flagship systems acquisitions tie up immense resources. In

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[3] According to Paul Brooks,

> When a satellite is being designed the owners look for ways to extend its mission. The designers then put more payloads on the spacecraft to deliver more value, but then the cost goes up…This creates more financial risk which then requires greater assurance that everything will work as planned. The greater assurance lengthens the lead time. You ultimately end up with very large missions and by the time the payload is launched, it is out of date. We noticed that this pattern repeated itself in the satellite industry and, unlike other technology-driven markets, there weren't huge increases in performance and large decreases in cost. We believe that Moore's Law should apply to spacecraft as well….

See Greg Berlocher*, Small Satellite Technology: Gains Open Space to More Players*, VIA SATELLITE**,** Aug. 1, 2008*,* http://www.viasatellite.com/via/features/Small-Satellite-Technology-Gains-Open-Space-to-More-Players_23881.html. According to Webopedia, the observation was made in 1965 by Gordon Moore, co-founder of Intel, that the number of transistors per square inch on integrated circuits had doubled every year since the integrated circuit was invented. "Moore predicted this trend would continue for the foreseeable future. In subsequent years, the pace slowed down a bit, but data density has doubled approximately every 18 months, and this is the current definition of Moore's Law, which Moore himself has blessed. Most experts, including Moore himself, expect Moore's Law to hold for at least another two decades." *See Moore's Law,* http://www.webopedia.com/TERM/M/Moores_Law.html (last visited Sept. 5, 2013). Moore, then Fairchild Semiconductor's Director of R&D, edited and published his observation, in what was originally an internal company paper, as Gordon E. Moore, *Cramming more components onto integrated circuits*, 38(8) ELECTRONICS, 114-117 (April 19, 1965).

recent years, acquisition debacles on national security and civil flagship systems such as the Space Base Infrared System (SBIRS), Future Imagery Architecture (FIA), National Polar-orbiting Operational Environmental Satellite System (NPOESS), the James Webb Telescope, and others have become emblematic of these problems. These acquisitions siphoned off vast resources and intellectual capital that could have been used to field other vital space capabilities. Similarly, NASA's long close embrace of the now retired Space Shuttle and on-going International Space Station programs, and their archaic 1960s-1980s technologies, eviscerated much of the agency's scientific enterprise, and drained resources that could have been better invested to bolster and invigorate a struggling aerospace industrial base and support new science and technology research activities vital to maintaining US global scientific and engineering leadership. Anecdotes abound of space shuttle engineers who have transitioned to new careers to keep income flowing to their families. Some now flip houses (that is, purchase, upgrade, and sell them) and others have moved to the booming Dakotas to work as petroleum engineers.

Transition to the next generation – The space business has always strived to begin development of a next generation of systems while building out and launching the last generation. SBIRS began in the late 1990's, long before the last Defense Support Program (DSP) satellite was placed in orbit[4], the Global Positioning System (GPS) III was begun before the Air Force had even launched the first satellite in its GPS IIF block, and the same with Advanced Extremely High Frequency (AEHF), WGS and even the Evolved Expendable Launch Vehicle (EELV). Entities positioned to profit from current acquisitions do not want to move on. Some of these companies now make the case, with a little sleight-of-hand and a wee bit of revisionist history mixed-in, that the US has never begun the development of a next generation of systems while still building out the current

[4] Actually, the author understates the DSP-SBIRS overlap. His career touched on programs aimed at replacing DSP during the 1980s. They eventually evolved into what became the Air Force's SBIRS system and the Missile Defense Agency's Space Tracking and Surveillance System (STSS).

version. With the combination of the acquisition problems, complicated by the economic, fiscal, and monetary challenges facing the nation, many are willing to listen and forgo investments necessary to prepare for next generation space activities. Doing this and delaying the transition compounds the error, making the issues of affordability and resilience bigger than they should be as such moves only delay inevitable and much-needed programmatic and investment decisions. The US needs to invest early in technology development and plan for its next general space systems as this has been shown to reduce overall costs over the long-term.

WISE LEADERSHIP IS NEEDED TO MOVE THE SPACE COMMUNITY FORWARD

With fiscal realities and growing military threats, these trying times demand smart and wise leadership within the US space community. Leaders must be prepared to challenge the underlying assumptions of the current space acquisition paradigm and forge new business models with different logic, inherent costs and resulting mission architectures. Program managers must be charged to lead their acquisition teams through rapid, sound and detailed systems engineering and integration. Fortunately, technology innovations achieved over the last decade have made possible important new satellite mission architectures. These technologies enable the use of small satellite constellations, hosted payloads, and disaggregated systems to achieve mission success. They offer tremendous flexibility and agility, and can satisfy important survival objectives, and the potential to achieve space mission goals more frugally, efficiently and effectively.

Implementing these technology and programmatic options will involve and bring about new and different challenges. Given pressing economic and fiscal challenges, the level of acceptable risks will change, and managers must anticipate them. Establishing and maintaining proper engineering baselines is difficult to achieve for flagship programs that take many, many years to develop. And improperly baselined programs cannot be executed successfully – by even the best systems program office.

The SBIRS and FIA fiascos began with inadequate engineering preparation; this foolishness was compounded by an early failure to acknowledge, on both the government and contractor side, the true scope of resources needed to achieve technical success given their ambitious objectives and planned complexity. The architectures and the technology readiness levels needed to support their programmatic objectives were inadequate, and these inadequacies were matched to cost-objectives and programmed resources that were hopelessly optimistic.

Flagship programs last for decades and are continually confronted with pressures to allow for requirements creep. Program managers are often pressed to make short-term decisions based on public financial reporting and accommodate transient funding instabilities. Nevertheless, they must continually fight or accommodate temptations to make changes to their requirements. Demands for change occur throughout the life of long-duration programs. Further, various players take interests in the capabilities a large system might provide, and try to hitchhike their wants on them, imposing their own additional requirements, further exacerbating requirements instability. Given expanding program lengths, it is not easy to fight off requirements creep as users demand more and more as they become more knowledgeable and sophisticated as to what state of the art could provide. While the desires to continually evolve are legitimate, making changes on flagship programs can be very expensive and could serve as program killers.

Funding instability is simply a fact of life in the Department of Defense (DoD), and funds are continually moved about as priorities change within the executive and legislative branches. This requires continual re-planning, with many involved not understanding the re-planning's cost and schedule impacts. Further, when one decides to stretch programs the decision not only introduces more risk, which is not likely adequately budgeted for, but it also adds long term cost, for which the programs later get blamed. In addition, decisions made in corporate boardrooms, often imposed by quarterly financial reporting pressures for public companies, precipitate short term decisions. Those decisions often generate undesirable long-term negative effects.

Finally, managers must also understand the international and domestic laws that affect their programs and constrain their decision-making and ultimate satellite ground and on-orbit operations. As the legal issues are identified and worked, the understanding of what constitutes acceptable risk will evolve, and must then be balanced by the manager against cost, adaptability, technology insertion, resilience, and other technical and programmatic factors. Program managers must therefore employ attorneys to identify, minimize and defeat legal and programmatic risks challenges.

THE NEED FOR OPTIONS: FLAGSHIP SYSTEMS SUFFER FROM THE SPACE ACQUISITION VICIOUS CIRCLE

Flagship systems are often confronted by an insidious phenomenon described as the "Space Acquisition Vicious Circle." In the Circle, each attempt to resolve problems in the acquisition process creates new problems and expense. As a result, space systems become more and more complex and expensive, with less and less room for failure. As described by Major General Thomas "Tav" Taverney (USAF, Ret.), in his essay "Resilient, disaggregated, and mixed constellations," the aggregation of mission requirements generates very damaging consequences:

> • It takes many years to build these highly integrated bundled mission capabilities. With this reality, the US government customer demands that its contractors integrate advanced technology into a developed system, so that it is not totally obsolete when finally deployed. Unfortunately, try as they might, the resulting long schedule adds obsolescence along with technology and schedule risk to a system that is ultimately launched.
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> • The resulting high cost and risk minimizes the number of new program starts. The circular thinking behind this is if the US government cannot afford to approve many new starts, program planners, in an honest attempt to get the warfighters the space capabilities they need, think they should structure scarce, new programs to get everything out of them that can be funded.

- As users demand more and as a result of the previous step, acquirers design more and more complex systems to meet a greater number of aggregated requirements. This has the unfortunate consequence of generating complex and expensive sets of technical requirements for space acquisition efforts. Sometimes these requirements are at cross purposes (e.g., precision navigation and timing systems with nuclear detection capability). As a result, very complicated payloads are proposed, and they turn out to be very expensive and high risk to build and operate.

- Another unintended consequence is the resulting satellite systems are heavy, complex, and expensive to develop and operate. Spare satellites for such systems are unaffordable. With no spares, the acquirers must significantly increase system reliability, again increasing overall program cost. That means the system must be designed to work the first time, every time. It also means intense and expensive reviews of every developmental step, and even more extensive testing to be sure everything is very reliable and meets the multiple (and sometimes incompatible) requirements. That then drives cost and schedule. As the system becomes more expensive, less tolerance for risk is allowed. The system becomes too big to fail. So this leads to even more program reviews, senior service reviews, independent reviews, testing, and expense—and the vicious circle continues.

- Since this acquisition approach of buying aggregated satellites is expensive, funding needed to develop robust ground systems just like the funding for sparing [Author's note: space parts, systems] is equally complex, and unaffordable.

- Ultimately, we are left with satellite systems that are very expensive and with heavy payloads, long development cycles, and no spares. Unfortunately, with no spares, programs cannot afford a launch failure. This all demands 100 percent launch success rates, which are also impossible to achieve. This in turn results in very expensive, risk averse, and expensive launch processing. [Author's note: And little to none of that expense and risk is absorbed by the contractor, nor should it be! That makes the program even more expensive for the US Government customer.] The concern about risk drives demands for extensive launch reviews, both developer and programmatic, along with independent reviews. Launch afforda-

> bility calls for fewer satellite systems, which results in a lower launch rate. As launch rate is the single biggest driver in the cost of launch, this now compounds our launch affordability problem. With very low launch rates we get expensive launches, or we get expensive launches because our rate is low. As launches become more and more expensive, the US government is compelled to reduce their number, which means we can only launch a select few important payloads. As launch costs are driven up, resistance rises to increasing the launch rate or using our launch vehicles by other agencies or commercial satellite builders. Finally, as costs skyrocket, we can't afford to launch a wide variety of missions.[5]

The Space Acquisition Vicious Circle cannot be exited easily. It is not easy to forge success with programs that must integrate a myriad of complex technologies; few are completed within the usual optimistically planned resources and schedules. Controlling risks is critical in space programs, and adequate cost and schedule risk margins are essential, but difficult to maintain. Not adequately accounting and budgeting for risk, however, results in huge costs in the form of overruns and unplanned delays. And there is usually little programmatic room to spare. Even though some US satellite systems do have large constellations (read: GPS), the US Government does not usually acquire spare satellites to cover the risk of launch or on-orbit failure. So when the US Government loses a launch, it also loses critical capabilities for its warfighters and peacekeepers.

In the end, despite best efforts, most large space programs are unable to successfully contain costs and limit engineering problems. Still, many seek the selection and honor to serve as space program managers. Once selected, they are consigned to an eternity of useless efforts and unending frustration as they roll programmatic boulders up hills with zeal that would earn the sympathies of their equally condemned brother, Sisyphus.[6]

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[5] Thomas D. Taverney, *Resilient, disaggregated, and mixed constellations*, THE SPACE REVIEW (Aug. 29, 2011), http://www.thespacereview.com/article/1918/1.

[6] In Greek mythology, Sisyphus is said to have been a king who was punished in the afterlife in the Underworld for his chronic deceitfulness. He was compelled to roll an immense boulder up a hill, only to watch it roll back down, and to repeat the action forever. On the other hand, successful program managers are better confused with

ACHIEVING AFFORDABILITY AND RESILIENCE THROUGH INNOVATION IS VITAL TO FUTURE SUCCESS

Despite the challenges posed by the five major destabilizing factors, space systems must satisfy two important objectives—first, they must be "affordable". Affordable is defined as "what one can bear the cost of." Of course, what was affordable 20 years ago, may not be affordable today. In today's parlance, "affordable" should perhaps mean costs that are 20-25 per cent lower than current ones to acquire and perform missions. Therefore, the next generation of systems need to be developed so they present the needed mission capabilities in a more cost-effective and efficient manner. Second, space systems must be "resilient". Resilience is the ability to recover from or adjust easily to misfortune or change. In the case of national security space, this means recovery or adjustment from losing a satellite occurring as a result of hostile acts, accidents, or as result of damage caused by the space environment. National security space systems, and commercial systems for that matter, must prepare for and increase the odds that they can survive an unexpected attack (the quintessential space Pearl Harbor) and reconstitute/augment themselves in a manner such that they can effectively deliver services that support their warfighter customers.

How should the affordability and resilience imperatives be reconciled in the current space acquisition environment?

Affordability. More often than not, when buying the same type of systems, the US Government has continued to do business as usual — buying more and more expensive and complex systems, sometimes with compromised engineering approaches that creates new problems. The failure to reform, spending more, and allowing delays can be characterized as a joking form of insanity: doing the same thing over and over again the same way and expecting different results.[7] Now, most large prime

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great Greek hero Hercales, who, in his Fifth Labor, cleaned the Augean stables. This assignment was intended to be humiliating and impossible, not impressive. Heracles rerouted the rivers Alpheus and Peneus to wash out the dung.

[7] The joking observation is attributed to Albert Einstein.

contractors are burdened with immense overhead costs and are unable to provide agile solutions to evolving acquisition needs.

Complexity and the attendant high costs burden launch, operations, and sustainment. Managers try to ensure 100 percent reliability, and this causes prices to spiral upward on all but the least capable microsatellites. Satisfying the "affordability" imperative demands that the total cost of space systems be reduced to what the nation can and will pay. The space acquisition community has been directed to take a number of steps it hoped would save money – for example, it has been directed by Congressional committees to trim acquisition costs by reducing management reserves; and directed by the Secretary of Defense to de-funding and de-scoping much wanted programs. These actions conserved a few dollars. Some directions encouraged managers to skimp on essential mission assurance and risk reduction engineering activities. This, in turn, dramatically increased overall program risks. Saddled with reduced systems engineering and appropriate risk reduction, some programs failed. Other grew to behemoths that squandered national treasuries and drained contractor corporate reserves. When their managers realized penny-wise, pound-foolish strategies had led to catastrophes on must-have, can't-fail programs, they had to return to the Congress to secure additional funds.

There is no single technology fix or magical management process that can solve affordability issues. Space systems and their support systems are expensive, and have been throughout the Space Era. Their acquisition can be improved and refocused with innovative new technologies and operations concepts. Rather than consolidating resources on flagship class satellites, with their attendant cost problems, managers could move to unbundle their systems. Constellations or clusters of small satellites and hosted payloads, and block purchases of such systems, could enable programs to survive severe fiscal constraints.[8]

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[8] COMMITTEE ON EARTH STUDIES, ET AL., THE ROLE OF SMALL SATELLITES IN NASA AND NOAA EARTH OBSERVATION PROGRAMS 43 (2000) [hereinafter THE ROLE OF SMALL SATELLITES IN NASA].

The miniaturization of payloads and the development of small capable spacecraft provide opportunities to employ innovative constellation architectures to satisfy mission needs. Small satellite technologies have significantly advanced in recent years; new, small buses can now be used host the miniaturized payloads to support a wide variety of missions. Small satellites will be more fully discussed in the next section.

Another way to reduce cost may be found through the innovative use of commercially available systems. That is, using satellites buses and systems already coming off existing satellite manufacturers production lines. Heretofore, this approach has been discounted, as the US Government usually buys only a few satellites and the ones they buy are often unique, one-of-a-kind systems. Employing a commercial approach will require that managers perform a risk and cost analysis — balancing their ability to build and install payloads on uniquely-tailored and manufactured satellite buses verses moving to integrate those payloads on more readily available and generic commercially buses. The National Academies Space Studies Board has found that commercial "production" satellite buses offer the potential for reducing costs. "However, they generally have to be tailored—with attendant costs—to accommodate existing Earth observation payloads."[9] The Board also observed that designing payloads to match existing bus capabilities offers greater cost-effectiveness, though caution must be exercised not to compromise the mission.[10]

Happily, the commercial space industry has grown and is thriving, and it produces very capable buses, often with significant excess capacity. The US Government now can take advantage of existing product lines and their low-risk. Another, even

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[9] *Id.* at 36.

[10] *Id.* at 35. The Board noted that very low costs are experienced only with simple spacecraft performing limited missions. "Small spacecraft can be relatively expensive when they retain the complexity required to meet demanding science objectives (pointing accuracy, power, processor speed, redundancy, etc.)…The true cost of a mission must also include the investment in technologies around which the activity is built. Leveraging advanced technology to lower mission costs is laudable, but understanding the true cost of the mission requires consideration of such prior investments, particularly when they are directly supportive of the mission (e.g., preexisting sensors)."

more innovative, approach being evaluated is using commercial rideshares, and hosted payloads, which have potential not only to reduce bus cost and risk, but also to share launch costs with other payloads. This not only reduces cost and risk, but allows the DoD to focus on developing the critical satellite asset, its payload. Hosted payloads will be discussed later.

Resilience. In a contested, congested, and competitive space domain, "resilience" demands the United States retain access to vital space capabilities, even if those capabilities are targeted by adversaries or compromised by the space environment, on-orbit debris, or unintended electromagnetic interference. This must be done because the US is more dependent on space than any other nation, not only for national security but its private sector as well. Disrupting space systems offers a means by which adversaries can eliminate the significant asymmetric advantages they offer.

How should important space systems be protected? A synergistic strategy to assure the US access to space capabilities depends on four mutually supportive elements, or pillars: global engagement, space situational awareness (SSA), deterrence and defense, and a responsive infrastructure.[11] A responsive infrastructure enables the US to present agile responses to changes in the space environment, defeat man-made threats, and assure a continuing viability of space capabilities. And given the growing threats, US space operators should need more payloads on orbit, and more readily deployable as spares, despite persistent "affordability" constraints.

Of course, in hoping to achieve savings with new systems approaches, this will require substantial lowering of launch costs, something the DoD thus far has been unable to do. Increasing the numbers of payloads on orbit, whether achieved through small satellites or hosted payloads, could secure the economies of scale needed to support spacelift innovation and recoup investment in those technologies. In addition, by operating under a concept of employment that envisions regular, not

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[11] These themes have been expounded on by the author in: James D. Rendelman, *Space Assurance for the 21st Century*, 5 (2) HIGH FRONTIER, 46-53 (Feb. 2009), and *Strategy for Space Assurance*, *supra* note 2.

infrequent or as-needed, replenishment of space systems, decision-makers would potentially have sufficient numbers of systems on hand to conduct rapid reconstitution or augmentation operations in response to a national emergency.

Many are coming to realize that spending a little more now could provide significant savings in the future, and increase overall mission resiliency by inserting more satellites into orbit and thus decreasing the impact of losing a single (or several) systems. Sustainment and reconstitution schemes could replenish and ensure access to needed space capabilities. Their use would require support by robust and reinvigorated launch systems with satellites inserted into orbit with a myriad of air launched and ground launched systems being used. Interestingly, if these spacelift systems are sufficiently diverse, they would create a strategic dilemma for an adversary as the diversity and span of activities means the adversary cannot guarantee a complete decapitation of replenishment capabilities if conflict activities were directed toward space systems. Launch diversity would achieve a form of resilience. While multiple launches of small satellites present a higher risk of loss due to launch or satellite anomalies, the impact of a single failure would not be significant. A follow-on satellite would already be in production, ready to be launched in event of loss. Compare this situation to a flagship program, where the loss of scarce expensive satellite would send the warfighter reeling, scrambling to fill the capability void.

SMALL SATELLITE SYSTEMS CAN AUGMENT FLAGSHIP SYSTEMS

A mixed fleet of small and large satellites can provide the flexibility and robustness needed for any given mission, and achieve desired affordability and resilience objectives. Recent developments of highly capable small satellites offer tremendous flexibility. Constellation designs leveraged by responsive small satellite systems can take advantage of important new technology innovations, especially those that are rapidly emerging from the global marketplace. Miniaturization of components offers sophisticated capabilities, useful for a wide variety of operational and science and technology missions. The exact mix

depends on the mission's particular needs. In a sense, the US Government already performs a comparable form of these trade-offs in the way it obtains communications bandwidth for its far-flung forces, using a mix of commercial and government satellites.

Small satellite should lower costs. They provide a wonderful opportunity to use rapid building block or spiral development acquisition approaches; these can help keep programs simple and successful. The use of simpler space hardware should result in shorter development timelines, increased resilience, and reduced risk; shortened development cycles allow for spirally-developed block versions of each bus, payload and other parts of the system. Programs could achieve success with larger, more predictable buys of satellite buses that can rapidly accommodate insertions of the new payload technologies, and thus unwind the Space Acquisition Vicious Cycle. Smaller satellites can improve the much needed connections between users and the program offices, breaking down "big requirements" (which can often take years in conventional acquisition programs to satisfy) into smaller, more manageable, "little requirements," Thus, the small satellite approach enables acquirers to deliver needed capabilities faster within rapidly changing technology refresh cycles.

The Space Studies Board has noted that small spacecraft offer tremendous opportunities for low-cost missions. The Board also concluded small satellites system acquisitions present favorable economic opportunities if employed as part of a replacement strategy for failed sensors or for sensors with limited design life or reliability.[12] Other secondary benefits could be achieved—the US aerospace industrial base and engineers employed in it could be reenergized by acquisition strategies that require or allow for continuous engineering improvements and tweaks to these space system. As observed by the Board:

> Small satellites offer new opportunities to address the core observational requirements of both operational and research missions. Small satellites, in particular single-sensor plat-

[12] THE ROLE OF SMALL SATELLITES IN NASA, *supra* note 8, at 58.

> forms, provide great architectural and programmatic flexibility. They offer attractive features with respect to design (distribution of functions between sensor and bus); observing strategy (tailored orbits, clusters, constellations); faster "time to science" for new sensors; rapid technology infusion; replenishment of individual failed sensors; and robustness with regard to budget and schedule uncertainties. New approaches to observation and calibration may be possible using spacecraft agility in lieu of sensor mechanisms, for example. Small satellite clusters or constellations can provide new sampling strategies that may more accurately resolve temporal and spatial variability of Earth system processes. (cit.om.) With advances in technology and scientific understanding, new missions can be developed and launched without waiting for accommodation on a multisensor platform that may require a longer development time.[13]

In establishing an optimal mix of satellites, the design trade-offs between flagship class and small satellite systems involve a host of calculations. Presently, small satellites in LEO are the choice for network services. The lower altitudes allow for simple and portable terminals due to smaller attenuation and shorter propagation delays for the small satellite signals. This helps enable services that require large throughputs. Small satellites can also leverage a variety of launch options. On the downside, the lower altitude and associated smaller spot beams demand large constellations to achieve global coverage. Managing and coordinating the satellites with large number of earth stations and managing complex handover schemes between satellites is major drawback for such systems.[14]

Operators of small satellite constellation can cost-effectively satisfy mission needs through: low earth orbit (LEO), multiplane Walker constellation patterns[15]; insertion of multiple sat-

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[13] *Id.* at 41.

[14] Rizwan Mustafa Mir, *Satellite Data Networks* (Aug. 14, 1997), http://www.cse.wustl.edu/~jain/cis788-97/ftp/satellite_data/index.htm#Elbert (*citing* BRUCE R. ELBERT, THE SATELLITE COMMUNICATION APPLICATIONS HANDBOOK (Artech House, Inc., MA., 1997).

[15] Many constellations designs can be used to satisfy the needs of a particular mission. Coverage can be optimized to reduce the number of satellites needed to sustain a continuing view of particular location on the Earth by at least one satellite in the con-

ellites on each launch; selection of mature technology readiness level (TRL) sensor or communication payloads and satellite buses; block acquisition approaches; simplified platforms/buses; and common mission control/ground systems. The increasing ability of information systems to aggregate, analyze, manage, and research data collected from multiple small satellites with different payloads may make possible the best of the low cost factors from this architecture. Technology improvements and miniaturization could be leveraged with cross-linked systems employing new and advanced internet protocols for telemetry, tracking and command (TT&C) and data sharing and flexible downlinks to users. A variety of mission payloads could be fielded on a common bus, using architectures somewhat similar to the overly-ambitious, innovative but failed Teledesic communication satellite system.[16] Despite high hopes, the Teledesic business case did not prove to be a success, but its failure was more an artifact of changed demand for the capabilities the system would have provided, not design.

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stellation and most are designed so the satellites in them have similar orbits, eccentricity and inclination. With similar orbits, on-orbit perturbations generally affect each satellite in approximately the same way helping operators reduce excessive station keeping, reduce propellant consumption, and increase satellite life. Each satellite can be phased and this enables constellation satellite separation to avoid collisions or interference at orbit plane intersections. John G. Walker explored different types of constellation solutions. A class of circular orbit geometries that has become popular is the *Walker Delta Pattern* constellation, and it is used by the nascent Galileo navigation system. Near-polar constellations with an orbital seam between ascending and descending planes are named the *Walker Star Pattern* because all of the orbits cross near the Poles. If viewed from above one of the Poles, the satellite orbital planes intersect to make a star. *See* SERVICE EFFICIENT NETWORK INTERCONNECTION VIA SATELLITE: EU COST ACTION 253, 218 (John Wiley & Sons Ltd., Y. Fun Hu, et al. eds., 2002), http://onlinelibrary.wiley.com/doi/10.1002/0470845929.app1/pdf (*citing* John G. Walker, *Some circular orbit patterns providing continuous whole Earth coverage*, 24 J. BRIT. INTERPLANETARY SOC'Y,369–384 (1971), and John G. Walker, *Satellite constellations*, 37 J. BRIT. INTERPLANETARY SOC'Y, 559–571 (1984).

[16] Teledesic's promoters wanted to provide high data rate (broadband) fixed and mobile services. Its original design called for 840 active satellites (actually 924 satellites, including in-orbit spares) in 21 planes in a sun-synchronous, inclined circular LEO. Teledesic then changed its design from 40 active satellites in 21 planes at 695-705 km altitude, to one consisting of 12 planes of 24 active satellites (288 satellites) at a 1350 km altitude, and attempted a move to laser inter-satellite link technologies. Lloyd Wood, *Big LEO tables* (Aug. 17, 1999), http://personal.ee.surrey.ac.uk/Personal/L.Wood/constellations/tables/tables.html.

A number of national security missions are amenable to LEO small satellite systems — communications, reconnaissance, missile warning and defense, and weather come to mind. Commercial operators, such as OrbComm and Iridium Communications, Inc, have already deployed smaller, short-life, yet capable satellites with streamlined mission control architectures. OrbComm has used small satellites built by German OHB System AG (the bus) and by Orbital Sciences Corporation (the payload). The OrbComm, Iridium, and Galileo constellations employ or will employ well-designed Walker patterns to provide ubiquitous 24/7 coverage of much of the globe.

Other benefits can be secured with small satellite systems. For example, space debris is a growing problem. The issue has generated considerable concerns since the late 1970s and early 1980s. The 2009 Iridium collision with a defunct Soviet Cosmos satellite only highlighted the growing problem. Much of the space-faring community is moving to apply best practices in order to reduce the on-orbit collision risks. LEO missions are deorbited more efficiently. Of course, the life of satellites and associated debris on orbit is mostly a function of its orbit, mass, and density; small satellites at the low end of circular orbits deorbit in relatively short order unless station-keeping activities are continually performed by a satellite operator. In contrast, flagship satellites placed in higher altitudes can remain on orbit for hundreds or thousands of years.

Continued replenishment of small satellite constellations do enable a worthy solution to the Moore's Law conundrum discussed earlier, assuming operators take advantage of the opportunities to replenish the constellations and continually update their systems. Ultimately this could decrease the cost of systems and permit more rapid insertion of new technologies, sensors and processors into mission constellations. In addition, tying these opportunities to sustainment strategies could mitigate the long periods of time required to resolve on-orbit anomalies. Small satellites concepts also provide an opportunity to orchestrate de-orbits of mission sensors and busses so we can assess their performance and defects, and then use them to explore ways to improve satellite manufacturing techniques and also understand how to make systems more reliable.

Hosted payload solutions can fill the seams between flagship and small satellites

Acquirers must continually seize upon the best design approaches. The use of mixed systems of flagship and large numbers of small satellite supports affordability and resilience objectives through an important new de-bundling architecture concept known as *disaggregation*. The Air Force is now moving to take the disaggregation concept one step further. It is exploring possibilities of using hosted payloads to disperse important space-based capabilities among the large number of commercial satellites. A hosted payload is an "instrument or package of equipment that is affixed to a host spacecraft and operates in orbit making use of available capabilities of that spacecraft, including mass, power, and/or communications."[17] A host satellite or spacecraft is a "satellite bus with subsystems capable of maintaining operation of multiple payloads; the entity holding the primary contract with the spacecraft manufacturer is considered to be the host operator."[18]

Commercial buses and rideshares offer significant opportunities to improve mission reliability, reduce cost, and increase responsiveness. There are six major manufacturers of commercial communications satellites operating in GEO: Thales Alenia Space, Boeing Corporation, EADS Astrium, Lockheed Martin Commercial Space Systems, Orbital Sciences Corporation, and Space Systems/Loral. A new block of the LEO-based Iridium NEXT constellation will be coming on line, perhaps in 2015 or shortly thereafter. All of the major commercial GEO fixed satellite operators (Eutelsat, Intelsat, SES, and Telesat) have declared themselves receptive to hosting payloads, as have non-GEO users such as ORBCOMM and Iridium.[19] Companies such as Orbital, ATK, and Boeing are building commercial LEO capable hosted payload satellites, and commercial MEO systems like those planned by Germany's OHB is not far away.

The primary advantage of flying a hosted payload on a commercial host spacecraft as opposed to flying on a govern-

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[17] Futron Corporation, *Hosted Payload Guidebook*, 10 (Aug. 2010).
[18] *Id*.
[19] *Id.* at 6.

ment-host mission is leveraging the faster tempo of commercial programs, and using the speed and access to orbit to achieve lower costs.[20] And while many science missions have been limited to LEO, given the expense of getting to GEO, the use of hosted payloads on commercial satellites provides a terrific low-cost opportunity to assure improved access to higher orbits by the DoD and other agencies.[21]

As noted by Futron in its *Hosted Payloads Guidebook*, other advantages offered by hosted payloads include:

> …a reliable and predictable launch schedule, with a large choice of launch vehicles (commercial operators usually are on the manifest of several launchers, in order to be better prepared for contingencies); the use of existing mission support facilities; and the fact that, once on-orbit, the primary payload operator will take care of all operations and maintenance of the host spacecraft as well as (if requested) data downlink and processing. In addition, since commercial spacecraft are insured, the hosted payloads on those spacecraft can also be insured, helping defray the costs of a replacement mission in the event of a launch failure.[22]

Commercial operators have already shown themselves to be highly reliable and dependable partners in satisfying US satellite communications and remote sensing needs. Their systems are built at a relatively moderate cost, and the industry has often employed the use of plug-and-play buses to achieve this result and flexibility. Plug-and-play interoperability offers big advantages and the industry is fast moving to the standard. While the US Governments has talked about plug-and-play bus approaches for years, the volumes of systems purchased, unique requirements, and inability to turn inside a commercial decision loop has left this a largely unrealized opportunity. Nonetheless, hosted payloads can become an important and viable part of the future space constellations, since it would not be difficult to design military payloads to fly on commercial buses.

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[20] *Id.* at 2.
[21] *Id*.
[22] *Id*.

Among the first major U.S. government payloads hosted on commercial GEO systems were the two non-military L-band Wide Area Augmentation System (WAAS) packages operated by Telesat and Intelsat for the prime contractor, Lockheed Martin, under contract to the Federal Aviation Administration. One WAAS payload is carried on Telesat's Anik F1R, and was built by Astrium and launched in September 2005. Iridium and ORBCOMM, and other operators already have hosted government payloads. In addition, the India National Satellite System (INSAT) has hosted several India Space Research Organisation (ISRO) payloads, all of them either scientific or technology demonstrators in nature.[23] Recently, the Americom Government Services' Commercially Hosted Infrared Payload (CHIRP) attracted considerable attention for its successes. Designed to reduce risks in developing wide field-of-view starring infrared sensors, the CHIRP Wide Field of View staring sensor was developed by SAIC, along with the payload processing capability, while the team was led by SES Americom, with Orbital Sciences Corporation providing the bus, bus integration, and TT&C. The U.S. Air Force–funded Overhead Persistent Infrared (OPIR) payload is now hosted on board a commercial communications satellite, SES-2 (a SES World Skies system) and is approaching its second year of operations.

Similarly, the Australian Defence Force placed a hosted payload on Intelsat 22, with a Boeing-built 702B bus, to provide UHF communications for Australian and American military forces in the Middle East and Afghanistan.[24] That effort went from contract to on-orbit capability in 35 months. This pace approaches what enthusiasts might call the "speed of need." Intelsat General, vice-president of hosted payload programs, Don Brown, proudly bragged the Australian arrangement required "an extraordinary bit of creative contracting" to add the UHF payload, provided by the ADF, onto the satellite, but the country saved over $150 million compared to alternative approaches. According to Brown, an independent analysis of the project con-

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[23] *Id*. at 3.

[24] Jeff Foust, *An opening door for hosted payloads*, THE SPACE REV. (*Oct. 29, 2012), http://www.thespacereview.com/article/2179/1.*

cluded the hosted payload approach "was 50% more effective economically than flying the payload as its own satellite, and 180% more efficient than leasing the capacity—assuming the capacity was available at all to lease."

The opportunity commercially hosted payloads offer to the US and allied governments is awesome. Nearly 200 launches to GEO are planned over the next decade, and many of their space operators welcome hosted payloads. If only half of these 200 satellites are built with buses with enough weight and power capacity to accommodate additional payloads that still leaves 100 platforms available for vital new hosted payloads. Of course, the amounts paid to primary satellite operators vary considerably as every platform comes with unique limitations and demands. Price drivers for program go-aheads include the size and mass of the proposed hosted payload, the need for ancillary services for payload operations, payment structure, lost opportunity costs, impacts on the host business case, launch vehicle choices, insurance, export controls, and the like.

Primary commercial communications satellites payloads typically have a lifetime of 15 years, and often more. Many hosted payloads, in contrast, are likely to have shorter lives, depending on the mission type (tech demo, operational demo, gap-filler, or operational). This mismatch should be less of an issue, or a non-issue, for hosted communications payloads, which can be easily designed and constructed to operate for as long as the primary spacecraft. Even for shorter life systems, the hosted payloads provide the host operator assured bandwidth sales early in the life of the commercial communications satellite, an important economic windfall, giving the host time to find buyers for the bandwidth being used first by the hosted payload, and achieve a win-win for all. In addition, as the spacecraft ages and its power output decreases, the loss of one hosted payload allows the host operator to transfer the power to its other paying customers, maintaining his income stream. On the other hand, long host platform life may present an opportunity for enhanced data continuity that has not typically been made available to past payload missions.

Using standardized commercial buses as dedicated platforms for payloads is another significant option that could be

considered by a manager, as it allows customers to focus on developing their payloads, and significantly reduce the risk of custom satellite bus builds. Of course, employing commercially based architectures will demand more responsive government decision-making, and shorter and more flexible development timelines.

Developing and executing the hosted payload strategy is taking longer than some innovators in industry and government officials would like.[25] The current US national security space architecture rests on large, multi-mission flagship satellites and the culture is having difficulties adjusting to idea that it reduce requirements for smaller mission platforms. In addition, adequate planning by each hosted payload owner and the host must occur. The earlier a hosted payload's requirements are incorporated into the host's planning process the greater the likelihood the two systems can be successfully integrated. Institutionalizing systems engineering needed to support such planning and analysis should produce value and capability over the long run for both. Hosted payloads must coordinate vital engineering issues such as payload location, line of sight/look angle requirement, antennae and electronic interference issues, and orbital locations.

There is a danger a host could integrate too many hosted payloads and thus take on the objectionable attributes of flagship systems with potentially conflicting sensors, electromagnetic interference, and missions. Also, if providing a hosted payload, the government must adhere to the strict constraints imposed by the federal acquisition regulations and other law. Once it has installed a potentially long-lived payload, the government accepts negotiating risks with the host if it does not adequately anticipate the needs for future contract extensions, and realities of sole-source negotiations. Finally, procurement, construction, and launch schedules for commercial satellites are different. Government rules can be onerous and demand long-looks at issues; commercial acquisition may demand quick turn

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[25] Warren Ferster, *NASA Eyes Air Force Contracting Vehicle for Hosted Payloads*, SPACE NEWS (Apr. 22, 2013), http://www.spacenews.com/article/military-space/34982 nasa-eyes-air-force-contracting-vehicle-for-hosted-payloads#.UZ8DEJXn-Hs.

decisions. A government hosted payload and host are alternately more and less flexible and more driven by time constraints than their counterparts, depending on the matter at hand.

USING HOSTED PAYLOADS TO AUGMENT DISAGGREGATED SATELLITE ARCHITECTURES WILL NOT BE EASY

The integration of hosted payloads is no small matter, and the key is to "do no harm". This usually means the hosted payload needs to be independent of the primary payload and not interfere with or impact the primary mission. These issues were solved on the CHIRP program, and always must be considered when integrating a payload on a commercial host.

A perfect engineering solution is useless unless and until it can be implemented. Given the strategic importance of space systems, engineers should not be surprised to find legal and policy concerns intrude on all elements of the space system mission design process. Design and architecture decisions should not be made in an environment devoid of context. The complete span of legal, policy, and diplomacy implications should therefore be fully considered and integrated when planning for and executing space activities. Program managers, engineers and their legal advisors should work together to craft a space system, anticipating law and policy issues in order to avoid potential "show stoppers" – adverse decisions that could be directed by government leaders, customers, suppliers, legislators or courts, and the international community. Managers and engineers need to appreciate the need, the means, and time it takes to comply with applicable laws and deal with competing policy interests.

Another big challenge confronting the government is aligning its acquisition timelines with the commercial hosts. Recognizing this, the Air Force's Space and Missile Systems Center (SMC) Hosted Payload Office has sought commercial sector assistance to develop the appropriate mechanisms for use with the Hosted Payload Solutions (HoPS) indefinite delivery, indefinite

quantity (IDIQ) contract construct.[26] The average time spent on a commercial satellite's procurement, from concept definition to operations, is about 32 months.[27] This process generally involves: 5 months for the requirements definition, RFP generation, proposal evaluation, and contract negotiation; and average 24 months for satellite construction; and 3 months for the launch campaign, orbit-raising, and in-orbit testing together.[28] In contrast, government schedules for the same types of acquisitions can be five years and even longer if the primary mission is complex.[29] Only time will tell whether the Air Force's hopes for speeding its acquisition timelines will be satisfied.

To the extent allowed by law, hosted payload program managers would be wise to approach prospective hosts early before they acquire their satellites. By doing this, an agreement can be finalized setting the payload requirements before the operator concludes its final contract with its satellite manufacturer. That, of course, raises an important fiscal issue — before the government approaches a host it should have the funding to proceed, which means it anticipated the need in a prior fiscal year and budgeted for it — a tall order. If done right, this conversation should enable interface definition requirements to be identified and incorporated into the hosted payload request for proposal (RFP), and help avoid satellite platform incompatibility issues.[30] Alternatively, the host could specify its interface requirements. While accommodations for hosted payloads can often be made in the negotiation phase, once set, the schedule is usually inflexible. "The satellite owner typically is time-constrained and unwilling to let the construction or launch schedule slip due to considerations specific to the hosted payload."[31]

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[26] Anne Wainscott-Sargent, *All Eyes on Hosted Payloads*, SATELLITE TODAY.COM (June 1, 2013), http://www.satellitetoday.com/via/features/All-Eyes-on-Hosted-Payloads_41221.html. HoPS IDIQ contracting will be discussed in the next section.

[27] *Hosted Payload Guidebook*, *supra* note 17, at 5.

[28] *Id*.

[29] *Id*.

[30] *Id*. at 6.

[31] *Id*. at 5.

As noted, the commercial satellite's construction schedule is usually far more aggressive than the government's; the government's hand is usually slowed by numerous rounds of reviews and analysis demanded by federal acquisition regulations (FAR) and US acquisition policies. And those reviews are sometimes delayed or otherwise held hostage by the whims of senior executives and the hierarchy involved in the acquisition, by the attendant decision processes, and by executive-level availability to preside over the reviews. So while the US Government might proclaim it is, in principal, in favor of short commercial schedules, it has had great difficulty in accommodating them. As a result, it can be expected to resort to decision-making along its usual protracted timelines.[32]

LEVERAGING HOSTED PAYLOAD CAPABILITIES WILL BE BUFFETED BY CONTRACTING CHALLENGES

The contracting challenges are all too real and must be comprehensively addressed if the US Government hopes to fully embrace the hosted payload construct. According to Doug Loverro, recently the Executive Director of SMC, and now serving as Deputy Assistant Secretary of Defense for Space Policy, the Air Force planned to build on the success of CHIRP with a follow-on program called CHIRP+, again using hosted payloads to test infrared sensors, but the effort ran into roadblocks in the US Congress, where House appropriators deleted funding for the follow-on hosted payload effort, instead allocating resources for ground segment technologies.[33] Another setback occurred when the DoD failed to secure a deal to host payloads on Iridium's next-generation constellation of LEO communications satellites; some suggest this lost a once-in-a-generation opportunity

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[32] If wanted and needed, speed can be achieved. The early years of the National Reconnaissance Office (NRO) provide a shining example on the establishment of a lean, mean, and effective space acquisition teams. The NRO recognized that streamlined processes and procedures would enable it to speedily and effectively achieve its significant national mission objectives. This produced intense pressure to create tight, cohesive government-contractor management teams. Given the need for speed, specially selected young officers were given authority and power to act to move acquisition activities to success.

[33] Foust, *supra* note 24.

to put payloads on an ideal system that could provide the DoD provide global coverage.[34] Money issues did not scuttle the contract — rather no appropriate contract vehicle was found sufficient to secure agreement. On this lost opportunity, Loverro observed: "We didn't have the right contractual relationships established to make this easy, to make it not a Herculean effort."[35]

This has led the SMC to embrace IDIQ contract vehicles as a first step in moving towards a normal, accessible, and repeatable hosted payload arrangement.[36] SMC's Hosted Payload Office has announced its long-anticipated HoPS IDIQ contracting vehicle. Colonel Scott Beidleman describes the Hosted Payload Office's role as of "matchmaker between government payloads and commercial hosts," with the HoPS vehicle providing a framework for establishing a set of pre-qualified commercial vendors able to bid on government payload opportunities. The Air Force expects the pre-qualification will be completed by the end of the 2013 calendar year followed by the first delivery order contract by March 2014.[37] Actually, it is not just pre-qualification; the Air Force is relying on industry to identify the opportunities that will lead to the HoPS contract vehicle's success. News reports indicate SMC is expected to select up to 14 hosted payload service providers, and 9 of them will involve GEO satellites, with the remaining 5 dedicated to LEO and medium Earth orbit (MEO) satellites.[38] The selected contractors likely will be a mix of satellite operators, manufacturers and related service providers and US-based[39], no doubt for export control and other policy reasons.[40]

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[34] *Id.*

[35] *Id.*

[36] *Id*.

[37] Wainscott-Sargent, *supra* note 26.

[38] Ferster, *supra* note 25 (*citing* David Anhalt, vice president of government solutions, Space Systems/Loral of Palo Alto, Calif., and Hosted Payload Alliance board member).

[39] *Id*.

[40] While nearly all of the world's biggest satellite operators and hosted payload advocates are incorporated and/or headquartered overseas, these companies also have US subsidiaries that routinely do business with the DoD. *Id*.

NASA recognizes the opportunities hosted payloads offer, and is collaborating with the SMC to secure them by leveraging the HoPS contracting vehicle. If mission funding and a commercial host can be found, the agency's $90 million Tropospheric Emissions: Monitoring of Pollution (TEMPO) mission could be among the first to take advantage of the HoPS vehicle. The TEMPO decision go-ahead will be made sometime in 2014.[41] NASA is pursuing other hosted payload opportunities, including demonstrations of a heliophysics deep-space atomic clock experiment (GOLD), a laser communications technology demonstration (LCRD), and the Global-scale Observations of the Limb and Disk mission, which will study Earth's upper atmosphere.[42]

Despite the high hopes for the HoPS IDIQ contracting vehicle, there are still many considerations to be addressed if the US Government hopes to successfully employ hosted payloads. While the HoPS contracting vehicle is hoped to facilitate the use of available space aboard commercial satellites and establish technical standards for payload accommodations, in most circumstances, one can expect each payload and host situation will differ despite best efforts. After all, hosted payload solutions are to be employed to update payload technologies. Contracting matters must be addressed for the overall process to be successful, and a complex variety of technical, resource, schedule, and other risk aspects must be addressed and their solutions integrated into the final system, including: the hosted payload and its mission; prospective satellite platforms; unique attributes of the hosted payload and host spacecraft manufacturers, operators, and sustainers; launch solutions; ground systems; and financing. Multi-party government, satellite operator, satellite manufacturer, hosted payload manufacturer arrangements and their attendant contracts must be developed. Program managers must comply with US law and federal acquisition regulations as they make informed decisions with regard to acquisition competitions, termination liabilities, payment structures, and

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[41] *Id*. (*citing* NASA spokesman Steve Cole).

[42] *Id.* (citing Janet Nickloy, director, aerospace mission solutions, Harris Corp., and David Anhalt). See also Wainscott-Sargent, *supra* note 26.

use of multi-year contracts.[43] Tight commercial satellite contracting schedules must be accommodated. Wise systems engineering practices also dictate the government, where possible, understand its options for acquiring and deploying large number of identical, hosted payloads on multiple satellites, to include contract option exercise dates, cost, schedule, and related factors.

Government programs have unique requirements that must be met for a contract to be formalized. Hosted payload agreements should be structured accordingly.[44] The government might want to seek to contract for access to a hosted payload expected to provide service for at least 15 years, but for the government, negotiating a 15-year contract is pretty much impossible. Instead, it might seek a contract with 15 years of options. This all presents legal and business risks the host operators and government negotiators need to navigate. "Satellite operators that are unfamiliar with doing business with government customers may be surprised at certain conditions necessitated by federal procurement rules" For example, the federal government includes "termination-for-convenience provisions" in its contracts with private companies. And any satellite operator counting on revenue for the life of a satellite could face a "rude surprise" if it receives notice from a government customer that a contract will be terminated.[45]

The US Government will not accept the same kind of liability and indemnification language commonplace in contracts with private sector customers.[46] Although indemnification is a standard commercial term, it is only found by exception in fed-

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[43] 10 U.S.C. §2306b allows the DoD to enter into multi-year contracts and Federal Acquisition Regulation §17.101 provides the DoD with the authority for multi-year contracts for up to 5 years, with a ceiling of $500 million. §17.101 was used as the legal basis for the ClearView/NextView acquisition of imagery. FAR §217.171 authorizes the DoD to enter into multi-year contracts for services, limited to 5 years. *Hosted Payload Guidebook*, *supra* note 17, at 13.

[44] Paul Dykewicz, *Creative Solutions and Cooperative Negotiations Can Bridge Legal Issues-Part I*, HOSTED PAYLOADS BY SPACENEWS (Aug. 24, 2011), http://www.hostedpayload.com/blog/creative-solutions-and-cooperative-negotiations-can-bridge-legal-issues-part-i (*citing* Phillip L. Spector, Intelsat executive vice president, business development, and general counsel).

[45] *Id*.

[46] *Id*.

eral government contracts, as it cannot indemnify a contractor without express statutory authority. Many times, managers and their contracting officers will not object to accepting contingent liabilities and indemnities which do not impact their current funding. In contrast, government contractors are generally not willing to accept the same risks from the government which they would readily accept from a commercial customer. Similarly, the contractor often moves to negotiate shifting more risk to the government than they would a commercial customer. The government generally does not agree to contracts with liquidated damages provisions or indemnifications. If a host contractor screws up and causes harm to the government, the government may often act more generously than commercial customers would and, as appropriate, may waive the contractor's liability to the government

As noted, US Government is subject to restrictions or specific requirements with regard to multi-year contracts, assignments, progress or "milestone" payments, contract termination and dispute resolution.[47] While the government's ability to make long term commitments is limited, but once it can and does make such a commitment the contractor is usually assured of it will abide by the commitment. As to assignments, transfers of the ownership of a host satellite can be made more complicated since the transfer of contractual obligations with the government usually requires government approval and retention of contingent liabilities. Payment arrangements are generally flexible, but are negotiated and must be specified. Government contracts can be terminated for the convenience of the government, and the equitable adjustment concept can be applied to contract changes. Government contracting offers special alternative dispute forums to resolve disputes. The Armed Services Board of Contract Appeals (ASBCA) is routinely used.[48]Going to

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[47] Mark Andraschko, et al., *The Potential for Hosted Payloads at NASA* (NASA Langley Research Center: Hampton, VA, 2012), http://ntrs.nasa.gov/archive/nasa/casi.ntrs.nasa.gov/20120003420_2012003757.pdf.

[48] According to the ASBCA, it is a neutral, independent forum which has a primary function to hear and decide post-award contract disputes between government contractors and the DoD and other entities with whom the ASBCA has entered into agreements to provide services. The majority of matters on its "docket involve appeals

court is still the natural progress of things for any dispute involving the government.

Host satellite operators have said they will accept termination-for-convenience language, but only if it is accompanied by a "large, pre-negotiated" termination fee that would protect the operator's expected revenue stream for a specific number of years.[49] They claim such conditions are typically included in contracts when a government customer buys satellite service on a short-term basis on existing satellites.[50] These conditions would conflict with general termination for convenience provisions for which a central tenet is the contractor will not be paid for work which is not performed. At this point, the government is not offering multi-year contracts with termination liabilities built-in, and commercial contractors are still engaging the government about hosted payload contracts.

Hosted payload contracts presently have two primary components. The first deals with integration of the hosted payload onboard the host and its launch to orbit. From the government's perspective, it is to be structured simply as a fee for work to be completed and does not address any issues related to host satellite revenue streams. The second component addresses the use of the hosted payload and associated ground support for a certain number of years. If the government is able to secure Congressional approval for a multi-year contract, it could then offer the host a commitment commensurate with an extended payload life revenue stream. Absent a multi-year contract, the government program office would have to request authority to deviate from requirements that it include a provision in the contract granting it termination for convenience rights, obtain budget approval, and secure appropriations to cover such a termination fee provision.

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by contractors from government contracting officers' final decisions or failures to issue decisions." *See* www.asbca.mil (last visited Sept. 5, 2013).

[49] Dykewicz, *Creative Solutions and Cooperative Negotiations Can Bridge Legal Issues-Part I*, *supra* note 44 (*citing* Phillip L. Spector).

[50] *Id*. According to Spector: "This requirement is especially important when an operator is building a non-commercial payload for a military customer, i.e., a payload that cannot easily be resold in the commercial marketplace."

In the end, the government must make well-thought-out decisions as to how it hopes to acquire desired mission capabilities with hosted payloads. The government could contract to obtain additional payload capabilities, and access data from the payload, from the host satellite operator/manufacturer, and define and set the requirements for the contractor to achieve. Alternatively, the owner/operator of the host could procure a payload from third parties based on government specifications. Or, as a third alternative, the government could separately procure the payload hardware to be integrated onto the host. Responsibilities and risks must be allocated among the hosted payload, the manufacturer of the hosted payload, the owner/operator of the host commercial satellite, the manufacturer of the satellite, and the launch services provider.

The government and host satellite owner/operators must also study the payload's mission fit and ascertain whether it will be adversely affected by criteria such as schedule and technical difficulties. If the government provides the payload hardware, or plays a significant role in the design and development of the overall system, strict compliance with delivery schedules will be required. If the government is late, commercial hosts may want to negotiate contract provisions that provide reimbursement for lost opportunities, and other expenses. If the commercial host is late, or the host satellite fails on-orbit before the hosted payload's mission can be completed, the contract could call for the satellite operator to be penalized if the government does not reasonably get its expected services. Financial aspects of hosting and annual operation fees may need to be differentiated to more accurately ascribe these damages.

CONTRACTING MUST ANTICIPATE SYSTEMS ENGINEERING AND OPERATIONAL PRIORITIES

When contracting to acquire, integrate, and operate hosted payloads, managers must anticipate many potential difficulties, including: prelaunch delayed deliveries of the hosted payload and the host satellite; launch delays and failures; on-orbit failures, partial losses or technical problems of the hosted payload and host; reduced on-orbit life; and station-keeping challenges.

When the US Government provides the hosted payload, it must account for important systems engineering tasks performed by the respective payload and host entities to ensure the payload is properly integrated. The government and commercial host must also identify and track technical changes to the payload that could adversely impact the host and its ability to perform its primary mission as well as any other hosted payloads. Typically, the US Government will demand a host provide a contractual commitment to avoid interfering with the hosted payload, whether by any host satellite operation or other hosted payload.

After launch, the US Government or its contracted operator, usually must turn on, check out and calibrate the hosted payload, perform required acceptance testing, and start its normal operations. Then, it must monitor the payload's operations to ensure it is performing its mission and, importantly, also ensure it is not interfering with host spacecraft and other payloads. The government must also ensure its contracting processes address issues such as operational communications and coordination between the host satellite's operations site and the hosted payload operations site, and delivery of data once the hosted payload begins operations.[51]

Given the government's unwillingness to indemnify a host satellite operator from potential claims for the operations of its hosted payload, the host could seek to limit its liability by "handing off" operating control of the hosted payload to a government customer.[52] In this way, it is argued the government user not only takes control, but also the responsibility for the health and safety of the hosted payload asset. In many cases, the government will demand this control. The operator could also negotiate for the government to agree to share part of the cost to insure a satellite.[53] In general, the insurance costs would be allocated to overhead accounts and mostly certainly charged in rates for all of the host's customers.

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[51] *Hosted Payload Guidebook*, *supra* note 17, at 14.

[52] Paul Dykewicz, *Creative Solutions and Cooperative Negotiations Can Bridge Legal Issues-Part II*, HOSTED PAYLOADS BY SPACENEWS (Aug. 26, 2011), http://www.hostedpayload.com/blog/creative-solutions-and-cooperative-negotiations-can-bridge-legal-issues-part-ii (*citing* Phillip L. Spector).

[53] *Id*.

The host satellite operator purchase of a policy to protect itself against a potential loss is "vital" in the event of a launch failure or another catastrophic anomaly before the payload is handed over to the government customer. The contractor host would be expected to negotiate with its government customer to share some portion of launch costs, and even attempt, as an element of its negotiating strategy, to charge the government for the cost of the entire launch.[54] Nevertheless, some cost sharing would be appropriate if it helps compensate the host for its need to use a larger launch vehicle to accommodate the government payload or to cover the loss of revenues that otherwise might be generated if commercial transponders on the commercial satellite system had been included instead of the hosted payload.[55]

Government technical advisors can use the hosted payload/host contract to ensure the satellite owner/operator provides the necessary interface specifications for integrating the hosted payload and address the requisite elements of a hosted payload qualification document to certify the payload and support systems have complied with the interface specification. Coordination of issues such as schedule and launch readiness, test plans for flight-qualified hardware, and updates on issues that could impact the mission, should be addressed as well.[56]

Commercial hosted payload priorities should be expected to be nearly always secondary to the host's primary payload. Their operations will be suspended in favor of the primary in event satellite resources are limited or lost, or if the hosted payload's operations threaten the host or disrupt its primary payload. Why is this? The fees generated from hosting are usually much less than those generated by the host's primary mission. Understandably, secondary payloads on government host spacecraft are treated in much the same fashion, though the government is not expected to relax its usual requirements.[57] The Government should be expected to insist the host contractor follow US Government space debris mitigation guidelines, though ad-

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[54] *Id*.
[55] *Id*.
[56] *Id*.
[57] *Hosted Payload Guidebook*, *supra* note 17, 15.

ditional launch, on-orbit, and end-of-life directions are imposed via licensing actions taken by the Federal Aviation Administration Office of Commercial Space Transportation (FAA/AST) and Federal Communications Commission (FCC). Of course, negotiations can reallocate the priorities resident in nominal and in unusual circumstances, and provide exceptions in certain circumstances. They can establish the protocols and procedures for taking actions to suspend or limit the hosted payload's operations. The government and the host can also negotiate terms for compensation or allowances, if any, for such limitations, or for circumstances where the host satellite fails.

EXPORT CONTROLS AND NATIONAL POLICIES CANNOT BE IGNORED

Contracting, systems engineering, and operational issues aren't the only problems that arise with a greater use of hosted payloads. Integrating hosted payloads on the wide variety of platforms owned, launched, and operated by entities found in the international space-faring community is complicated by export controls. US law and policy dictate transfers of articles, technologies, designs and other information that relate to space systems be limited or controlled. These controls seek to stop and slow the proliferation of missile technologies and the technologies that can be used to deliver weapons of mass destruction. The attendant US Government licensing processes make payload integration more complicated, and in some cases much more costly. Indeed, export control issues associated with licensing the launch of the CHIRP payload were not insignificant, as the SES-2 satellite host was launched on an Ariane 5. SES management argues there would have been a "significant additional charge" if they had chosen to launch the satellite on a Russian Proton.[58]

Export control considerations should play a role in any program seeking to place a hosted payload aboard a non-US host satellite. Nearly all commercial satellites use non-US launchers

[58] *An opening door for hosted payloads*, *supra* note 24 (citing *Tim Deaver, SES Government Solutions at AIAA Space 2012 panel, Pasadena, California).*

or satellite integrators. Some hosts plan to integrate non-US components in the bus or in the primary satellite payload, or plan to integrate other non-US hosted payloads. Flying a hosted payload on a commercial satellite demands managers and attorneys navigate through the attendant policy approvals and obtain appropriate licenses from the US Government. Of course, balancing national security and economic interests during the Cold War was arguably less complicated. The major competitors then were the US and the old Soviet Union, and commercial interests played only a minor role. With the disintegration of the Soviet Empire, globalization and large new commercial space markets emerged. In this new environment, striking a balance between national security and economic interests has proved exceedingly difficult for US policy makers, industry, and academia.

The Arms Export Control Act (AECA)[59] governs the sale and export of defense articles and services and related technical data.[60] Designated space-related articles and services are subject to the AECA. The AECA requires exports of space articles, services and related technical data meet US national security interests. The US Munitions List (USML), which is contained within the International Traffic in Arms Regulations (ITAR), specifically designates articles such as rockets, spacecraft, space electronics, and guidance equipment. Defense services are also included, defined as furnishing help "in the design, engineering, development, production, processing, manufacturing, use, operations, overhaul, repair, maintenance, modification or reconstruction of articles." An export does not have to cross a border; thus, an export occurs when an individual discloses technical data concerning a spacecraft or rocket to non-US entities or citizens, even if the disclosure occurs within the US. The articles and services may be determined to be so important by the US Government that they are deemed to be non-releasable even to

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[59] *See* Arms Export Control Act of 1976, 22 U.S.C. §2751-2799. 22 USC § 2778 provides the authority to control the export of defense articles and services.

[60] US export control policies predate the Cold War. The US Department of State began to regulate munitions trade in 1935, seeking to ensure strategic exports support both national security and foreign policy prerogatives.

allies, close partners, and sometimes one or more members of a coalition.[61]

Nearly all members of the space community, foreign and domestic, consider the US export control rules to be burdensome and onerous. International partners are also wary. The rules undermine potential international partnerships. In attempting to bolster national security by more strictly controlling the transfer of space technologies, the US may have actually harmed its own national interests. There is a substantial paperwork component associated with complying with export controls. These rules are said to have driven small suppliers out of the US export marketplace as they usually lack the economies of scale to respond properly to export requirements. Some argue the limits also contributed to a substantial decline of US commercial satellite market share and fostered the development of significant space capabilities of competitors abroad. The potential for US criminal liability arising out of violations of the regulation is generally agreed to have cost the US space industry billions of dollars in sales in the international marketplace. The US communications satellite industry has lost market share to international competitors who claim their systems, products and services are "ITAR-free".

Recent legislation has encouraged the US Executive branch to review and revamp the regulations, and seek further relief where appropriate from the Congress. The Administration has responded and is making moves consistent with the direction.[62]

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[61] Of course, other nations also secure their technologies for diplomatic, military and economic reasons. So program managers must be prepared to develop the means to integrate their payload on the host compliant with comparable controls imposed by non-US states.

[62] The relevant changes to export controls occurred as a result of changes in a number of National Defense Authorization Acts ("NDAAs"). With the Cold War over, responsibility for the export of some "dual-use" US commercial communication satellites was transferred from the State Department to Commerce in 1992. From 1996 to 1999, communications satellites were placed on the Commerce Control List (CCL) found in the Export Administration Regulations (EAR), which were issued pursuant to the Export Administration Act (EAA). Commerce generally approved proposed exports of commercial satellites, components, and related services and applied a presumption of releasability consistent with its charter to promote U.S. economic interests at home and abroad. This changed after the Chinese scandals of the 1990s. §1513 of the 1999 Strom Thurmond NDAA directed all satellites and related items be subject to the ITAR, and

On May 24, 2013, as part of the Obama Administration's ongoing export control reform effort, the Department of State proposed to amend the ITAR and revise the USML Category XV (Spacecraft Systems and Related Articles). The changes are intended to reduce unnecessary, outdated, or disproportionate regulations, revise their scope, and clarify them in order to reduce confusion and any uncertainty about their interpretation. Under the proposed rules, only articles designated by the DoD to have an "inherently military" purpose or those that provide unique intelligence or military value and are only sourced from within the United States will remain subject to USML controls. The proposed rules also revise the definition of "defense service" under the ITAR which now specifically includes the furnishing of assistance for certain spacecraft related activities.[63] Further, under the changes, many satellite and other space related articles would be moved from the USML to a new Export Control Classification Number (ECCN) enforced under the Department of Commerce's Bureau of Industry and Security (BIS) Commerce Control List (CCL). These items still will be subject to national security, regional stability, and anti-terrorism controls, and some will also be subject to missile technology controls.[64]

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removed the President's authority to change their jurisdictional status (as to whether regulated by the Department of State or Commerce). *See* Strom Thurmond National Defense Authorization Act for FY 1999. Pub. L. No. 105-261. As noted, problems in export control enforcement emerged, and so §1248 of the 2010 NDAA (Public Law 111-84) required the Secretaries of State and Defense to assess the risks associated with reconsidering the statutorily-imposed policy. Their review identified certain satellites and related items that do not contain technologies unique to the United States, are not critical to national security, and are more appropriately controlled by the Commerce's Export Administration Regulations (EAR), which allow for creation of license exceptions for exports to certain destinations and complete controls for exports to others. The proposed rule changes reflect the recommendations of the resultant report. §1261 of the 2013 NDAA (Public Law 112-239) removed requirements imposed by the 1999 NDAA, and §38(f) of the AECA returned to the President the authority which regulations govern the export of satellites and related articles and to "determine what items, if any, no longer warrant export controls."

[63] The revisions contained in the proposed rule implement part of State's plan highlighted under Executive Order 13563, completed on August 17, 2011.

[64] The proposed changes revise the definition of "space qualified" articles to reflect the amended definition agreed to in the 2012 Wassenaar Arrangement on Export Controls for Conventional Arms and Dual-Use Goods and Technologies, www.wassenaar.org (hereinafter Wassenaar Arrangement). The proposed rules holds that "space qualified"

As proposed, hosted payloads owned by, or built for, the U.S. Defense Department and launched on commercial satellites remain on the ITAR's Munitions List, specifically "Department of Defense-funded secondary or hosted payload, and specially designed parts and components therefore."[65] This proposal has caused some confusion. Some in industry contend that the revised rule, rather than achieving cost-saving ways, will complicate industry efforts. "Categorizing by funding source, instead of the actual technology, is not smart, and probably not what the drafters intended."[66] Satellite Industry Association (SIA) President Patricia Cooper has commented that the new language "is unusual in the export control environment."[67]

John A. Ordway, an attorney specializing in satellite export control issues, has observed that "the hosted payload language leaves too much room for confusion. For example, he said, at what point is a given payload considered 'funded' by the Department of Defense? A payload financed by the private sector following an agreement that the U.S. military will lease it may be covered, or may not."[68]

At the time of writing this article, the industry is asking the State Department to provide additional clarification on the new rules the relate to hosted payloads. In its comments, citing the topic, the SIA urged that the revised export control system not establish a "double licensing" requirement, where both a Commerce Department and a State Department license would be required for export. SIA argued that "double licensing" requirements "run contrary to the goal of streamlining and simplifying the existing system."[69]

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articles are those that are "designed, manufactured, or qualified through successful testing, for operation at altitudes greater than 100 km above the surface of the earth." *Id.*

[65] Peter B. Selding, *Proposed ITAR Changes a Mixed Bag for U.S. Satellite Industry*, SPACENEWS (June 14, 2013), http://www.spacenews.com/article/satellite-telecom/35794proposed-itar-changes-a-mixed-bag-for-us-satellite-industry#.Ub7-aZXn_De.

[66] *Id*.

[67] *Id*.

[68] *Id*.

[69] Marc Boucher, *SIA Submits Comments on ITAR Draft Rules*, NASA WATCH (July 12, 2013), http://nasawatch.com/archives/2013/07/sia-submits-com.html

Other US laws, regulations, and policies apply to exports of space data, hardware, and services.[70] These may limit or slow attempts to employ hosted payloads. Given the challenges, and the reality that no construction, launch or operation will occur until the ITAR issues are resolved, the government entity procuring the hosted payload's launch and on-orbit operation will be well served by getting involved in facilitating the export control paperwork processing to help ensure appropriate licenses are issued. The constraints of export controls are not insurmountable, but planning to work within them and obtain government license approvals should be started early in the acquisition process. Obtaining approvals through the bureaucracy can be lengthy, so the involved parties need to build time into the contract and manufacturing schedule. Early outreach to US State Department's Directorate of Defense Trade Controls and to non-US agencies regulating the activities of the host satellite operator owner/operator and the launch operators can be helpful in ensuring US government hosted payload interests are secured.[71] The hosted payload program managers can help ensure relevant people in the regulatory agencies understand the

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[70] For example, US policies relating to release of classified information are driven by important guiding principles. *See generally*, National Security Decision Memorandum (NSDM) 119, *Disclosure of Classified United States Military Information to Foreign Governments and International Organizations* (July 20, 1971), *available at* https://www.hsdl.org/?view&did=463374, and Exec. Order No, 12958, Classified National Security Information (1995), *as amended by* Exec. Order No. 13292, Further Amendment to EO 12958, as Amended, Classified National Security Information (2003), and by other executive orders.

See also, the Export Administration Act of 1979, Pub. L. No. 96-72, 93 Stat. 503. The Export Administration Act of 1979 (EAA) governs the export of most dual-use unclassified articles and services (having both civilian and military uses) not covered by the AECA. The EAA controls exports on the basis of their impact on national security, foreign policy, or supply availability. With the expiration of EAA in 1994, the President declared a national emergency and exercised authority under the International Emergency Economic Powers Act, Pub. L. No. 95-223, 50 U.S.C. 1701 et seq., to continue the EAA export control regulations then in effect by issuing Executive Order 12924 on August 19, 1994.

[71] Paul Dykewicz, *Clearing Export Control Hurdles for Hosted Payload Operators*, HOSTED PAYLOAD BY SPACENEWS (Jan. 5, 2012), http://www.hostedpayload.com/blog/clearing-export-control-hurdles-for-hosted-payload-operators (*citing* international law practitioner, Nancy Fischer).

hosted payload mission, its equipment, and their potential sensitivities.[72]

Some suggest US national space policies can also constrain attempts to employ hosted payloads, though that has not happened. For example, the 2010 US National Space Policy provides in pertinent part:

> Government payloads shall be launched on vehicles manufactured in the United States unless exempted by the National Security Advisor and the Assistant to the President for Science and Technology and Director of the Office of Science and Technology Policy, consistent with established interagency standards and coordination guidelines. Where applicable to their responsibilities departments and agencies shall:
>
> ––Work jointly to acquire space launch services and hosted payload arrangements that are reliable, responsive to United States Government needs, and cost-effective[73]

Some hosted payload advocates have expressed worries about this specific policy language, suggesting an ambiguity in the term "Government payload" could result in enforcement of a rule that would be an obstacle to the greater use of hosted payloads. Given the small market share US vehicles have in the commercial space launch market, most commercial satellites are launched by non-US systems, like the Ariane, Proton, and Zenit.[74] As observed by Dr. Jeff Foust, if strictly interpreted, the "Government payloads shall be launched" provision would seem to either require government agencies to get administration approval for hosted payloads on international launch systems, or somehow sharply limit the number of opportunities for flying hosted payloads.[75] It all depends on how "payload" is defined. For satellite manufacturers and satellite operators, payload re-

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[72] *Id*.

[73] OFFICE OF THE PRESIDENT, NATIONAL SPACE POLICY OF THE UNITED STATES OF AMERICA 5 (June 28, 2010), http://www.whitehouse.gov/sites/default/files/national_space_policy_6-28-10.pdf.

[74] Jeff Foust, *When is a Hosted Payload Not a Payload?*, HOSTED PAYLOADS BY SPACENEWS (Nov. 3, 2011), http://www.hostedpayload.com/blog/when-is-a-hosted-payload-not-a-payload.

[75] *Id*.

fers to, in essence, the heart of the satellite: its transponders, sensors, cameras, or other instruments that are the reason for flying the spacecraft. But for launch providers, payload typically means something else: the satellite or satellites the rocket is carrying to orbit.[76]

Foust suggests the definitional distinction makes sense:

> …in both cases the term "payload" refers to the purpose for building the satellite or performing the launch—but the cause for confusion becomes clear. So what is the intent of the language of the policy? You can make a case that when the policy refers to "payload," it's referring to satellites, and not to payloads carried on satellites. The policy is a space transportation one, so the terminology is launch-centric. Other passages in the policy refer to, for example, "intermediate and larger payloads" that clearly mean satellites, not their contents. Also, when this policy was drafted in 2004, hosted payloads were not widely discussed, particularly using that specific term.[77]

If one wants to apply and enforce the more limiting interpretation, Foust has written that a conservative way ahead could be adopted by program managers:

> Given the limited domestic commercial launch opportunities for hosted payloads at least in the near future, one possibility is to encourage that such hosted payloads be launched domestically, but not require the same approvals for non-U.S. launches as would be needed for full-fledged government satellites. This will give government agencies and satellite operators and manufacturers the flexibility to optimize the use of hosted payloads on commercial spacecraft, while keeping in mind the need to help restore a robust commercial launch industry in this country—objectives that need not be at odds with each other.[78]

Thus far, the "launched on vehicles manufactured in the United States" proviso has not been interpreted by the US Government to limit integration of hosted payloads onto commercial

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[76] *Id*.
[77] *Id*.
[78] *Id*.

satellites launched by non-US entities. Thus, this may be more a tempest-in-a-teapot, meaning it is a situation that has been exaggerated out of proportion, and no dramatic revision of the policy is required.

LAW OF ARMED CONFLICT AND RELATED CONSIDERATIONS

Cynics might contend space warfare possibilities pose significant challenges to hosted payload arrangements, especially for those host satellites owned and operated by non-US entities. They could argue spacecraft operators need to consider the risks and consequences of flying payloads that support US military activities. That there is a danger in the event of military conflict, their satellites, ground nodes, and communications links could be targeted by third parties who are belligerents to the US government, who would argue that their attacks should be characterized as lawful.

In practice, these concerns have turned out to be overblown. Commercial providers have demonstrated a willingness to work with the US Government because their business and integration plan matches its customer's needs. Indeed, commercial satellites already provide significant and vital communications bandwidth and remote sensing capabilities for far-flung US forces.

The conduct of US military space activities is an accepted practice and fully consistent with international law, including the United Nations (UN) Charter, the Outer Space Treaty, other agreements, and customary international law. But the imperative to comply with international law, by itself, will not always dissuade adversaries from seeking to engage in space warfare or prepare for such conflict.[79] Fortunately, the steady expansion

[79] There are caveats to this point. The Limited Test Ban Treaty restricts nuclear explosions in space. *See* Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space, and Under Water, Aug. 5, 1963, 14 U.S.T. 1313, T.I.A.S. No. 5433, 480 U.N.T.S. 43 (effective Oct. 10, 1963). Article IV of the Outer Space Treaty restricts military activity and prohibits placing "nuclear weapons or any other kinds of weapons of mass destruction" into orbit or permanently affixing them to a celestial body. *See* Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, art. IV, *opened for signature* Jan. 27, 1967, 18 U.S.T. 2410, 610 U.N.T.S. 205 [hereinafter Outer Space Treaty].

and exploitation of military, civil, and commercial space capabilities by the international community has fostered a greater understanding of their strategic and geopolitical implications. As a result, global policymakers have counseled the exercise of great restraint with regard to decisions to attack space-based systems. Nearly all states appreciate the perennial consequences of space conflict — the debilitating problems and physics of space debris; the indiscriminate, disabling consequences of employing nuclear weapons in space; the loss of space-enabled technologies important to modern societies; and the loss of stability in the space domain which is increasingly globalized in an interdependent world. "[M]ilitarily increased space debris would in turn endanger satellites belonging to neutral States."[80]

Given the all too real dangers of producing space debris, an adversary kinetically engaging one satellite would threaten the space activities and interests of all other nations, and potentially complicate its own security interests as a result. "Deterrence can be greatly reinforced if an adversary has to contend not only with a U.S. response, but with an international response also."[81] International cooperation can complicate adversary plans and intentions. It creates more stakeholders in the orderly use of the space environment. Given this, national security and defense strategies emphasizing international space cooperation are not devised in a vacuum. Increased international cooperation bolsters peace and security. The US National Space Policy anticipates these approaches and positively engages the global space-faring community when it vows the US will assure and defend the use of space by responsible parties:

> The United States will employ a variety of measures to help assure the use of space for all responsible parties, and, consistent with the inherent right of self-defense, deter others from interference and attack, defend our space systems and con-

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[80] Michel Bourbonniere & Louis Haeck, *Jus in Bello Spatialis*, SPACE STUD. INST. 141-151, 147 (1999).

[81] John B. Sheldon, *Space Power and Deterrence: Are We Serious?*, MARSHALL INST. POL'Y OUTLOOK 1–5, 3 (Nov. 2008).

> tribute to the defense of allied space systems, and, if deterrence fails, defeat efforts to attack them.[82]

There are limitations to an adversary's right to use force. Before using force, it must analyze targeting decisions within the context of Law of Armed Conflict (LOAC) humanitarian law considerations.[83] The LOAC is a collection of international law that sets boundaries on the use of force during armed conflicts through application of fundamental principles or rules of necessity, distinction, and proportionality. US military capabilities and operations are designed to precisely comply with LOAC.[84] Its principles and rules are derived from a combination of treaty, customary international and municipal (domestic) law. The LOAC sets limits on when and what degree of force may be used; targeting; and treatment of noncombatants. LOAC targeting rules are very relevant to concepts of space warfare. LOAC principles must be considered before using force against space-based systems, or against their terrestrially-based space system support, command & control, and user components.

The LOAC principle of proportionality prohibits the use of force exceeding that needed to accomplish a military objective. Professor David Koplow argues it is unlawful to "undertake an attack that would inflict excessive damage on non-combatants,

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[82] *National Space Policy*, *supra* note 73, at 3.

[83] For a good discussion of LOAC as it applies to space warfare activities, see generally P.J. Blount, *Limits on Space Weapons: Incorporating the Law of War into the Corpus Juris Spatialis*, *in* PROC. OF THE INT'L INST. OF SPACE L. 1, 4.

[84] DoD policy is to comply with the LOAC "in the conduct of military operations and related activities in armed conflict, however such conflicts are characterized." U.S. DEPT. OF DEFENSE, DOD LAW OF WAR PROGRAM, Dir. 5100.77, para. 5.3.1 (1998). Chairman, Joint Chief of Staff Instruction (CJCSI) provides the U.S. "will apply law of war principles during all operations that are categorized as Military Operations Other Than War." Chairman of the Joint Chiefs of Staff Instruction, *Implementation of the "DoD Law of War Program"*, CJCSI 5810.01, para. 5.a, (1999). Under the US military's Standing Rules of Engagement (SROE), "US forces will comply with the Law of War during military operations involving armed conflict, no matter how the conflict may be characterized under international law." Standing Rules of Engagement for US Forces, *Purpose and Scope*, CJCSI 3121.01B, §1(d) (2005).

when compared to the direct, concrete military advantage to be gained from the action…"[85] Koplow also contends:

> When a military force anticipates (as it virtually always must) that a proposed attack would generate both positive, direct military value (in damaging or destroying enemy military assets or personnel) and undesired harm on civilians (and on neutrals and other non-belligerents) or their effects, then the attacker must pause to assess the comparative value of those two factors. Admittedly, this calculation is inherently opaque and inexact, as it requires weighing starkly incommensurable variables, but (proportionality) requires the attacker to consider whether, with all things considered, the strike is "worth it." (cit.om.)
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> Long-term, as well as immediate, effects must be considered, and the attacker is obligated to attempt to gather the data necessary for making an informed, mature judgment, including assessing the possible harms inflicted on nationals of neutral countries, and even on the natural environment. (cit.om.) If the anticipated collateral damage is excessive—if the reasonably expected hardship to protected sites is greater than the benefits that the operation can accomplish—then the attack must be modified or aborted. (cit.om.)[86]

With the proportionality principle, the attacker must balance incidental loss against military advantage. This requires a balancing test between the substantial, actual, and direct military advantage anticipated by attacking a legitimate military target and the expected incidental and unfortunate civilian injury or damage. Under this test, excessive incidental losses are prohibited. The principle encourages combat forces to minimize collateral damage. This principle is also reflected in Additional Protocol 1, which prohibits "an attack which may be expected to cause incidental loss of civilian life, injury to civilians, damage to civilian objects, or a combination thereof, which would be ex-

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[85] David A. Koplow, *ASAT-Isfaction: Customary International Law and the Regulation of Anti-Satellite Weapons*, 30 MICH. J. INT'L LAW 1187-1272, 1243 (2008-2009).

[86] *Id.* at 1246.

cessive in relation to the concrete and direct military advantage anticipated."[87]

An action causing excessive or catastrophic damage to civilians or to property should be proscribed. The principle of proportionality offers some guidance with regard to using force against space systems: since collateral damage to civilians is considered a natural consequence of combat, the proportionality test should be applied to determine if an attack on a dual-use object warrants the consequences to the innocent. Similarly, Bourbonniere and Hoeck argue:

> The resulting debris from the use of force in space must be factored in the proportionality calculus of military operations. In this case space benefits from an indirect protection regime. Space is protected not in itself but as an application of other rights of international law.[88]

In applying the proportionality test to certain satellite missions, one could conclude then that some hosted payloads performing should not be lawfully attacked; this includes interfering with space-borne payloads providing national technical means (NTM)[89], missile warning, emergency communications and even perhaps precision navigation and timing capabilities. As such, commercial operators could conclude that including certain vital national payloads on-board as hosted payloads would not pose additional risks in a conflict because the US adversary targeting calculus might conclude that attacks on its satellite are unlawful because of proportionality considerations.

Space-borne NTMs serve an important role. They assure adversaries that they have complied with arms control treaty terms; provide transparency, enhancing confidence in actions of

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[87] Geneva Convention, *Additional Protocol I,* at art. 51(5)(b). Protocol I is a 1977 amendment to the Geneva Conventions clarifying and affording protection to potential victims of armed conflict. It was signed by not ratified by the United States Senate. A number of its articles are recognized as customary international law. Under Article 51, indiscriminate total war is unlawful.

[88] *Jus in Bello Spatialis*, *supra* note 80.

[89] "National technical means" is a phrase that appeared in the context of verifying the provisions of the 1972 Strategic Arms Limitation Treaty (SALT I) and Anti-Ballistic Missile Treaty. The term includes a variety of monitoring technologies, including imagery, remote sensing, radars, and more.

others, and diffusing tensions; and help stem the potential of a nuclear holocaust, which would produce a catastrophe whose damaging effects would be global in nature. Preserving access to hosted payloads performing such missions would appear to be protected by the proportionality principle; hence, this would proscribe any attacks on such systems to destroy, disable, or otherwise interfere with them. Proscribing such attacks would satisfy the higher needs and general interest of the whole international community.

Perhaps similar arguments could be made with regard to missile warning and emergency communication capabilities performed by hosted payloads. These systems would help the US understand, manage and limit the extent of damage associated with exchanges of weapons of mass destruction, all to the benefit of the global civilian community. Arguments that such considerations proscribe attacks on space-based precision navigation and timing capabilities could also be made. Proponents for this position would be bolstered by demonstrating the dimensions of the effects and global chaos that could occur in the commercial and civil communities as a result of the destruction of these capabilities. While these arguments are less compelling from ones tied to preventing conflict with weapons of mass destruction, they could be made just the same and, perhaps, accepted.

CONCLUDING THOUGHTS

In selecting space system architectures, programs managers must work the trade space, balancing capabilities offered by exquisite single-point-failure flagship class spacecraft with those presented by more numerous and redundant small satellite systems, and ultimately hosted payloads. Moving to fly significant government-sponsored hosted payloads onboard commercial satellites, in place of building flagship, government-only systems, has gained significant traction in recent years as the demand for space-based information has increased, along with the costs of supplying the demand. Hosted payloads hold great potential to augment the resilience of US national security space systems architectures and achieve cost savings by getting

mission payloads on orbit faster and by sharing launch and platform costs. They also offer faster ways to insert innovations to space technology, and testing them before incorporating them in more complex satellites.

Integrating these capabilities with existing commercial systems will present significant challenges and involve accepting new programmatic risks. Despite the advantages, placing national security and intelligence payloads aboard commercial satellites raises unique contracting, policy, and LOAC issues. Those who benefit from current acquisition paradigm systems can be expected to resist these changes, but new systems must be responsive to economic and resilience needs. In the end, hosted payloads will give the US Government new operational and architectural flexibility. They can enable the space community to affordably satisfy mixed architecture requirements over specific geographic areas, especially with regard to communications capacities. And they offer flexibility to pursue new means to obtain capabilities in a way that is presently difficult to do inside the Department of Defense.

THE BIOCHEMICAL FOUNDATIONS OF EVOLVING METALAW: MOVING AT A GLANCE TO THE BIOLOGICAL BASIS OF SENTIENT "ESSENCE"

George S. Robinson[*]

The philosophic construct and motivation for all domestic and international space law derives from contemporary empirical interpretations of "Jus Naturale" *upon which current definitions of Metalaw are premised, i.e., the underlying justification for humankind species survival. Humankind and its single cell predecessors have always been an evolutionary work in progress…and hopefully will continue to be*

I. ANDREW GALLAGHER HALEY: THE GENESIS OF METALAW?

In his Categorical Imperative, Immanuel Kant asserted in 1788 that everyone should "act according to the maxim whereby you can at the same time will that it should become a universal law."[1] This "principle" is generally accepted as the predecessor of the concept of "Metalaw" first introduced formally as such by

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[*] Dr. Robinson, retired from the Smithsonian Institution, is currently in private law practice, and serves on several boards of trustees and advisory committees. He received an AB from Bowdoin College ('60), an LL.B from the University of Virginia ('63), an LL.M. from the McGill University Institute of Air and Space Law ('67), and the first Doctor of Civil Laws degree from McGill University's Graduate Law Faculty, Institute of Air and Space Law ('71).

[1] The Categorical Imperative formulated by Immanuel Kant is based on what he referred to in his Groundwork for the Metaphysics of Morals as including three different components or interpretations: 1) Universal Law Formulation –"Act only on that maxim through which you can at the same time will that it become universal law," 2) Humanity or End in itself Formulation – "Act in such a way that you always treat humanity, whether in your own person or in the person of any other, never simply as a means, but always at the same time as an end," and 3) Kingdom of Ends Formulation (combines the preceding two formulations) – "All maxims as proceeding from our own [hypothetical] making of law ought to harmonise with a possible kingdom of ends." *See*, therefore, http://hercules.gcsu.edu/~hedmonds/lecture%20notes/kant%20lecture%20notes.htm *also,* Robert Johnson, *Kant's Moral Philosophy*, *in* STANFORD ENCYCLOPEDIA OF PHILOSOPHY, Apr. 6, 2008*,* http://plato.stanford.edu/entries/kant-moral/; and *see generally,* Immanuel Kant's "goodwill, duty, and the categorical imperative", ETHICS AND SOCIAL CONCERN (NY; Paragon House Publishers, 1989).

Andrew G. Haley at the International Astronautical Congress of the International Astronautical Federation (IAF) held in Rome, Italy in September 1956. The concept was subsequently addressed in the October 1, 1956 issue of *Time* magazine, and a few months later in the same year, it was covered in the December 29, 1956 issue of *The New Yorker* magazine.[2]

Haley, somewhat arguably referred to by the legal profession as the "first space lawyer,"[3] asserted that "Metalaw" referred to fundamental legal precepts of theoretically universal application to all intelligences, human and extraterrestrial. Numerous attempts at relying on Hindu, Buddhist, Christian, Islamic, etc., principles that must dictate relations among humankind were not responsive to the dictates of Metalaw governing projected relations between and among humankind and "intelligent" extraterrestrials, i.e., the traditional Golden Rule was "starkly anthropocentric."[4] It only reflects the subjective needs and wishes of humans. The dictates of the empirically understood . . . at least up to its present level . . . biochemical underpinnings of humankind behavior are ignored in the traditional, and even current in certain respects, understanding of the es-

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[2] Andrew G. Haley coined the term "Metalaw," referring to a field of jurisprudence currently addressing the scientific search for extraterrestrial intelligence (SETI). At the time of the presentation and subsequent publication of his Metalaw principle, in addition to his private law practice and serving as General Counsel of the American Rocket Society, Haley also served as Chairman of the International Affairs Committee of the International Astronautical Federation. *See* TIME (Oct. 1, 1956), *available at* http://content.time.com/time/magazine/0,9263,7601561001,00.html.

[3] Eduardovich Tsiolkovsky (b. 1857 –d.1935), a Polish born Russian math teacher who inflexibly believed that humanity had to become a space civilization in order to survive, is credited with having been the first to address interplanetary travel issues in the 19th Century. Although he was not considered a practicing space lawyer, his approach relied on mathematical disciplines, which, as will be noted at a later point in the instant discussion, may well have laid the foundation for interplanetary relations in the context of evolving definitions of Metalaw. For additional related specifics regarding his variety of contributions to the concept of humans living in space, *see Konstantin E. Tsiolkovsky*, INTERNATIONAL SPACE HALL OF FAME, http://www.nmspacemuseum.org/halloffame/detail.php?id=27 (last visited Sep. 6, 2013). For a "Concise History of Space Law: 1910-2009," by space law historian Dr. Stephen E. Doyle, in which the author addresses early contributions to various aspects of space law, such as Metalaw, *see* NEW PERSPECTIVES ON SPACE LAW: THE PROCEEDINGS OF THE 53RD IISL COLLOQUIUM ON THE LAW OF OUTER SPACE YOUNG SCHOLAR SESSION, 1-24 (Mark J. Sundahl & V. Gopalakrishnan, eds. 2011), *available at* http://www.iislweb.org/docs/NewPerspectives onSpaceLaw.pdf.

[4] *See* TIME, *supra* note 2.

sence of the Interstellar Golden Rule embodied in Haley's view of Metalaw, i.e., do unto others as they would have you do unto them. But, in addition to certain relevant views of R. A. Freitas that are embellished upon at a later point in this discussion, the instant author questions just

> [w]ho, or what, determines that which is 'injurious or hurtful to some other being?' If mankind is to make such a determination, it is of necessity one which is anthropocentric in nature. If an alien being is to make the determination, is not man deprived of some rights as an integral party? Or perhaps there is a compromise based on an understanding of all participants of the ultimate laws of nature permitting or tending towards a balanced universal ecosystem? If there is truth in the latter approach, again we must turn to the principle involved in Haley's Interstellar Golden Rule—do not disrupt unilaterally the ecosystem of an alien sentient being.[5]

In this context, attorney A. C. Korbitz notes that

> [i]t is clear the metalegal precepts [Andrew] Haley and [Ernst] Fasan proposed are squarely rooted in natural law theory and flow from Kant's Categorical Imperative in a largely deductive manner rather than being drawn empirically from actual human legal institutions in an inductive fashion. Despite this, Haley acknowledged the obvious anthropocentric limits of natural law theory but could not ultimately divorce Metalaw from this intellectual construct. This failure led former Smithsonian . . . counsel George Robinson to note that the cultural concept of rules or law is itself anthropocentric . . . Robinson urged space lawyers, when engaging in metalegal research, to adopt an empirical approach similar to that used by cultural anthropologists. Robinson proposed an empirical analysis of Metalaw by studying human values formed with respect to totally alien concepts and potential situations, in particular 'in all bio-ecological and cultural regimes wherein categories of relationships occur and may be distinguished.' [6]

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[5] Quote taken from George Robinson, *Ecological Foundations of Haley's Metalaw*, 22 J. BRIT. INTERPLANETARY SOC. 266-274 (1969).

[6] See, therefore, Adam Chase Korbitz, *A Brief Introduction to Metalaw*, 9, http://metalawandseti.blogspot.com/p/brief-introduction-to-metalaw.html (last visited

As noted, above, Haley published his view of Metalaw in 1956 in an article entitled "Space Law and Metalaw – A Synoptic View."[7] In the article, again as referenced above, he proposed what is commonly known as his Interstellar Golden Rule, i.e., "do unto others as they would have you do unto them." In his review of the various papers delivered at the 1956 IAF Congress, A.E. Slater stated his view that Haley's "Space Law and Metalaw – A Synoptic View" was "deficient with respect to necessary definitions."[8] As noted in subsequent discussions, herein, the instant author agrees with much of Slater' assessment, particularly as it addresses deficiency of definitions in specific contexts. Nevertheless, Slater's assessment was totally rejected at the time by Haley.[9] "My reassessment of the Rome paper," asserted Haley,

> satisfied me that I had adequately defined anthropocentric law as being simply the law of human beings, and in this connection the term 'law' is frequently employed as referring to a science of principles; and, specifically, a science or system of principles or rules of human conduct; 'a system of rules and principles, in which the rights of parties are protected and enforced; a system of rules conformable to the standards of justice and on an enlarged view of the relations of persons and things as they practically exist; a mass of principles classified, reduced to order, and put in the shape of rules, agreed on by ascertaining the common consent of mankind; rules of civil conduct for the common good; rules promulgated by government as a means to an ordered society; the enforcement of justice among

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Sep. 6, 2013), and also Note 14, *infra,* for a recognition of Dr. Ernst Fasan's professional involvement with space law, in particular his role in the evolving constructs and definition of Metalaw.

[7] Andrew G. Haley, *Space Law and Metalaw: A Synoptic View*, HARVARD L. REC. 23 (Nov. 8, 1956).

[8] *See, therefor*e, A. E Slater, *Technical Sessions at the Rome Congress*, 16 J. OF THE BRITISH INTERPLANETARY SOC. 22, 41 (Jan.-Mar. 1957).

[9] Andrew G. Haley, *Space Law and Metalaw – Jurisdiction Defined*, 24 J. AIR L. & COM. 286 (1957) (for a rejection of Slater's view regarding definition deficiencies in Haley's 1956 IAF paper). For additional discussions of the Metalaw concept, and also of Slater's concern about lack of necessary definitions in Haley's presentation of the Metalaw concept, *see also* Andrew G. Haley, *Basic Concepts of Space Law*, *in* 26(11) JET PROPULSION (1956), and Andrew G. Haley, *Space Law – Basic Concepts*, 24 TENN. L. REV. 643 (June 1956).

> men.' It is said that the very definition of law is *sancto sancti jubens honesta et prohibens contrara*.[10]

The words underlined by the instant author are but a few examples that emphasize the critical lack of definitions in specific contexts, at that time, regarding operative words and phrases necessary to give an empirically substantive foundation to Haley's views. In fairness, of course, much has been uncovered since the early 1960s about the empirical data relating to the biochemistry/biophysics of the species *Homo sapiens sapiens*, or modern humans, and their societal/ecological interactive characteristics, as with all organic life forms, dictated by the human genome and specimen-specific genetic coding and genetic sequencing.[11]

It was in his 1956 paper, "Space Law and Metalaw – A Synoptic View," presented at the 7th Annual Congress of the International Astronautical Federation in Rome, Italy, that Haley proposed his "Interstellar Golden Rule." His view was that only one principle of human law can be resorted to in possible future relations with extraterrestrial life forms exhibiting "intelligence" that, apparently, only humans can define. The objective of the Interstellar Golden Rule was to impose or rely on "the stark concept of absolute equity" in human interactive relations with intelligent extraterrestrials.[12] The concept of Metalaw and

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[10] *Space Law and Metalaw – Jurisdiction Defined*, *supra* note 9, at 286 (emphasis added). The Latin phrase *sancto sancti honesta et prohibens contrara* can be interpreted generally as "the law is a sacred sanction, commanding what is right and prohibiting the contrary." The underlined words and phrases included in the quote are indications of terms and terminology considered requiring their own interpretations in context in order to give meaningful understanding of what is intended by "anthropocentric law" as a component of Metalaw.

[11] For the present discussion, "genome" may be defined in modern molecular biology and genetics as "the entirety of an organism's hereditary information . . . encoded either in DNA [deoxyribonucleic acid] or, [even for many types of primitive non-cellular] viruses, in RNA [ribonucleic acid]. The genome includes both the genes and the non-coding sequences of the DNA/RNA." For a more descriptive, but still general, overview characterizing the genome and its function, *see* http://en.wikipedia.org/wiki/Genome**.**

[12] What characterizes "extraterrestrial" also is subject to open-ended discussion at this time given the re-emergence of the panspermia theory that the genesis of organic life occurred not necessarily on Earth or any specifically identifiable planet or component of the cosmos, but rather life forms are continuously exchanged between and among those entities, including Earth. The concept has not been proven, but remains open to scientific assessments based upon ongoing research into extraterrestrial life

the Interstellar Golden Rule was re-introduced by Haley in his seminal book of 1963*, Space Law and Government.*[13]

II. DR. ERNST FASAN: UPDATING AND FINE-TUNING A DEFINITION OF "SENTIENT BEING"

Not until 1970 was there any significant refinement or embellishment of the Metalaw concept and the Interstellar Golden Rule. In that year, *Relations with Alien Intelligences: The Scientific Basis of Metalaw* was published by Dr. Ernst Fasan.[14] In this work expanding on Haley's Metalaw concept of 1956 (and characterized in more detail in 1963), Dr. Fasan emphasized his view, along with those of Haley, that Metalaw was the entire sum of laws that regulate, or will regulate, the relationships between and among the different "races" in the universe. He emphasized that Metalaw is the "first and basic 'law' between races" that establishes the ground rules for interactive relationships if and when *Homo sapiens sapiens* encounters a representative of an extraterrestrial race; and that this basic body of law would be relied upon to regulate the conduct both of humans and intelligent extraterrestrials in order to avoid mutually harmful activities. Again, unfortunately, the word "intelligent"

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forms and/or the essential components for life as we presently understand them. In this context, for a comprehensive history and list of publications regarding the origin of life and the panspermia theory, *see* http://en.wikipedia.org/wiki/Panspermia#Hoaxes. In most works relating to Metalaw and interaction between and among humankind and intelligent extraterrestrials, the operative word "intelligent" is never defined, either scientifically and/or in specific context. It simply is *assumed* to be defined as an anthropocentric characteristic.

[13] *See, generally,* ANDREW G. HALEY, SPACE LAW AND GOVERNMENT (New York: Appleton-Century-Crofts, 1963).

[14] ERNST FASAN, RELATIONS WITH ALIEN INTELLIGENCES: THE SCIENTIFIC BASIS OF METALAW (Berlin Verlag, Berlin, 1970) [hereinafter RELATIONS WITH ALIEN INTELLIGENCES]. Dr. Fasan is an Austrian attorney and internationally recognized as a leading authority on space law, and particularly Metalaw, which he has addressed in the context of his significant attention to the Search for Extraterrestrial Intelligence (SETI). Among other highly recognized involvements with space law and issues relating to Metalaw, Fasan remains an active member of the SETI Permanent Study Group of the International Academy of Astronautics, and leadership involvement with the International Institute of Space Law (IISL) of the International Astronautical Federation. In June 2008, as an honorary director of the IISL, Dr. Fasan assisted in representing the IISL before the United Nations in seeking and attaining Permanent Observer status of the IISL before the UN Committee on the Peaceful Uses of Outer Space (UNCOPUOS).

as it is referred to in Metalaw interpretations and applications is left undefined in specific contexts, and without consideration of the possibility, if not probability, that certainly some form of extraterrestrial life may manifest characteristics of "intelligence" and "race" different from those of modern humans, even those of sentient hominid precursors of modern humans. Also, use of the word "race" remains undefined in any specific context.[15]

In trying to clarify and expand upon Haley's Metalaw concept, Fasan falls into the same trap as Haley, i.e., a failure to use explanatory words and phrases in carefully defined characteristics and in equally as carefully defined contexts. A seminal instance of this failure is the use of the word "scientific"[16] in describing his view of the basis of Metalaw. Further, Fasan asserts that Metalaw consists of all legal relationships between different races in the universe.[17] Without defining "races," of which there are several on planet Earth alone, in context, Fasan characterizes Metalaw as the "first and basic 'law' between races" providing the "ground rules" for a relationship if and when we establish communication with or encounter another intelligent race in the universe" so as "to avoid mutually harm-

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[15] "Race," at present, usually refers to an actually or potentially interbreeding group within a species, including use of technology for biotic replication and/or metabolic activities; but excluding self-replication and metabolic activities solely by technological entities, regardless of whether "intelligent." For a definition of "race", *see*, WEBSTER'S NINTH NEW COLLEGIATE DICTIONARY 969 (1991). The word "intelligence" as applied to humans also has many different definitions and connotations, such as "having a high degree of…mental capacity [however that "mental capacity" may be defined in context]; revealing or reflecting good judgment or sound thought…," but all needing to be defined in specific contexts to be meaningful in their interpretations and manifestations of Metalaw. For definitions of "intelligence", *see*, *id*. at 626 (1991).

[16] The word "scientific" relates to the method, or exhibits the methods or principles, of science, i.e., quite simply "knowledge as distinguished from ignorance or misunderstanding." Generally, science is understood, correctly or not, as referring to the study of nature or "natural objects. *Id.* at 1051. Normally, the word "scientific" refers to a methodology used in studying and/or "determining a body of facts . . . systematically arranged and showing the operation of general laws," such as in mathematics; "a systematic knowledge of the physical or material world gained through observation and experimentation[;] any of the branches of natural or physical sciences. "Science," DICTIONARY.COM, http://dictionary.reference.com/browse/science (last visited Sep. 6, 2013).

[17] RELATIONS WITH ALIEN INTELLIGENCES, *supra* note 14.

ful activities."[18] At immediate issue is what constitutes a "race?" What constitutes "intelligent?" Must it be *mutually* harmful, or can it be *unilaterally* harmful?

In "A Brief Introduction to Metalaw,"[19] A. C. Korbitz notes that Dr. Fasan sets out the following five essential characteristics of what constitutes "sentient"[20] beings:[21]

1. Life, in the sense of influencing the environment.
2. Intelligence involving self-realization, free will [presently considered by certain theoretical and subatomic physicists to be property seemingly possessed by electrons], and "realization of the basic ideas of good and evil."
3. Detectability by humans.
4. Three-dimensionality, or existence or activity with three–dimensional space.
5. At least a rudimentary will to live.

A. Incorporating Sentient Beings Into the Principles of Metalaw

It was on these characteristics of what constitutes, in his view, a "sentient" being, that Dr. Fasan ranked in descending order what he believed were the principles embraced in, and reflected by, Metalaw, i.e.,

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[18] *See, therefore,* Korbitz, *supra* note 6. *See*, also, by George Robinson, *Metalaw – Prolegomena to the Quantification of Jus Naturale*," 40 GEO. WASH. L.REV. 709 (1972).

[19] Korbitz, *supra* note 6.

[20] WEBSTER'S NINTH NEW COLLEGIATE DICTIONARY, *supra* note 15, at 1073 (for a rather ephemeral definition of "sentient", i.e., "[r]esponsive to or conscious of sense impressions." This definition, which perhaps might apply as easily to the common field mouse, and also defined as a feeling or sensation as distinguished from perception and thought, seem together to be laying the foundation for the next step in biochemical evolution, which is abstract perception and reasoning. Recent studies have indicated that those characteristics are not necessarily limited to *Homo sapiens sapiens*, or modern humans, and even, perhaps, are shared independently by certain simians, cetaceans, etc., and post humans.

[21] *See*, RELATIONS WITH ALIEN INTELLIGENCES, *supra* note 14 (for Fasan's reference to what he believes constitutes an extraterrestrial "being.").

1. No partner of Metalaw may demand an impossibility.
2. No rule of Metalaw must be complied with when compliance would result in the practical suicide of the obligated race.
3. All intelligent races of the universe have in principle equal rights and values.
4. Every partner of Metalaw has the right of self-determination.
5. Any act which causes harm to another race must be avoided.
6. Every race is entitled to its own living space.
7. Every race has the right to defend itself against any harmful act performed by another race.
8. The principle of preserving one race has priority over the development of another race.
9. In case of damage, the damager must restore the integrity of the damaged party.
10. Metalegal agreements and treaties must be kept.
11. To help the other race by one's own activities is not a legal but a basic ethical principle.[22]

These principles ultimately were condensed by Fasan into a general characterization, rather than a workable formula of three, i.e.,

1. A prohibition on damaging another race.
2. The right of a race to self-defense.
3. The right to adequate living space.[23]

At the end of his discussion in *Relations with Alien Intelligences*, Fasan addresses Kant's assertion that "moral principles are not based upon that which is typical of human nature, but must exist *a priori* of themselves."[24] In response, Fasan asserts in a rather ephemeral and functionally amorphous fashion that "[w]hen …we discuss legal rules, valid for every intelligent race and its members, we must start with those principles which are

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[22] Korbitz, *supra* note 6.
[23] Korbitz, *supra* note 6.
[24] *See*, RELATIONS WITH ALIEN INTELLIGENCES, *supra* note 14, at 31.

deducible by and from pure reason."[25] As noted by Korbitz, however,

> "[i]t is clear the metalegal precepts Haley and Fasan proposed are squarely rooted in natural law theory and flow from Kant's Categorical Imperative in a largely deductive manner rather than being drawn empirically from actual human legal institutions in an inductive fashion. Despite this, Haley acknowledged the obvious anthropocentric limits of natural law theory but could not ultimately divorce Metalaw from this intellectual construct."[26]

Korbitz then continued by observing that this failure of Fasan's led the instant author to note "that the cultural concept of rules of law is itself anthropocentric."[27] Further, he noted that the instant author

> "…urged space lawyers, when engaging in metalegal research, to adopt an empirical approach similar to that used by cultural anthropologists . . . [and] proposed an empirical analysis of Metalaw by studying human values formed with respect to totally alien concepts and potential situations, in particular 'in all bio-ecological and cultural regimes wherein categories of relationships occur and may be distinguished.'"[28]

Note, however, that the Metalegal precepts Haley and Fasan proposed are not necessarily rooted in Natural Law Theory, and the ensuing discussion will focus on this reservation; particularly in light of the unfolding empirically based understanding of the biochemistry subtending all humankind behavioral manifestations and "cultural" activities. As with all natural disciplines and subdisciplines, human jurisprudential theories and consequent implementing positive laws are understood from a quantifiable empirical perspective using a secular meth-

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[25] *Id.* at 52.

[26] Korbitz, *supra* note 6, at 4.

[27] *See generally*, by George S. Robinson, *Ecological Foundations of Haley's Metalaw*, 22 J. OF BRIT. INTERPLANETARY SOC. 266-274 (1969). For an interesting and forward thinking analysis of Metalaw and the contributions of Haley and Fasan, *see also*, Rita M. Lauria, *Metalaw*, 1(1) INT'L L.J., http://lacba.org/FilesMain%20Folder/Sectgions/International%20Law//International/file/InternationalLawNewsletter/files/Metalaw.pdf.

[28] As quoted in Korbitz, *supra* note 6, at 4.

odology. This does not disfranchise the humanist/religious approach and its importance in the absence of quantifiable explanatory and predictable empirical data derived from experience and ever-increasing/evolving research data.

III. DOES METALAW REST UPON NATURAL LAW THEORY?

A secular grasp of Natural Law Theory, or *jus naturale*, shifts and metamorphoses also as reliable empirical data becomes available. A basic and useable definition of the theory may be considered a philosophic construct, understood initially to have derived from Aristotle and expanded upon by numerous other "philosophers" such as Thomas Acquinas. The construct essentially is based on what are considered universal traits applicable to all existence and shared by all humankind and, perhaps, all life forms, and upon which human laws are premised and referred to as "positive laws" in the form of, say, legislation and implementing regulations. The theory has evolved since the dawn of written philosophy, and has been distorted in concept to include functionally shifting precepts of "morality" and human "rights," all of which are, in effect, manifestations of positive laws, whether religious or secular, but which in fact are shifting expressions of biological dictates.

In the traditional jurisprudential realm of *jus naturale*, the theory was considered to have found its genesis in Greek philosophy, and then used essentially in the philosophic considerations of Roman jurists in the Antonine Age. At that time, and still embraced now by certain natural law theorists, the concept denoted

> " . . . a system of rules and principles for the guidance of human conduct which, independently of enacted law, or of the systems peculiar to any other people, might be discovered by the rational intelligence of man, and would be found to grow out of and conform to his nature, meaning by that word his whole mental, moral, and physical constitution."[29]

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[29] *See,* Black's Law Dictionary 1177 (4th ed. 1951) (for a relatively current definition of *jus naturale* and its evolving history, "Natural Law"). While the Natural Law Theory

Interestingly, history shows that the conception of what is termed the Stoic Doctrine relating to Natural Law Theory led to a departure from the philosophy of the Antonine Age and focused on life being ordered "according to nature," which in its turn

> "rested upon the purely supposititious existence, in primitive times, of a 'state of nature' . . . a condition of society in which men universally were governed solely by a rational and consistent obedience to the needs, impulses, and promptings of their true nature, such nature being as yet undefaced by dishonesty, falsehood, or indulgence of the baser passions."[30]

While this characterization of the evolution of *jus naturale* has been manipulated and evolved over the centuries as human behavior became increasingly understandable from an empirical perspective, it was still cloaked in religious and often very imprecise terms. Nevertheless, non-empirically based and manipulative terminology continues to be used to paint human behavior in a social context as non-empirical by using such imprecise terms as "moral," "ethical," and the like, to describe acceptable, but transitory, social behavior that, in fact, is based solely on genome competitiveness and other forms of species and individual survival-oriented competiveness. In other words, use of these words and concepts constitute an ongoing attempt to disregard the evolutionary history of all hominids, protohominids, and even carbon-based single cell and viral life forms, the shoulders upon which and whom modern humans and the ongoing evolutionary potential of *Homo sapiens sapiens* stand. In this context, it is important to keep in mind that "intelligence" and sentient or abstract perception and reasoning characteristics of modern humans are and have been shared by many of those entities on the bush of evolution before they became extinct or were pushed to a lower order in the philosophic musings of early Greeks and Romans. In fact, certain genetic character-

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found its genesis in Greek philosophy and subsequently the Antonine Age jurisprudentially oriented philosophers, works of more current traditional "students" of the theory *of jus naturale* include those of St. Thomas Aquinas, Thomas Hobbes, and John Locke.

[30] *Id.*

istics of a sentient, but extinct, hominid species/subspecies still survive in *Homo sapiens sapiens*…such as Neanderthalensis.[31] All of which brings this discussion of the tenets of Metalaw to the changes that empirically based secularism is imposing on that theory.

A. Metalaw: A Shift to Empirical Pragmatism?

As noted by A.C. Korbitz, "[w]hile the term *Metalaw* and the concept it represents are both today rather obscure, the term did enter the popular parlance of the day rather quickly in the 1950s, only to fade gradually into the fog of history," until now.[32] Perhaps in the realm of faith and evolution of religions filling the seemingly endless gaps in empirical, quantifiable, and predictable aspects of existence, the evolution of humankind to the present has still allowed *Homo sapiens sapiens* to raise itself much too far above its biological origins in trying to establish a variety of jurisprudential concepts and implementing positive laws for relatively peaceful global existence without considering that the species is still in the process of evolution of its sentient, abstract/perception reasoning . . . and its very "essence."

In the context of the preceding discussions, "xenobiology" is defined as the study of extraterrestrials, especially their biological compositions and behavioral manifestations. More broadly, it can be said to be the study of all aspects of life, intelligence, and civilization indigenous to environments other than Earth.

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[31] A Neanderthal genome project was started in 2006 by the Max Planck Institute for Evolutionary Anthropology in Germany. The Institute coordinated a study consisting of a collaboration of scientists studying the bases that make up the complete genome of the closest human relative, i.e., *Homo neanderthalensis*. In the study released May 7, 2010, the team of collaborating scientists issued a paper addressing the initial results of its Neanderthal genome study, based on several Neanderthal fossils from Croatia, Germany, Spain, and Russia. These results indicated that Neanderthals were more closely related to modern humans outside of Africa. The results of the study also identified several genomic regions that appear to have played a significant role during human evolution. A small percentage of Neanderthal genes appear in the genetic make-up of certain modern humans. *See*, therefore, by R.E. Green, et al., *A Draft Sequence and Preliminary Analysis of the Neanderthal Genome*, 328(5979) SCIENCE 710-722 (May 7, 2010), http://www.sciencemag.org/contents/328/5979/710.full.

[32] Korbitz, *supra* note 6, at 3.

More parochially, in medicine and medically-oriented research laboratories, xenology is considered the study of parasites, on Earth and, perhaps, elsewhere.[33] In a context more relevant to Metalaw principles addressing relations of human*kind* in interactions with Earth-alien extraterrestrials, xenology is focused on the biological traits and relationships of all life forms, their levels of "intelligence," however that term is defined under specific circumstances, and the empirically quantifiable, ecologically interactive characteristics of the cultures, societies, and civilizations they represent, *but indigenous to environments other than Earth*. Nevertheless, as addressed in subsequent discussions, extraterrestrial environments do not necessarily preclude those of humankind and their biotechnologically integrated descendants, i.e., transhumans and post humans. In this context, Robert A. Freitas, Jr., hints even more closely at an appropriately inclusive definition of xenology, i.e.,

> the study of alien life forms is a major subdisciplne within the xenological sciences. Its subject matter is the set of all possible life systems in the universe, rather than just the biology of a single world. The common assertion that xenology is 'a science in search of a subject' because no extraterrestrials have yet been found ignores the long evolutionary history of our planet. From the cosmic point of view, Earth is an alien world as exotic as any in the Galaxy."[34]

Even more relevant to the instant and following discussions is that alien intelligences in the form of transhumans transitioning into post humans is, perhaps, much closer than most

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[33] *See*, "xenology" as defined in MOSBY'S MEDICAL DICTIONARY (8th ed., 2009), http://medical-dictionary.thefreedictionary.com/xenology.

[34] *See*, Robert A. Freitas, Jr., *Xenology*, 101 ANALOG SCIENCE FICTION/SCIENCE FACT, 30-41 (Mar. 1981), http://www.xenology.info/Papers/Xenobiology.htm. Much has evolved and been discovered in the fields of exobiology and Earth indigent medical and biologically-related research on Earth since Frietas published this article, but the basic premise remains valid. Interestingly, even in 1981, Freitas was compelled to note that "chauvinism" is a word that has "come to be associated with any absurd, unreasoning, single-minded devotion to one's own race, nationality, sex, religious persuasion, or, more generally, to one's own peculiar point of view. Chauvanisms usually are associated with ignorance [not stupidity, which can be defined as recidivistic ignorance] – in view of our lack of hard knowledge about lifeforms elsewhere in the universe, chauvanisms are predictably common in xenology." *Id.* at 30.

researchers and the general public are willing to accept.[35] Nevertheless, one of the principle obstacles to overcome by the legal, biological research, engineering, medical, and theological professions is the failure to define operative words consistently and in varying contexts. This can be seen in the a sample of the historical landmarks representing evolution of Metalaw theory from its modern inception by Andrew Haley until shortly after Dr. Fasan's assessment and treatment of the term and subtending principles.

B. Metalaw Resting on Ancient as well as Modern Laurels

Robert Freitas suggests some of the signal moments in history that represent evolution of the basic principles reflected in what became known as Metalaw. These include those set forth below, among many others, up to Dr. Ernst Fasan's approach to what constitutes those evolved characteristics.[36] Many principles focused on pragmatic as well as anticipatory philosophic perspectives and undefined, amorphous terminology. Several, but not all, predate in antiquity the principles of Metalaw espoused by Haley and Fasan: e.g.,[37]

1. "What is hurtful to yourself, do not unto your neighbor" – Judaic Talmud.
2. "As you wish men to do to you, so also do you to them" – Bible, Luke 6.3.1
3. 'We should behave to friends as we would wish friends to behave to us" – Aristotle.
4. "What I do not wish others to do unto me, that also I wish not to do unto them" – Confucius.

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[35] *See infra* Subheading IV: QUANTIFICATION OF METALAW OBJECTIVES, for additional discussion of Metalaw and its potential relevance and applicability to transhumans and post humans.

[36] For a complete listing by Robert A. Freitas, Jr., of his personally selected historical signposts regarding evolution of the principles of Metalaw, *see* ROBERT A. FREITAS, XENOLOGY: AN INTRODUCTION TO THE SCIENTIFIC STUDY OF EXTRATERRESTRIAL LIFE, INTELLIGENCE, AND CIVILIZATION (1st Ed., Xenology Research Institute, Sacramento, Calif., 1979), http://www.xenology.info/Xeno/25.1.2 .

[37] *Id*. The quotes presented herein are taken from Robert A. Freitas, Jr., *Exenology: An Introduction to the Scientific Study of Extraterrestrial Life, Intelligence, and Civilization*, *id*. Quotes and dates ascribed are not taken from original sources, but fairly reflect the views of those quoted.

5. "Do good unto others as God has done unto thee" – Mohammed.
6. "People have the right to travel to any lands they desire subject to the restriction that they must not do harm to the natives residing therein" – A quote in 1532 by Francisco de Vitoria, a Spanish theologian perhaps best remembered for his defense of the rights of the native Americans and others of the New World against the colonists, and for his views regarding the limitations of otherwise justifiable warfare.
7. The 1788 Categorical Imperative formulated by Immanuel Kant demanding that humans "[a]ct only on such a maxim as you can will that it should become a principle of universal legislation," but a viable observation only if it will enhance survivability of the interacting culture, society, or civilization and the predominant genome and/or genetic coding; or when viewing the taxonomic lower orders of the animal/plant Kingdoms, and what will ensure genome/genetic coding/genetic sequencing survivability and adaptive evolution of that representative genome, etc.
8. " . . . link conduct with probability, and give mathematical proof that certain patterns of conduct increase the probability of certain kinds of coincidences" – A 1945 "*ethical* equation" introduced by Murray Leinster that drifted into the use of empirically related assessments of human behavior, and that would lead to the conclusion that, eventually, "an exact balance of punishment or reward would occur" depending upon whether interactions between one person and an alien either were "good" or "wrong;" unfortunately, a drift back to an amorphous sense of what constitutes moral/amoral and ethical/unethical behavior.
9. "There could be no truce between men and a superior form of life" – A 1949 quote by Murray Leinster that seems to revert from non-pragmatic definitions of morality and ethical behavior to the realities of the biological/biochemical foundations *of Homo sapiens sapiens* survival and that of its evolving descendants…both on Earth as well as in space.
10. The 1956 assertion by Andrew C. Haley, in furtherance of his Interstellar Golden Rule, that "[t]here may be no visitation whatsoever of any inhabited area until intelligible

contact will have been made and the Authority is satisfied that no physical or psychological hazard exists to either the explorer or the explored."

11. A 1958 reaffirmation by Haley of the basic Metalaw construct, i.e., "[i]t is better to destroy Mankind than to violate Metalaw," a view that appears to retreat from any recognition of the biological foundations of *Homo sapiens sapiens* . . . and, indeed, all Earth indigent life forms giving evolutionary rise to modern humans.
12. "If the planets are inhabited, sovereignty may be established only in two ways: By a victorious war or by agreement. War is and will always be the first origin and the *ultima ratio*. Sovereignty means power and ultimately military amid technical power. Whatever may be the means and ways. Agreement would be the acceptance by inhabitants of the rule of the conquerors. The hypothesis of mutual sovereignty is practically excluded as the superior group would necessarily dominate…If the planets are not inhabited, the law would be accomplished by virtue of occupation. The planets would then be *res nullius* and the venerable custom and general principle of the law, according to which the effective possession and continuous occupation establishes sovereignty, would govern." This 1960 quote by Julian G. Verplaetse reflects, indeed embraces, a drift to biological realism embodied in the fright, flight, or fight expressions of the autonomic nervous system, which injects a certain aspect of biological reality in the variety of views embracing the underlying wishful sanctities at the core of Metalaw.
13. "Any idea of aggression or conquest should be discarded—the mission of man when visiting other planets should evidence a high degree of civilization and a sense of legality" –Aldo Armando Cocca, 1962.
14. "We may find inferior beings, and these we may keep from harming us by purely protective means" – Andrew G. Haley, 1963.
15. "The exploration and use of Outer Space, including the Moon and other celestial bodies,[38] shall be carried out for

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

the benefit and in the interests of all countries, and shall be the province of all Mankind. There shall be freedom of scientific research and exploration in outer space, including the Moon and other celestial bodies" – Article I of the 1967 Outer Space Treaty gives no recognition of any legal status of potential interactions between and among Earthkind and extraterrestrial life . . . including biotechnologically-integrated and Earth indigent advanced forms of artificial intelligence *in extremis.* Ensuing Articles IV and VIII reference jurisdictional controls, but only with respect to human activities controlled by Earth-sovereign nations that are Treaty signatories. This discrepancy may be addressed during the current assessments of the Treaty presently being undertaken, and any need for amendments consistent with current technology, public and private funding, and prevailing international relations.

16. Haley's Interstellar Golden Rule" – 1969 observation by G. Robinson relying on the bioecological foundations of all humankind behavior.
17. "Our basic interest will be to protect ourselves from any possible threat to Earth's security. Our second concern would be to assist in developing or to participate in a stable system of interstellar politics that provides an acceptable level of security for all. Our third concern would be to learn from the aliens in order to advance our knowledge of the universe and to add to the tools of civilization" – 1973 observation by M. Michaud that illustrates a certain ambivalence about the sanctity of the Interstellar Golden Rule and its place in the body of Metalaw principles.
18. "Advanced civilizations might be reluctant to disseminate information that may be dangerous to less-developed societies, or which might, in the hands of those societies, become dangerous to themselves." -1975 statement by B. Campbell that focuses on humankind interactions with extraterrestrials representing alien life forms less evolved than *Homo sapiens sapiens* and its descendants, biological and/or biotechnological in the form of transhumans and post humans. This statement, like most of those embodied in preceding quotes, above, are replete with undefined terms in vague contexts, and generally are more obfuscating than precise and helpful in terms of the specific

functional values intended to be adopted pursuant to the Interstellar Golden Rule.

19. "We should leave other cultures entirely alone—let them evolve naturally, with no help or interference by outsiders" – 1997 *principle of non-interference* somewhat surprisingly put forth by R.A. Freitas, Jr. Freitas has been one of the more outspoken supporters of recognizing the basic biological underpinnings of all human behavior; indeed, the biological underpinnings and dictates of all Earth indigent forms of carbon based life.

While these are only a few examples of the transitioning and evolution of the Metalaw concept and its component operating principles to the present, they are fairly representative of the dysfunctional vagaries that derive from lack of definition in specific contexts of critical wording and phrases. It reflects a lack of commitment to, and often recognition of, the empirically-dictated biochemical underpinnings of all life forms. Jurisprudents, and certainly most practitioners of positive laws, seem to confuse and intermix these biological dictates with some ephemeral and sentient perception/definition of seemingly relevant and applicable terms such as "moral," "ethical," and the like. The necessary transitioning to a secular approach to Metalaw, indeed all forms of jurisprudence and implementing positive laws, will be seen in the discussions, below.

IV. QUANTIFICATION OF METALAW OBJECTIVES

As indicated previously, Robert A. Freitas, Jr., is an attorney and researcher at the Xenology Institute in California, and has published rather extensively over the years on the subject of xenology consistent with its purest definition.[39] In the context of rules or principles the guardians of Metalaw have formulated for interactions with and among human*kind* and traditional concepts of the basic characteristics defining extraterrestrials, Freitas makes a few observations that are helpful as a segue to the potentially interactive characteristics between and among

[39] MOSBY'S MEDICAL DICTIONARY, *supra* note 33 (for the definition of "xenology" used in the instant discussion).

Homo sapiens sapiens, *Homo sapiens alterios*, and perhaps eventually *Homo alterios spatialis*, i.e., post humans. He urges his audience to keep in mind that the search for life just in our solar system is, comparatively speaking, only beginning. Some of his relevant observations include:

> . [T]here used to be the notion that oxygen . . .is absolutely required for higher life. Many xenobiologists today categorically reject this proposition. Oxygen was largely absent during the first few billion years of evolution on Earth, and many organisms today still do not need this element to survive.[40]
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> . Another early biological chauvinism was the insistence that life is an especially fragile phenomena [*sic*] limited to a very narrow range of environments. During the 1960s scientists examined the extremes of terrestrial life and found that the flora and fauna of Earth (especially microorganisms and other simple lifeforms) resist death even when subjected to conditions that would quickly kill a human being.[41]
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> . When a TV camera was retrieved from the American lunar probe Surveyor 3 by Apollo astronauts, a colony of . . . bacteria was found growing inside the lens. These hardy microbes evidently survived three years of hard vacuum, no food or water, exposure to cosmic rays, and temperatures ranging from well above the boiling point of water in the daytime to – 160 C° during the night.
>
> . All living creatures we know about are made up of complex carbon compounds immersed in liquid water. It may be that all life in the universe must take this form. . . . Over the years one of the most persistent and seemingly most reasonable biological chauvanisms has been the contention that water is the only good biochemical solvent But [sic]this view is slowly changing . . . Today, xenobiologists regard ammonia . . . as the lead in alternative to water for hypothetical alien life chemistries.[42]

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[40] Robert A. Frietas, Jr., *Xenobiology*, 101 ANALOG SCIENCE FICTION/SCIENCE FACT, 30-41 (Mar. 30, 1981), http://www.xenology.info/Papers/Xenobiology.htm.

[41] *Id.*

[42] For a relatively early, but in large part abiding, technical treatment of this proposition, *see* Peter Molton, *Non-Aqueous Biosystems. The case for Liquid Ammonia as a Solvent*, 27 J. BRIT. INTERPLANETARY SOC. 243-262 (Apr. 1974).

> Ammonia is known to exist in the atmospheres of all gas giants in the Solar System and is thought to have been plentiful on Earth during the first billion years of the planet's existence. . . . Numerous other biological solvent systems have been proposed from time to time, as for instance sulfur dioxide, hydrogen fluoride, methane, hydrazine, chlorine and sulfur.[43]

The ongoing disputes between and among the biologists, exobiologists, chemists, physicists, and representatives of other relevant disciplines continue, particularly as new discoveries are made incrementally with the expanding varieties of experiments and discoveries made both terrestrially and in space. But what is frequently missing in the search for extraterrestrial life is a consistent definition of what constitutes "intelligence." What and how is "sentient" defined universally, other than with respect to Earth biota, and even the limiting constraints of what has been considered a parochial hominid trait are beginning to expand into a more inclusive representation of Earth indigent life forms beyond the hominids and protohominids; e.g., the cetaceans.[44]

Finally, in the context of the biochemical foundations of organic life as we know it, certainly on Earth, Frietas notes that "[l]ife requires metabolism, a systematic manipulation [by the application of force] of matter-energy and information."[45] What is even more determinative of organic life are the biological necessities of survival through metabolic activities and self-replicative capabilities. In this context, Freitas also notes that "the advancing intelligence and versatility of electronic computers suggests that some sort of solid state 'machine life' may be plausible. Such entities would survive by manipulating electron flows and fields in order to process matter-energy and patterns of information."[46] [Note that even on the smallest theoretical form of energy on the Plank scale, all energy takes the form

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[43] *Frietas, Xenobiology, supra* note 34.

[44] For a relevant, interesting, and informative discussion of the current research findings relating to the "brain power" and intelligence, or comparative cognitive characteristics, of cetaceans (e.g., whales, dolphins, etc.), *see* "Cetacean Intelligence" at http://en.wikipedia.org/wiki/Cetacean_intelligence (last visited Sept. 6, 2013).

[45] Frietas, Xenobiology, *supra* note 34.

[46] *Id.*

of relatively organized information.][47] Freitas concludes by observing "it is very likely that ours is just one possible life chemistry of many, and that all biochemical life is only one of many modes of xenobiological existence. But regardless of what shape they take, all lifeforms are worthy of our curiosity and respect as manifestations of the same fundamental unity and cosmic order that gave rise to life on Earth eons ago."[48]

In a current context of the understanding and status of Metalaw principles by legal philosophers and practitioners, Metalaw is beginning to be viewed as somewhat "out of touch" with reality. For example, S.W. Greenwood, according to Freitas, has questioned its substantive validity in the context of the carbon based biochemical nature and dictates of human existence and social behavior, as well as for that speculated for extraterrestrial life forms and behavior. According to Freitas, Greenwood believes that

> [t]he Great Rule of Metalaw proposed by Andrew Haley appears to have aroused surprisingly little critical comment. It seems to me to be a highly dangerous approach to the problem of how to behave in the presence of an alien intelligence. Literally it appears to direct an Earthman to do whatever an alien desires. What should be done when an alien desires an Earthman to hand over his vehicle, his equipment, and his crew? It is evident that the Rule of Metalaw would often be unworkable.[49]

Again, in a more contemporary understanding of the substantive jurisprudential underpinnings of the Metalaw concept, Dr. Rita M. Lauria, author and practitioner of space law and Metalaw, defines Metalaw as

> an emerging juridical science that seeks to discover the basic tenets that can serve as guides to interaction with any intelligent life form in the universe. Because technology advances

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[47] For an explanation of Planck units in the context of physics, *see* Planck Units at http://en.wikipedia.org/wiki/Planck_units (last visited Sept. 6, 2013).

[48] Frietas, Xenobiology, *supra* note 34, at 10.

[49] *Frietas* ,XENOBIOLGY, *supra* note 34 (*citing* S.W. Greenwood, *Correspondence*, 1 SPACELIGHT 261 (Apr. 1958).

> faster than jurisprudence can generally respond, it is reasonable for the global community to prepare fully for the consequences of scientific disciplines, like the space sciences and space exploration, as these may well alter our traditional legal definitions. We need to be prepared in anticipation of such consequences. Are there universal tenets that apply across all life forms in the universe? If so, what are these tenets that can serve to guide the interactions of different forms of sapiency [sic] such that if we make contact with these we shall properly know how to conduct relations?[50]

This definition of Metalaw fits into current realities of applicable space technologies, and focuses the instant discussion on the subject of transhuman and post human traits that may help in identifying and characterizing what constitutes "intelligent"[51] in the context of applying the principles of Metalaw.[52]

A. Religious Foundations of Metalaw?

A passing observation, but quite obviously a very important component of understanding the secular approach to Metalaw, is the influence of religions, the humanistic view, on the *cosmic* perspective of Metalaw. Interestingly, in the context of current

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[50] Lauria, *Metalaw,* supra 27. *See generally*, Rita M. Lauria & George Robinson, *From Cyberspace to Outer Space: Legal Regimes under Pressure from Emerging Meta-Technologies*, 33 U. LA VERNE L. REV. 219 (May 2012) [hereinafter *From Cyberspace to Outer Space*]; and by George Robinson & Rita M. Lauria, *Legal Rights and Accountability of Cyberpresence: A Void in Space Law/Astrolaw Jurisprudence*, XXVIII ANNALS OF AIR & SPACE L., 311-326 (2003) [hereinafter *Legal Rights and Accountability of Cyberpresence*].

[51] A general, but scientifically antiquated, definition of "intelligence" is "the ability to learn or understand from experience; ability to acquire and retain knowledge . . . the ability to respond quickly and successfully to a new situation; use of the faculty of reason in solving problems…." *See,* WEBSTER'S NEW WORLD DICTIONARY OF AMERICAN ENGLISH 702 (3rd College Edition, 1988). Scientific definitions of "intelligence" are almost as varied as those used by the lay public, and frequently rely on the use of words that also are ill-defined or totally inappropriate in the scientific context used.

[52] Perhaps it should be noted specifically at this point that the term "meta" is Greek in origin, and is interpreted as "a change in position or form, alteration, [and] transposition;" or, in a possible analogy to "metaphysics." Metalaw might be defined as "going beyond or higher, transcending" and is used to "form terms designating an area of study whose [sic] purpose is to examine the nature, assumptions, structure, etc., of a (specified) field." *See*, the definition of "meta," *in* WEBSTER'S NEW WORLD DICTIONARY OF AMERICAN ENGLISH, *supra* note 51, at 851.

influences of religious concepts on international relations and indeed the interpretation and application of Metalaw, the classic Islamic system of jurisprudence known as the *maqasid al shari'ah* is brought to bear. Currently, to some, this involves seeking a new Golden Rule, as articulated in what are considered by Muslims as "summaries of eight irreducible principles of human responsibilities and human rights . . . All the revealed religions contain a universal paradigm of thought . . . [and] Muslims call this Islam."[53] Dr. Robert D. Crane asserts that Islam "is based on an affirmation that there is an ultimate reality of which man and the entire universe are merely an expression, that therefore every person is created with an innate awareness of absolute truth and love, and that persona in community can and should develop from the various sources of divine revelation, including natural law or the *Sunnat Allah*, a framework of moral law to secure peace."[54]

The above observations are noted here to indicate that in many respects the confusion in understanding the basic precepts and objectives of Metalaw, particularly when interpreting them in the context of Natural Law disciplines, which, in turn, refer such an "accurate" understanding to elusive words and phrases used without careful definition in specific contexts: For example, "moral law," "absolute truth," "love," "ethical," "peace, "divine revelation" (a very individualistic phenomenon even if it could be defined in an empirical/quantifiable or measurable fashion), etc. All religions rely on these types of words and phrases for definition and characterization of their basic tenets. But they are not helpful in defining and ascertaining in an empirical and workable fashion the biochemical founda-

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[53] Robert D. Crane, *The Global Vision of Metalaw*, 1 (Scholar's Chair at Menefee Mountain, Washington, Va., Sept. 11, 2011), http://www.kaskas.com/uploads/Metalaw-Global_Vision.pdf.

[54] *See*, Robert D. Crane, The Global Vision of Metalaw (Scholar's Chair at Menefee Mountain, Washington, Va., Sept. 11, 2011) (an unpublished concept paper). *See also generally*, Robert D. Crane, former advisor to President Richard Nixon, and former Deputy Director of the United States National Security Council, Lecture Delivered in Celebration of his 80th Birthday before the International Institute of Islamic Thought (Mar. 27, 2009), *MaqasidAl-Shari'ah: A Strategy to Rehabilitate Religion in America,* http://www.iiit.org/NewsEvents/News/tabid/62/articleType/ArticleView/articleId/133/Default.aspx.

tions/dictates of all human and other life-form characteristics reflected as various relative levels of energy in the form of organized information. This, again, is a topic for another discussion and approach to defining a Natural Law Theory resulting in a jurisprudence(s) embracing specific flexible values underlying universally acceptable definitions of civil and criminal behavior . . . between and among cultures, societies, and civilizations and cross-civilization religious tenets; perhaps even "cosmically" if *jus naturale* is to fit into a universal definition of Metalaw.

B. Cyberspace, Cyberpersona, and Cybernation: Catalytic Phenomena Embraced by the Metalaw Operating Construct

Dr. Rita M. Lauria, a noted early pioneer in the relationship of Metalaw and communications, particularly in the arena of space jurisprudence, telepresence, and virtual reality (which she prefers to call "virtuality"), addressed the role of virtuality in the context of "inside information." She adopts the definition of "virtuality" as "essence . . . potential existence . . . potentiality."[55] Further, she expands on the concept by asserting that the

> [c]ontemporary use of the term 'virtual' has been associated with many fields, but especially with computers and computational media where the term has been extended to a type of computer phenomenon that generates a virtual space that living, breathing human beings accept as a reality, a virtual reality. Unlike [the traditional understanding of] physical reality, virtuality and its attendant virtual space connote an environment that coalesces from electric phenomena driving computationally mediated bit streams of information to interplay with human ingenuity and imagination. Virtuality is experienced as if it were a real realm. The question can be raised: Is it real?[56]

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[55] *From Cyberspace to Outer Space*, *supra* note 50, at n. 2 (*citing* MERRIAM-WEBSTER'S COLLEGIATE DICTIONARY 1397 (11th Ed. 2003).

[56] *See*, *From Cyberspace to Outer Space*, *supra* note 50, at 220. *See also generally*, *Legal Rights and Accountability of Cyberpresence, supra* note 50, at 311-326.

In this context, group systems designer Murray Turoff asserts that "what is possible with computers is not a representation of reality as we know it but a new essence or a new reality that may be different from anything we have known before."[57] Further, Turoff believes that

> "[V]irtuality is the property of a computer system with the potential for enabling a virtual system (operating inside the computer) to become a real system by encouraging the real world to behave according to the template dictated by the virtual system. In philosophical terms, the property of virtuality is a system's potential evolution from being descriptive to being prescriptive."[58]

All in this context, Dr. Lauria and the instant author believe that traditional jurisprudential concepts and definitions in implementing positive laws will need significant reworking in order to respond to various technologies and biotechnologies developing faster than cultural, societal, and civilization jurisprudences can respond and adapt. These authors dealing with exponentially advancing technologies are forcing jurisprudential attention toward a special body of positive laws that address the developing vagaries of *Homo sapiens sapiens* in the form of transhumans, which the authors seem to believe already exist. Given the direct intervention of pharmaceuticals, surgical implants, and limited genetic manipulation, and the like, already being performed on human specimens, including certain aspects of astronaut physiology, regardless of whether unnecessarily transmittable sexually, it is not pressing the envelope of *trans*-humanism to say that the phenomenon already exists.[59]

From this reasonably disciplined speculation, a more pragmatic characterization of the potential jurisprudential issues (already existing with respect to Earth-indigent legal systems and the activities of cyberpersona operating "strictly" in cyberspace) can be seen in contemporary discussions and cases in-

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[57] M. Turoff, *Virtuality*, 40 COMM. OF THE ACM (1997).

[58] *See*, *id.* at 38.

[59] In this context, *see* George Robinson, *The Search for Biogenesis and the* Lurch *Toward Space Law Secularism*, XXXIV Annals of Air and Space L., 645, 674-691 (2009) [hereinafter *The Search for Biogenesis*].

volving the issue of Earth indigent legal systems asserting jurisdiction over cyberspace and cyberpesona activities.[60] The related cases and specific issues being argued might be considered the closest approach to contemporary Metalaw principles and the evolution of two distinct interfacing legal systems which might be ignoring that portion of the Interstellar Golden Rule addressing the rights and responsibilities of humans interfacing with the culture of alien life forms, i.e., an assertion of independent cyberpersona; an entity considered by many as a distinctly separate and independent personality functioning in cyberspace. For humans and/or transhumans projecting their cyberpersona into cyberspace from, say, the International Space Station, the multilateral agreements of participating nations cover relevant issues regarding activities of their citizens in cyberspace.[61]

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[60] *See*, *e.g.*, a discussion of issues of law relating to whether Earth indigent jurisdiction can be asserted over e-commerce deriving from cyberspace for purposes of taxation, by Rifat Azam, *E-Commerce Taxation and Cyberspace Law: The Integrative Adaptation Model*, 12(5) VA. J. OF L. AND TECH., 1-32 (Summer 2007). *See also*, Betsy Rosenblatt, *Principles of Jurisdiction on the Internet*, http://cyber.law.harvard.edu/property99/dmain/Betsy.html. *See* State of Minn. V. Granite Gate Resorts, Inc., 568 N.W.2d 715 (1997) (for an interesting discussion of a defendant's activity in cyberspace and the issue of personal jurisdiction), & Panavision International v. Toeppen, 141 F.3d 1316 (9th Cir. 1998) (dealing with personal jurisdiction applicable to conduct that occurred*, in part*, in cyberspace). Note that the term "cybernation" is usually characterized as the control of processes by computer, and the term "cyberculture" denotes cognitive processes, or the culture that emerges from the use of computers for communication activities strictly *in* cyberspace. Note also, that the term "cyberspace" is credited to William Gibson, who used it in *Neuromancer*, a novel written in 1984. Gibson "defines cyberspace as 'a consensual hallucination experienced daily by billions of legitimate operators, in every nation, by children being taught mathematical concepts . . . A graphical representation of data abstracted from the banks of every computer in the human system. Unthinkable complexity. Lines of light ranged in the non-space of the mind, clusters and constellations of data.'" WILLIAM GIBSON, NEUROMANCER 128 (New York: Berkely Publishing Group, 1989). *Cyberspace*, TECHTERMS.COM, http://www.techterms.com/definition/cyberspace (last visited Apr, 25, 2013).

[61] *See*, 1998 Intergovernmental Agreement on Space Station Cooperation, *available at* http://www.spacelaw.olemiss.edu/library/space/International_Agreements/Mulilateral/ISS_IGA/1998%20-%20Agreement%20Among%20Canada,%20ESA%20States,%20Japan,%20Russia,%20and%20the%20United.pdf (last visited Sept. 6, 2013) (signed on 29 January 1998 by fifteen governments involved in the Space Station project), & the Code of Conduct for the International Space Station, 14 C.F.R. §1214.403 (2012). For a joint discussion by governmental representatives of the U.S., Russia, Japan, and the Netherlands (ESA) dealing with preparations for humans beyond low Earth orbit, *see* K. Laurini, G. Karabadzhak, N. Satoh, & B. Huffenbach, *International Space Station (ISS)*

As noted, above, Dr. Lauria and the instant author co-authored an article that explored the impact of "cyberspace" and other forms of meta-technologies on existing jurisprudential concepts and various implementing regimes of positive laws, both of which are transitioning to a somewhat mysterious existence in outer space.[62] In this regard, Professor Clifford Nass, of Stanford University, studies the interactions of humans and machines, i.e., how humans regard and interact with computers as though the latter were living human beings.[63] In a recent interview, Nass observed that "[p]eople are more accepting now than they used to be of having technologies that are more richly and clearly social. They want personality, they want something that will joke or be more present."[64] When asked about the appearance and "nature" of human interactive technology, Nass observed that

> [i]t would have a human face (because people love human faces), a human voice and a very clear personality. It would be extroverted and friendly. It'd use a lot of vocal range and it would be highly expressive. It would encourage you to talk back to it in natural language. It would understand all the social rules—it would flatter, it would understand your emotions and it would respond with similar emotions. It would do things to make people feel like they were part of its team.[65]

The relevant significance of these observations rests with the growing recognition, and perhaps acceptance, that advanced

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Lessons Learned and their Influence on Preparations for Human Exploration Beyond Low Earth Orbit, *in* 62nd INT'L ASTRO. CONG. (Cape Town, SA, IAC-11.B3.2.1).

[62] *From Cyberspace to Outer Space*, *supra* note 50.

[63] Professor Nass is director of the Communication between Humans and Interactive Media (CHIMe) Lab. In a recent book with Corrina Yen, Prof. Nass asserts that his research shows humans interact with and treat their computers and similar technology as though they are humans, i.e., we empathize, argue, and form humanlike bonds with them. According to Nass, some humans even lie on occasion to their computers and other interactive technologies to protect their feelings. *See*, C. NASS & C. YEN, THE MAN WHO LIED TO HIS LAPTOP: WHAT MACHINES TEACH US ABOUT HUMAN RELATIONSHIPS (New York: Penguin/Current, 2010).

[64] Bianca Bosker, *Clifford Nass On "Seductive" Tech And Why You Treat Your Phone Like A Friend*, HUFFINGTON POST (Mar. 3, 2013), http://www.**huffingtonpost.com**/2013/03/03/clifford-nass_n_2792780.html.

[65] *Id*.

artificial intelligence *in extremis* may be reaching the point of biotechnologically independent personalities, resting in large part on traditional components of what constitutes a biological system, such as self-replication of which certain nanotechnology is capable, and metabolic activities, of which certain technologies may be considered to be more efficient and effective than that relied upon by traditional carbon based life forms. These types of technological and biotechnological advances seriously invoke the need to start addressing the issues of what constitutes transhumans and even independent, self-replicating and metabolizing life in the form of biotechnologically integrated post humans…descendants of *Homo sapiens sapiens* and perhaps even extraterrestrially originated life forms not descending from human*kind*. The principal issue in the post human context involves determining at what point and under what circumstances applicable jurisprudence and positive legal regimes must regard post humans as totally independent entities responding to a completely non-Earth oriented or generated jurisprudence, i.e., the concept of a universal Metalaw applicable to all life forms. The relevance of these seemingly science fiction issues and characterizations is 1) humans, as previously noted, may be considered close to creating transhumans (depending upon the rules of definition applied) and even post humans. The immediate issue in the context of the applicability of Metalaw principles to humans and their interactions with and among transhumans and post humans is whether and when those principles would apply, and under what circumstances. Further, the Metalaw component addressing what Andrew Haley referred to as the Interstellar Golden Rule might well apply to *permanent* off-Earth modern human inhabitants domiciled in near Earth orbits, such as the International Space Station, and ultimately in permanent habitats on other celestial bodies such as Earth's moon and Mars, etc. [66]

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[66] In the context of astronaut behavior under the influence of applied medical dictates and those of an alien, synthetic life support system, *see* A. Farand, *Astronauts' Behavior Onboard the International Space Station: Regulatory Framework*, *in* LEGAL AND ETHICAL FRAMEWORK FOR ASTRONAUTS IN SPACE SOJOURNS: PROCEEDINGS OF THE ECSL/ESA/IDEST/UNESCO SYMPOSIUM (House of UNESCO, Paris, Oct. 29 2004). Astronauts are subject to numerous variations in behavior patterns and abnormal medi-

C. Current Protection of Potential Solar System Extraterrestrial Habitats

A final observation regarding the potential applicability of Metalaw principles and the Interstellar Golden Rule relates to the current and serious issues regarding what is termed Planetary Protection in past and current domestic and international space exploration programs, i.e., procedures relating to outbound and back contamination potentials; particularly as they relate to compromising the search for extraterrestrial life.[67] At what point, for example, should a single cell or basic unit of organic life as it is presently understood, be considered one component of a larger entity that manifests some form or even critical component of whole-body "intelligence?" Much like the human body? Its hominid ancestors? And the components of Earth's biosphere that, through trial and error on the bush of evolution, resulted in sentient organic entities, perhaps even the next evolutionary step in that evolution embodied in biotechnologically integrated post humans? Are , for example, protohominids disfranchised from a human-recognized form of "intelligence?" Would *Homo neanderthalensis* be considered an intelligent "race" that is self-aware of its interim role in evolving sentient characteristics?[68] Is "intelligence," regardless of how de-

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cal conditions while under the influence of off-Earth space flight, such as decompression sickness, barotrauma, immunodeficiencies, loss of bone and muscle, loss of eyesight, orthostatic intolerance due to volume loss, sleep disturbances, and radiation injury, all of which influence otherwise normative value forming processes and behavior patterns while in space. For an excellent coverage of the significant changes to human morphophysiology and ultimate interpersonal behavioral values and patterns, *see* "Effect of space flight on the human body" at http://en.wikipedia.org/wiki/Effect_of_spaceflight_on_the_human_body.

[67] In this context, *see* NASA Policy Directive NPD8020.7G, Subject: Biological Contamination Control for Outbound and Inbound Planetary Spacecraft, in which it is stated that, "The Conduct of scientific investigations of possible extraterrestrial life forms, precursors, and remnants must not be jeopardized (effective until Nov. 25, 2013).

[68] *See, A Draft Sequence and Preliminary Analysis of the Neanderthal Genome*, *supra* note 31 (regarding the status of research on several Neanderthal genomes). One of the abiding issues for determination is whether an attempt ultimately should be made to use the results of the research to "re-create" a living Neanderthal specimen. Further, consistent with the basic principle underlying the concept of Metalaw, the question would be raised whether such a specimen would have the same protections as an intelligent, non-human extraterrestrial. Or perhaps it would fall under the various domestic

fined, the terminal result of all life-form evolution - individual or societally collective?

Answers to these questions, even attempts at answers to these questions, may, indeed, will, give serious pause to any application of a non-empirical assessment of "intelligence," "race," and the like, in the context of biological and biotechnological evolution. It certainly will give cause to reassess the "rules" of space exploration and, in particular, the seeking of extraterrestrial life forms, in the context of the ultimate dictate of all organic life genomes (i.e., competition for survival). Again, leaving aside some vague and non-empirically based humanistic understanding of "altruism" (of which many societies of lower orders of animals such as the common honey bee exhibit) words such as "moral," "ethical, and the like, that remain undefined in context of species or even specimen survival are no more than temporary physical safeguards for a biological society's survival in the face of competition. This reality is embraced in all jurisprudential concepts and implementing positive laws finding their origins and foundations in the dictates of an ever-evolving Natural Law Theory and dependent jurisprudential concepts and implementing positivisms (e.g., domestic legislation, multilateral agreements in the international arena, treaties, etc.). The consequence relative to Metalaw, and certainly the Interstellar Golden Rule, is that the integral components or principles of each are, at very best, in constant transition.

IV. A FINAL, YET INTERIM, REFERRING TO THE ROLE OF METALAW AND ITS PRINCIPLES APPLICABLE TO TRANSHUMANS AND POST HUMANS: CONCLUDING OBSERVATIONS

- To some, Metalaw is a tool that catalyzes the essence of *intra*species and, in context, *inter*species relations to ensure some form of empirically, but loosely, undefined "ethical" and "moral" behavior, a sense of "fairness," allowing biological societies to evolve or survive naturally without external interference. But more than that, Metalaw, with or without being recognized and accepted for what its component prin-

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and international laws protecting endangered species with indicia of recognizable "intelligence," such as the cetaceans, etc.

ciples are designed to accomplish, is the very essence of awareness of the dictates of humankind evolution and survival as a species, past, present, and into the future, with the descendants of Modern Humans. The steps toward the evolutionary future of evolving humans and the essence that *may* set this species apart from all others, could well be embodied in "virtuality," and the immediate and pragmatic consequences of this recognition of the nature and properties of "virtuality" may be seen in the legal confrontations between Earth-based jurisprudence and that perceived by some to embody those unique to cyberpersona functioning solely in cyberspace.

- The principle underlying the Interstellar Golden rule is a non-secular humanistic "faith." In this context, such a rule does not ensure the survivability of the best interim genome to continue the search for "purpose."

- Change just one component of the biochemical underpinnings of organic life and its evolution, and the consequences of survival - *meaningfu*l survival beyond the Anthropic Principle -flowing from application of Metalaw principles may well fail when confronted by the dictates of organic evolution; perhaps even the very dictates of Creation. In the end, Metalaw principles may well ensure the termination of biochemical evolution; or ensure the ongoing odyssey of humankind essence (to understand the what, why, and who of creation) in an as yet unfathomable form of biotechnological integration, or an incomprehensible form of pure technological sentience, true post humans.

- Metalaw was formulated to enhance the survivability of the pristine odyssey of humankind sentience in seeking to understand the components of, and reasons for, its existence. Therefore, leaving aside any non-biochemical definition of altruistic species and specimen behavior, the Interstellar Golden Rule as a component of Haley's Metalaw is intended either to discard survival and perpetuation functions of a specific genome, or ensure the survivability of a competitor genome by "doing unto others as they would have you do unto them." This is the underlying Natural Law construct for all space law, i.e., space jurisprudence and implementing positive laws.

- "The ability to migrate successfully to more survival-compatible environments is an inflexible biological dictate. Migration assumes many forms and is manifest in endless contexts. There is a great tendency for most policy-makers, legislators, and lawyers implementing those policies and laws to raise modern humans all too frequently substantially above their biological origins - their biochemical foundations [and evolutionary dictates towards survival, or extinction]. *For Homo sapiens sapiens* and its transhuman/post human descendants, space migration has become an impending critical dictate for survival, not only of the physical embodiment of the specieskind, but for what humans in currently understandable empirical ignorance refer to as 'human essence' or 'human nature.' "[69]

Again, in this context, the instant author notes that

- "[i]t is the unforgiveable tendency of domestic, international, and global policymakers to ignore the cosmic clock seemingly ticking with ever-increasing rapidity, and its interplay with the evolutionary progress of *Homo sapiens sapiens*…with modern humankind; and the ability of that steadily ticking clock to compromise the survivability of biological and biotechnological sentience of humankind abstract conceptualization/perception relating to the as yet empirically unknown. Time truly is of the essence [and the current analyses and compromising of the original definition of Metalaw throughout its transitional phases to reflect these biological/biotechnological realities of *Homos sapiens sapiens*, transhumans, and post humans hopefully will force a globally shared philosophic construct that these entities are first and foremost of concern to proponents of human space exploration, including the search for, and ultimately interaction with, extraterrestrial intelligence]."[70]

- A transhuman is defined in several different ways, but generally is considered a biotechnological or technological in-

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[69] *See* George Robinson, *Space Law, Secularism, and the Survival of Humankind "Essence"*, 2(1) J. OF SPACE PHIL. (Spring 2013).

[70] *See generally*, George Robinson, *End of the Humankind Odyssey? Explore, Discover, Migrate, Adjust, and Survive…or Become Extinct*, 3 J. *Space & Evolution*, http://www.eaglehill.us/subscriberSPAEVO/pdfs-policy-series/SPAEVO-policy-3.pdf.

termediary form between a human and the hypothetical (but perhaps not quite so hypothetical at this point in time) post human. Transhumans are considered significantly more than "wishful thinking" by serious scientists as well as "pseudo-scientists." Transhumanism is considered on the very threshold of giving rise to the next step in this form of human*kind* evolution, [71] i.e., the creation of advanced artificial intelligence *in extremis* with a variety of other biotechnological assets leading to independent accountability as a subspecies of *Homo sapien*s or, indeed an entirely new and independent species,a "post human." The critically important aspect of the high likelihood of post human descendants of humankind is the need to determine at what point such entities are truly independent of all aspects of their human forerunners/progenitors that they may be held independently accountable under Natural Law and implementing jurisprudence/positive law deriving from human societies or, indeed, other "intelligent" life forms subject to the prevailing principles embodied in Metalaw. If the post humans are permanent inhabitants of off-Earth space, then they must be treated as self-replicating and metabolizing extraterrestrials subject to whatever the prevailing and applicable dictates of Metalaw may be at the time of interaction with humans.

- A post human, for purposes of the present discussion, may be considered in general terms as the point of an entity becoming totally independent with independent accountability regarding decision-making and attendant activities… independent of the taxonomic characteristics of predecessor humans. Some would consider post humans to be more than just different from its human predecessor, i.e., designed for superiority in sentient and certain functionally operative capabilities.[72]

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[71] For an interesting, relatively early, discussion of the history of transhumanism, *see Transhuman History*, *in* NATASHA VITA-MORE, CREATE/RECREATE: THE 3RD MILLENNIAL CULTURE (2000), http://www.transhuman.org/transhistory.htm.

[72] For a variety of discussions and characterizations regarding the "nature" of post humans, *see* DAMIEN BRODERICK, THE SPIKE: HOW OUR LIVES ARE BEING TRANSFORMED BY RAPIDLY ADVANCING TECHNOLOGY (New York: Forge, 2001); N. KATHERINE HAYLES, HOW WE BECAME POST HUMAN: VIRTUAL BODIES IN CYBERNETICS, LITERATURE AND INFORMATICS (Chicago: Univ. of Chicago Press, 1999); & R. KURZWEIL, THE AGE OF SPIRITUAL MACHINES: WHEN COMPUTERS EXCEED HUMAN INTELLIGENCE (New York:

- "[i]n terms of conscious awareness and of sentient or abstract perception driving from the evolution of carbon based life, it may well be said that the universe, or creation, has found a way to know itself. And that is the purpose of ensuring survival of the human species and its biotechnologically enhanced descendants; of ensuring the survival of the essence or nature of human*kind* to continue the odyssey of knowing itself and its Creator . . . of, perhaps, *knowing* the Creator. Survival of the species or species*kind,* then, is the objective of all human formulated jurisprudence and implementing legal systems. That is the objective of 'ethics' and 'morality' behind the biological laws designed to enhance the search for extraterrestrial life."[73]

- "[T]he underlying empirical knowledge of why we must seek indicia of extraterrestrial life, current or paleobiotic (and even the abiotic conditions that may well give rise to incipient basic life forms) is critical to determining the best standards and practices for protecting against adverse environmental changes on Earth from these activities and also from harmful forward contamination potentials…Ignoring the empirically quantifiable aspects of the causes driving human behavior manifestations with which the policy makers, legislators, jurists, enforcement officials, and practicing lawyers must deal, will lead to false assumptions regarding human behavior and the laws needed to control that behavior toward an evolving species and its survival objective…."[74]

Viking Press, 1999). For an interesting very early observation regarding the evolution of the human mind, *see* Marquis de Condorcet (Marie Jean Antoine Nicholas Caritat), *The Future Progress of the Human Mind* (1795), *available at* http://www.fordham.edu/halsall/mod/condorcet-progress.html.

[73] *The Search for Biogenesis*, *supra* note 59, at 677 (2009).

[74] *Id.* at 682-683. It should be noted that the UN Committee on Space Research (COSPAR) has assumed a responsibility to conduct an assessment of the "ethics" and of the law relating to astrobiological research. In the United States, the Planetary Protection Committee of the Science Advisory Committee for the National Aeronautics and Space Administration, noted in its 2008 report that "[o]ne of the major science questions is whether life exists, or at one time existed, elsewhere in the universe . . . As we do so, we must assure that we do not undermine the scientific exploration by contamination with terrestrial organisms . . . Planetary protection…is an ethical obligation that is embodied in international agreements."(The report is on file at NASA in the Office of the Administrator.) While this obligation appears on the surface to be limited to safeguard-

Again, these views emphasize the need to define carefully a secular philosophic construct shared globally among all humankind that underlies the real evolved premise of Metalaw, i.e., the physical survivability of representatives of *Homo sapiens sapiens* and, more important, the survivability and evolution of the "essence" of the species that justifies its anthropocentric odyssey, and that of its transhuman and post human descendants, including the shoulders of its evolved single cell progenitors on the evolutionary bush upon which the human*kind* species stands. Metalaw is a secular jurisprudential concept in transition, the component principles of which, in their implementation, could ensure an empirically designed set of secular rules for humankind space exploration that, perhaps hopefully, might lead to the discovery of extraterrestrial life, "intelligent" or not. Some of the immediate issues that need to be addressed and explored include whether "intelligence" should be the defining factor; whether carbon based life should/will be the defining factor, and if sentience and abstract perception are or should be the defining factors of intelligence. And, finally, whether *Homo sapiens sapiens* and its transhuman and post human descendants are or should be the determining factor as to whether "interference" is acceptable, regardless of whether intelligent.

Metalaw, like all existing and future domestic and public/private international space law, must be based upon the underlying philosophic construct of survival of the "essence," of the purpose and reason, of and for *Homo sapiens sapiens* and its biotechnological and fully technological descendants. Metalaw must always be considered "a work in progress," and not be constrained by humanistic and non-empirically defined principles of "wishful thinking." Humanistic forms of "faith" must always support a realistic embodiment of Metalaw in constant transition…or *Homo sapiens sapiens* and its descendants may well be retired from their secular odysseys in search of reason and purpose, much in the manner that its hominid ancestors became extinct.

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ing NASA's search for extraterrestrial life, it is a critical component of assessing the applicability of certain principles set forth in the current version of Metalaw.

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