

Introduction:-

On September 12, 1962, almost 4 years after the Russians successfully launched their manned satellite Sputnik into earth's orbit, President John F. Kennedy declared "We choose to go to the moon". This speech launched the United States and Russian into a 17 year space race. While both nations pushed themselves to prove their scientific superiority, it became clear that legislation would be needed to mediate actions in the space surrounding our planet and its celestial bodies.

The UN took precedent in guiding this legislation and established the United Nations Committee on Apollo 11the Peaceful Uses of Outer Space. In 1979 the Moon Treaty was signed as the first piece of legislation to tackle the question of "who owns space". The treaty states that "All activities on the moon, including its exploration and use, shall be carried out in accordance with international law, in particular the Charter of the United Nations..."

As the "battle for space" began to calm down, plans for a collaborative space station were beginning to formulate. In 1998 the first piece of the International Space Station was launched into orbit. Its purpose was for scientific research and discovery and corporation between nations. Its current members include the United States, Canada, Japan, the Russian Federation, and the European Space Agency. With potential for scientific discoveries and innovative solutions, the United Nations negotiated the 1998 Agreement; which appoints NASA as head coordinator of activities on the station and appoints each nation jurisdiction over its own ISS constructed piece. The agreement also includes mention of intellectual property and possible prosecution for violation of ISSthese terms.

Current law regarding intellectual property is governed by the NASA Authorization Act of 2010. This legislation allows the discoverer to maintain intellectual property rights as long as experiments and procedures are approved by NASA. These contracts allow organizations to profit from their discoveries as long as these discoveries are also shared in completion with NASA with the potential for further use.

This system corresponds to the initial purpose of the ISS as a collaborative government research lab. Strict regulation on intellectual property protects the integrity of what the ISS stands for and helps prevent from government corruption But in recent years budget cuts and redirection of government spending has left NASA with the need to obtain technology from other resources. In the last year NASA awarded both SpaceX and Boeing contracts making them responsible for transportation of ISS crews. Private industry is the future of the space industry; however, incentivizing innovation will be crucial in fuelling this push.

Patent Problems:

Zero Gravity Solutions Inc is one company that is conducting research in the international space station for commercial purposes. Some of their most promising research is in microgravity planting, an industry already riddled with controversy over the ability to patent living organisms. Under terrestrial law, Zero Gravity would have rights to their plant patents for 20 years at moment of discovery. However according to space law, Zero Gravity Solutions only have a patents protecting them for 5 years. "It could take five years of research to get to the point where you have something you can patent," states Richard Godwin of Zero Gravity Solutions. Lines can also be blurred when getting to the details each discovery. Some discoveries are made in space, where space law takes precedent. The confusion begins when this data is either transmitted back to earth or experiments are transported back to earth. Although the majority of an experiment took place in space, does space law still govern if the data is compiled on the ground?

There is now a push for commercial companies to own exclusive rights of their discoveries and to extend patent rights past the 5 year mark. There is proposed legislation by NASA to solve this problem by providing commercial companies' exclusive rights but still also complying to NASA standards.

Although this is a step in the right direction, there is still opposition to NASA being involved in intellectual property rights at all. Capitalism purists believe that there should be no government involvement in private industry. Government standards will become less relevant as private industry paves it own path into Earth's orbit.

In this transitional period between government funded space exploration and commercialization of space, I believe it is hard to write a definitive law in regards to intellectual property in space. Terrestrial laws will constantly be disputed between the international community since space and celestial bodies are not "owned" by one particular power. I think a solution lies in the creation of an international extra-terrestrial patent filing system. Instead of conforming to NASA regulations, there should be an international committee responsible for the filing of space patents. Just like the Federation found in StarTrek, no one government entity should be responsible for space. The moral responsibility of space travel and space discovery is placed on all of humanity; individual governments should not be allowed to "own" pieces of the final frontier.

Public Law 114-90: Governing Commercialization & Space Resource Utilization

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Abstract

In November of 2015, the President signed into law a number of changes to current provisions in U.S. governance of space activities. The significance of these changes is still under discussion, but it appears clear that enough has been done to signal that substantial changes in space activities could be underway in the near future. Specifically, the new law makes modifications or additions to the following areas: Commercial space launches, commercial remote sensing, the Office of Space

Commerce (formerly Commercialization), and, perhaps most notably, the exploration and use of space resources. The material below is an attempt to summarize the major changes, explain the motivations of the current law, and examine the areas which will likely trigger the need to obtain a grasp on the role of practitioners, regulatory counsel, and academics moving forward.

Introduction & Historical Matter

On November 25th, 2015, President Obama signed into law a new stage in commercial space exploration. What began in the U.S. House as a series of proposed bills was consolidated into H.R. 2262, which was in turn passed by both the House and Senate with an eye towards reinvigorating, and in some ways, reinventing commercial space industries. The majority of Congress' efforts on what is now known as P.L. 114-90 concerned modifications and additions to Title 51 of the U.S. Code, most of which affected Subtitle V (Programs Targeting Commercial Opportunities) or Subtitle VII (Access to Space). Below, an effort is made to summarize and comment upon the most significant aspects of the recent law making, with emphasis on aspects most clearly relevant for practitioners and government counsel.

Spurring Private Aerospace Competitiveness and Entrepreneurship Act

The first Title to P.L. 114-90 focuses on changes to the commercial launch industry in the United States. The short title is the SPACE Act of 2015¹, conforming to the Congressional penchant for thematic statutory acronyms. The predominant goals of the SPACE Act seem to have been updating elements of the Commercial Space Launch Act to reflect new realities in the ongoing public-private partnerships defining modern U.S. commercial space launches, as well as updating the probable loss claim methodology that is employed for insurance acquisition purposes during launches.

The first provision of the SPACE Act concerned the insurance requirements that underlie every launch governed by the Commercial Space Launch Act. Specifically, the Act noted that it was the "sense of Congress" that an update to the calculations used in

H.R. 2262 Sec. 101.

Public Law 114-90: Governing Commercialization & Space Resource Utilization determining the "maximum probable loss from claims" arising under commercial space launch activities was necessary.

Such calculations had long been required under 51 U.S.C. § 50914, and were intended to provide a pool for compensating third parties who might be injured as a consequence of commercial space launch activities. With this Act, Congress wanted to ensure that the quantities obtained for insurance reflected what might actually be expected to impact the Federal Government, and that private launch providers would not be purchasing more insurance than was necessary. In other words, Congress had the intention on examining the efficiency of the insurance requirements and the calculations used to generate those numbers.

A second major change to then-current law included adding indemnification protection to "space flight participants", who previously did not benefit from the statutory scheme in the same way that the Government, contractors, and subcontractors could.⁴

Such a protection would presumably encourage future participation in commercial space launch activities by space flight participants. The SPACE Act also recognizes a critical deficiency in the current regulatory structure of United States commercial space activities—that the country lacks a clear commercial space authority. Yet, the Act attempts to partially redress this issue by directing the

Secretary of State, the Secretary of Transportation, the Administrator of NASA, and the heads of other “relevant” Federal agencies to work with the Director of Science and Technology Policy to determine what commercial space activities are currently or soon-to-be ongoing, as well as which agencies in the Federal government should be responsible for authorizing and supervising these activities—an action in conformity with obligations from Article VI of the Outer Space Treaty.⁵

There are several other points of note covered by the SPACE Act, but the last discussed here is the addition of a new concept to commercial space activities. It has been longstanding policy for the Federal Government to encourage private space companies to participate in space activities. Recent statements by the Government have revealed the intention to place astronauts into space by utilizing private sector transportation.⁶ The Act notes that NASA “has a need to fly government astronauts...within commercial launch vehicles....”

Apparently, this need has necessitated the creation of a new definition of such individuals, perhaps to distinguish them from the other crew or space flight participants engaged in commercial space

<http://www.nasa.gov/press/2014/september/nasa-chooses-american-companies-to-transport-us-astronauts-to-international>.

Public Law 114-90: Governing Commercialization & Space Resource Utilization activities. The Act describes Government astronauts as people who are designated by NASA, are carried in space launch vehicles during the course of their employment, and are Government employees (including military).

This section confirms both the dedication of the Federal Government to private commercial space activities, as well as the continued presence of traditional astronauts in ongoing and future space efforts. Commercial Remote Sensing

The second Title to P.L. 114-90 makes one significant addition to commercial remote sensing activities, and also requires a statutory update report be drafted and submitted to Congress. As for the addition, Subtitle III of 51 USC chapter 601 has had “annual reports” added to the Land Remote Sensing Policy. These reports are to be submitted to the Committee on Commerce, Science, and Transportation in the Senate, as well as the Committee on Science, Space, and Technology of the House.

The reports seem directed towards helping Congress to understand licensing efficiency for private space-based remote sensing systems. They should contain information on the number of licenses applied for in the previous calendar year, as well as a list of all of those applications granted; a list of denied applications and the reasons for said denials, and a list of applications that needed more information than initially provided.¹⁰ The new rules also allow for classified annexes to be provided when necessary for protection of sensitive information, and maintains that these reporting requirements will be sunset on September 30th of 2020. Finally, and perhaps most significantly for regulators, no later than one year after the enactment of the U.S. Commercial Space Launch Competitiveness Act, the Secretary of Commerce, along with other “appropriate” heads of federal agencies, must submit a report on the necessary changes to the statutes that affect licensing of private remote sensing systems.¹¹ This special report will take into consideration the needs of both the continuing U.S. leadership role in private remote sensing, as well as national security concerns.

Office of Space Commerce

Title III of P.L. 114-90 served to rename and clarify the role of the office within the Department of Commerce that is responsible for issues surrounding commercialization in space. The first task of this Title was to rename the “Office of Space Commercialization” to the Office of Space Commerce.¹³ For consistency, the change from “commercialization” to “commerce” is repeated in several sections of the previous rule. While the first change appears more cosmetic than impactful, the other major facet was an effort to give more substantial definition to the role and functions of the Office of Space Commerce. These additions to the law include: a mandate to “foster”

H.R. 2262-8, Sec. 112(c).

H.R. 2262-16, Sec. 201 (adding 51 U.S.C. § 60126(a)).

H.R. 2262-16, Sec. 201; see also 60126(1)(A-E)).

H.R. 2262-16, Sec. 202.

Id. 13 H.R. 2262-17, Title III Sec. 301(a)(1).

Public Law 114-90: Governing Commercialization & Space Resource Utilization good conditions for economic growth and the U.S. space industry; coordinating space commerce issues inside the Department of Commerce; to promote U.S. space commerce in negotiations with foreign countries; to help grow and advance U.S. geospatial technologies, including by working with interagency groups; and, finally, to assist the Federal Government with its ongoing efforts in developing space-based positioning, navigation, and timing (PNT) policy.¹⁴ In particular, ascertaining Congressional intent behind creating and promoting “good conditions” for space commercial technology would be of assistance to regulators and the Department of Commerce, who are now tasked with achieving these notable, if only partially defined, goals.

Space Resource Exploration and Utilization Act of 2015 Perhaps the most notable shift in space governance provided in H.R. 2262 was Title IV—Space Exploration and Resource Utilization. In principle, this section of the law added to Chapter V of Title 51.¹⁵ The final iteration of the bill had the short title, “Space Resource Exploration and Utilization Act of 2015” (SREU Act), and it represented the end product of years of effort and legislative attempts at creating a legal basis for utilization operations in outer space. Indeed, two previous incarnations of resource extraction bills were worked up in the House, one being the not-so-successful ASTEROIDS Act¹⁶ from the 113th Congress, and the other being H.R. 1508, a resource utilization bill mostly reflective of what was eventually passed into law when H.R. 2262 was signed.¹⁷ Ultimately, the majority of the language found in H.R. 1508 was adopted by Congress in H.R. 2262, with notable changes made to address concerns over definitions, harmful interference in space activities, and sovereignty over materials taken from locations in space. Of late, much has been made of the desires of entities in the United States interested in traveling to asteroids, mining them for resources, and then returning them to the Earth.¹⁸ Recognizing this, the reasons for Congressional action on space resource extraction, or “space mining” as it is colloquially termed, are myriad. In part, one can look to efforts by space resource corporate entities, such as Planetary Resources or Deep Space Industries. Such entities *raison d’être* is to explore space, find asteroids capable of providing economically or scientifically valuable resources, and to extract them. The continued growth of these businesses throughout the years, despite not having conducted mining operations yet, is evidence of their conviction that they

will have the authority, recognized under the law, to conduct their affairs in space. The Act gives credence to this belief, and may jumpstart actual operations. Furthermore, the Act sits readily with H.R. 2262-17, Title III Sec. 302.

51 U.S.C. §§ 51301-03.

“American Space Technology for Exploring Resource Opportunities in Deep Space Act”, H.R. 5063, 113th Congress.

H.R. 1508, 114th Congress (2nd Sess. 2014), “Space Resource Exploration and

Utilization Act of 2015”. 18 See, e.g., Mike Wall, Asteroid Mining May be a Reality by 2025, Aug. 11, 2015,

<http://www.space.com/30213-asteroid-mining-planetary-resources-2025.html>.

Public Law 114-90: Governing Commercialization & Space Resource Utilization longstanding United States space policy, which includes as a goal the commercialization of space activities—be they Shuttle payloads¹⁹, remote sensing activity²⁰, transport of materiel²¹ and personnel to space stations, and more²². Indeed, the CSLA was designed, in part, to encourage private entities to invest in and launch spacecraft, with the understanding that the law was shaped to protect said investment.²³ Given the generally amiable legislative efforts to increase the U.S.’s commercial presence in space, the SREU Act seems an understandable extension of the overall commercial policy. In any event, the language of the law does not indicate the primary drivers for these changes, so one is left to understand Congressional intent by an analysis of the SREU’s structure and language. Indeed, it is what is absent from the law that may be of the greatest interest to practitioners.

Ultimately, the SREU Act is a brief, yet substantial change to the law. It is divided into three sections, concerning in turn, “definitions”, “commercial exploration and commercial recovery”, and “asteroid resource and space resource rights”. The simplicity of the Act contrasts with the two previous generations of bills, since the ASTEROIDS Act and H.R. 1508 provided more detail and covered additional matters than the bill that was eventually enacted. Congress likely acted to remove certain controversial sections of the previous bills in order to ensure passage of the current law, as well as to be certain the most important features needed to start up the industry were recognized.

Structurally, the first piece of the Act gives definition to the terms relevant to space resource utilization. It defines an “asteroid resource” as a “space resource found on or within a single asteroid”.²⁴ It goes on to define “space resource” as any non-biological resource found “in situ” in outer space.²⁵ Furthermore, and of great potential utility to both U.S. Government efforts and private enterprises in space activities, both water and minerals are included in the concept of space resources.²⁶ The choice of words here seems deliberate, giving notice that the United States has no intention to claim, or allow 19 U.S. policy, in the mid-1980s, included using the Shuttle to fly commercial payloads, a goal that changed with the Challenger disaster; see Philip Boffey, Commercial Launching by NASA Ordered Shifted to Private Sector, N.Y. Times, Aug. 16, 1986,

<http://www.nytimes.com/1986/08/16/us/commercial-launching-by-nasa-orderedshifted-to-private-sector.html?pagewanted=all>.

See generally 15 C.F.R. Part 960.

Cheryl Warner & Stephanie Schierholz, NASA Awards International Space Station

Cargo Transport Contracts, Jan. 14, 2016, <http://www.nasa.gov/press-release/nasaawards-international-space-station-cargo-transport-contracts>.

See generally, National Space Policy of the United States of America, available at

https://www.whitehouse.gov/sites/default/files/national_space_policy_6-28-10.pdf. 23 51 U.S.C. § 50901, 50914-15.

24 H.R. 2262-18 (51301(1)).

25 H.R. 2262-18 (51301(2)(A)).

26 H.R. 2262-18 (51301(2)(B)).

Public Law 114-90: Governing Commercialization & Space Resource Utilization private actors to claim, any life forms discovered on other celestial bodies; additionally, by maintaining that the resources contemplated for use and extraction are “in situ” (rather than the asteroid itself), the Act may be countering fears that mining operations would be contrary to the prohibition on appropriation of celestial bodies enshrined in Article II of the Outer Space Treaty.

Congress has also directed the President, along with “appropriate” agencies, to encourage the develop of, and remove barriers to, the nascent space resources industry. First, this is done by discouraging any governmental barriers to the successful growth of an “economically viable, safe, and stable” space resource industry.²⁸ Congress also directed the President to go further, by actively facilitating the commercial exploration and recovery of space resources.²⁹ Taken together, these provisions call for strong governmental promotion of a new industry, which in turn will require the attention of regulatory counsel. In point of fact, the Act recognizes the need to identify which agencies are “appropriate” for the tasks set before the executive, and how they can share in the responsibilities necessary to effectuate the desired goals of Congress.

The final section of the Act gives the best hope to private space mining interests.

Section 51303 grants numerous property rights to industry entities that obtain in situ asteroid resources or space resources. The entitlement includes the right to own, sell, transport, and use the resources, with the only restriction being that these must be exercised within the laws of the United States.³¹ While this section of the Act is the shortest in length, it has the clearest implication for commercial operators in space, and provides guidance to practitioners and other counsel that are or will be involved in the evolution of space mining operations. The section, is, of course, not without its controversy, and government regulators are going to need to find a way to argue that these resources are within the purview of U.S. law, and that giving commercial entities access to and rights over such resources will not be an affront to international norms to which the United States is party. While the Act possibly represents a “game changer” for the industry, much remains to be determined before practical operations could commence. The SREU Act seemingly fails to provide for structural and practical enforcement of the rights contained therein. In contrast, ASTEROIDS and H.R. 1508 made significant strides in the direction practitioners would require in order to provide venue for redress of their clients’ needs. Indeed, previous versions of the Act opened up important possibilities for practitioners. One such instance was H.R. 1508’s subsection dedicated to providing civil action for Outer Space Treaty, *supra* note 5, at art. II.

H.R. 2262-18 (51302(a)(2)).

H.R. 2262-18 (51302(a)(1)).

H.R. 2262-18 see generally 51302 (b)(2).

H.R. 2262-18 (51303).

Outer Space Treaty, *supra* note 5, at art. II; see also 51 U.S.C. §51302(b)(1) on identifying authorities needed to maintain U.S. international obligations.

Public Law 114-90: Governing Commercialization & Space Resource Utilization instances of harmful interference with activities contemplated by the bill.

That outlet has been transformed to a much less comprehensive provision in the enacted bill. H.R. 1508 also provided clear and exclusive jurisdiction in the district courts of the United States for any actions arising under that bill. Now, we are left to speculate as to where entities (U.S. “citizens”, as noted by §51301(3)) will go, and under what circumstances, should they experience a disagreement unresolved through more amiable conflict resolution processes such as negotiation or consultation.

Future considerations for implementation of the law need to be addressed. Though the Act operates to encourage the development of a commercial exploration and utilization industry within the United States, it does not make clear which agency or agencies will have authority over such activities. The law directs the President to issue a report to Congress, no later than 180 days after enactment, which will identify the proper authorities for authorization and supervision—to comply with international obligations. Insofar as those obligations are concerned, Congress is recognizing the requirement from the Outer Space Treaty that the United States may allow private actors to operate in space, but only after maintaining international responsibility for such activities by authorizing and continuously supervising.³⁶ This outright inclusion of language found in a major international agreement may be a way of deflecting criticism of the Act as a unilateral proclamation on the part of the United States. Indeed, one possible reason the first generation utilization act (ASTEROIDs) stalled, is on the understanding that previous versions of the bill failed to fully address international concerns. Not only has Congress moved to clarify the U.S. role in international space activities, but domestically it has sought to identify, with specificity, which of its current agencies are capable of taking on new tasks.

H.R. 1508, *supra* note 17, proposed section 51303(c), “Civil Action for Relief From Harmful Interference—A United States Commercial Space Resource Utilization entity may bring a civil action for appropriate legal or equitable relief, or both, under this chapter for any action by another entity subject to United States jurisdiction causing harmful interference to its operations with respect to an asteroid resource utilization activity in outer space.”

Enabling entities to be free of “harmful interference” is now something the President will “promote”, along with the appropriate federal agencies. 51 U.S.C. § 51302(a)(3).

51 U.S.C. §51302(b)(1).

Outer Space Treaty, *supra* note 5, at art. VI.

See Hearing on H.R. 5063 Before the Subcommittee on Space of the Committee on Science, Space, and Technology, 133th Cong., 6. Among other statements, one expert noted that “the potential impact of this kind [of] legislation on the international treaties is likely to be sizeable. Disagreement should be expected as to this kind [of] legislation...the legal status of some of the issues contained in

the proposed Bill is unclear and the concomitant international politics are highly contentious.” (statement of Joanne Irene Gabrynowicz, Professor Emerita, University of Mississippi School of Law).

Public Law 114-90: Governing Commercialization & Space Resource Utilization Conclusions For all its importance in moving commercial space programs forward, the U.S. Commercial Space Launch Competitiveness Act is only a step in the road towards the realization of space exploration and utilization envisioned by the United States Congress. Yet, the Act has made significant strides in furthering commercial space launch goals, and has made an effort to recognize the role of private launch providers in both commercial and governmental activities. With its emphasis on increasing efficiency of launches, and in giving new direction to the Office of Space Commerce, the Act has shown that Congressional interest in the field has far from waned over the years. Finally, the Act has moved the United States into a leadership role vis-à-vis space mining operations, though it remains to be seen whether the provisions of the Space Resource Exploration and Utilization Act will stand up to rigorous analysis under the international space treaty regime. Moving forward, the government will have its work cut out for it to implement these substantial changes to extant law, and the input and participation of government counsel, regulators, and private practitioners will be critical to the success of these new changes.

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Private Commercialization of Space in an International Regime: A Proposal for a Space District

Zach Meyer

I. INTRODUCTION

The Soviet Union inaugurated the Space Age in 1957 with the launch of the first artificial satellite, Sputnik I, into the Earth's orbit. Human activity in space, once only a dream, had become reality. The hope for human advancement was immense. However, over the past five decades, the progress of the Space Age has not matched the measure of that hope.¹ National space agencies have slowly and inefficiently explored and developed the space frontier. But, the success of a recent private competition suggests a better channel for facilitating space exploration and development: private commercial enterprise.

In 1996, the X PRIZE Foundation teamed up with the Ansari family to sponsor a private prize competition. The Ansari X PRIZE awarded \$10 million to the first team to "build and launch a spacecraft capable of carrying three people to 100 kilometers above the earth's surface, twice within two weeks."³ Twenty-six teams from seven different countries competed for the Ansari X PRIZE, spending more than \$100 million combined.⁴ On October 4, 2004, the 47th anniversary of the launch of Sputnik I, a team named Scaled Composites, led by aerospace designer Burt Rutan and financier Paul Allen, won the competition with their spacecraft, SpaceShipOne.⁵ The accomplishment of this feat was even more impressive because of its relatively cheap price tag: the total financing required to develop the SpaceShipOne technology was a mere \$20 million. NASA has sent limited numbers of astronauts into space over the last five decades, including landing a dozen astronauts on the Moon.⁷ Other national space agencies have or are poised to develop the ability to send astronauts into space.⁸ However, private commercial space enterprise promises to be a more

powerful catalyst to the full development of the Space Age. Consider that NASA is due to retire its space shuttle fleet in 2010, leaving the national space agency without the ability to transport supplies or a crew to the International Space Station ("ISS").⁹ To cover this gap, NASA will temporarily rely on the Russian Space Agency's Soyuz rockets to fulfill its ISS commitments.¹⁰ In addition, NASA has awarded commercial contracts to Space Exploration Technologies Corporation and Orbital Sciences Corporation ("SpaceX") for the development of a domestic, commercial alternative to reliance on the Russians.

" SpaceX has been rapidly developing a new space vehicle capable of reaching high orbit, docking with the ISS, and transporting supplies and crew at a more reasonable cost and within a more concrete schedule than NASA's own proposed new space transportation architecture.¹² Through the X PRIZE Foundation Home Page, Ansari X PRIZE, *supra* note 2. ⁵ See *id.* SpaceShipOne was the vehicle that actually entered space and returned to Earth afterwards; the design used a twin turbojet named White Knight for the first stage of launch before the hybrid rocket, SpaceShipOne, executed the second stage of launch. (Reporting that China became the third nation to send a person into space in 2003); David Barboza, *Chinese Launch 3 Men toward Orbit; Country Attempting Its First Space Walk.*

Patrick Peterson, *Low Costs, High Hopes*, FLA. TODAY, Jan. 8, 2009, at 8C. ¹² *Id.* In its most recent budget proposal, the Obama Administration has proposed Private Commercialization of Space accomplishments of SpaceShipOne and SpaceX, private commercial space enterprise has made a case for itself as the best-suited candidate for pioneering the space frontier. However, certain problems are holding private commercial space enterprise back, including the current structure of space law, which leaves too much uncertainty for a private commercial space enterprise, in particular regarding property rights and profitability. Some commentators have suggested reforms to space law to remove that uncertainty, but most of these suggestions bend, dismiss, or call for wholesale abandonment of clearly applicable international law. This comment suggests a seed of a very different sort of reform that works within the confines of established international law: the international community could organize a space district tailored to encourage private commercial space enterprise, but exclusively regulated by international authority and consensus.

Part II of this comment addresses why exploration and development of outer space should occur and why private commercial space enterprise is the best suited channel for exploring and developing outer space. Part III describes the structure of international space law as it is relevant to private commercial space enterprise. Part IV discusses what the structure of international space law means for private commercial space enterprises and what private firms require from space law to be able to adequately participate in space enterprises. Part V presents other commentators' suggested reforms to the structure of space law to encourage the participation of private commercial space enterprise in exploring and developing outer space but generally rejects them for being notable departures from or rejections of established international law. Part VI offers a suggestion for developing space law that is consistent with established international law: the design and creation of a space district, to be administered to encourage the participation of private commercial enterprise in outer space but with due regard for the sensitivities of the international community. Part VII briefly concludes this comment.

II. EXPLORATION AND COMMERCIAL DEVELOPMENT OF OUTER SPACE

A. Why Explore and Develop: Advancement, Profit, and Benefit

There are many reasons to explore and develop space, including that to do so is a challenge sure to bring out both creativity and dedication in its pioneers. Beyond adventure and futurism, other concrete and more immediate reasons exist: scientific and industrial advancement, commercial profit, and social benefit. Completely abandoning NASA's "new space transportation architecture." It has yet to be seen if Congress will approve that measure.

The vacuum of space, the absence or reduction of gravity, and the extremes in temperature provide an ideal environment for the material processing necessary in many manufacturing industries, including metallurgy, pharmaceuticals, semiconductors, genetic engineering, and molecular electronics.¹³ The vacuum that exists in space permits enhanced or perfect crystallization of certain substances.¹⁴ Therefore, in space, the production of these substances can be accomplished much more efficiently than on Earth—seven hundred times more efficiently and four times more purely.¹⁵ These conditions make possible substantial scientific advances in the areas of medicine¹⁶ and pharmacology,¹⁷ and industrial advances in electronics,¹⁸ glass,¹⁹ and metallurgy.²⁰

Commercial profit is sure to attach to the above scientific and industrial advances as well. Cheaper drugs, electronic components, and building materials mean higher profits for those companies willing to invest in space. Furthermore, the construction of a space infrastructure would stimulate all levels of the economy.²¹ In fact, space exploration and development has already birthed a multi-billion dollar industry.²² Last decade's telecommunications boom spurred the initial development of a commercial space infrastructure: the building, launching, and maintaining the space industry has already generated spin-off innovations and technology, including "a new method for breast cancer detection . . . [and] the accelerated development of hospital monitoring devices and similar paramedic tools, heart pacemakers, and artificial skin." Id. Also, the space environment is especially conducive to the treatment of and rehabilitation from certain conditions. Microgravity could prevent bed sores and help chronic diseases affecting the nervous, cardiovascular, and respiratory systems. Further, the absence of gravity would all but eliminate gravity-dependent conditions like pneumonia and certain pulmonary conditions. Id. at 628-30.

Medicines prepared in space are purer; this is particularly useful when preparing nonallergenic medicines and effective antibiotics, vitamins, serums and vaccines. Id. at 628. ⁸ Space allows greater purity and uniformity of crystallization and allows for the better production of ceramic oxide (used in computer memories, optical communications, optoelectronics, and ultrasonic) and gallium arsenide (used for turning on computers). Id. at 630.

Glass produced in space "would be ultrapure."

Metals could be produced super hard, and at only half the weight of current metals.

So far, despite the current economic environment's lull and the talk of a need to "stimulate" the economy, the new administration of President Obama has said precious little on the economic potential of stimulating the space industry. This space industry is not necessarily led by the United States, either. In fact, since the United States retired its Expendable Rocket Launch Fleet, the European Space Agency has captured the majority of commercial launch contracts with Arianespace's Ariane rocket. Even previously third-world countries are now major competitors of communications satellites. And now the infrastructure is rapidly evolving to accommodate the newest visitors to space: tourists. ²⁴ "More space activity" translates into "more necessary infrastructure" and "more economic stimulus."

The potential for future commercial profit from developing space infrastructure will also depend on another imminent space activity—space mining. The minable resources located on the Moon and in

near-Earth asteroids are both immense and valuable. These extra-terrestrial resources are probably necessary to build a comprehensive space infrastructure: it simply costs too much to blast industrial materials in mass out of Earth's 26 gravity. Outer space need not be all about dollars and cents though. Great social benefit also attaches to the exploration and development of outer space. Notably, outer space may provide solutions to energy and hazardous waste problems here on Earth. As finite energy sources are slowly depleted here on Earth, it is extremely relevant that bountiful supplies of energy exist in outer space. Solar energy is in almost infinite supply, significant hydrocarbon deposits exist nearby,²⁸ and the fuel for ultra-clean fusion orbits the Earth.²⁹ Outer space also provides a possible answer for the problem of accumulating hazardous waste on Earth—simply eject it into the far recesses of space.³⁰ Importantly, both of the above resolutions to the proposed International Legal Regime for the Era of Private Commercial Utilization of Space, 37 GEO. WASH. INT'L L. REV. 745, 746

(2005) (arguing that the most lucrative motive for entering space is "the mining and utilization of near-Earth space resources that exist on the Moon and near-Earth asteroids (NEAs)").

Helium-3 is an isotope ideally suited for clean fusion power. The problem has always been that there is simply too little of the resource here on Earth. However, solar winds from the sun have deposited a large amount of the resource in the Moon's substrate. *Id.* 30 The disposal of nuclear waste and other hazardous materials is especially suited for ejection into space. See *id.* at 631. This proposed resolution is not above reproach: after all, just because it is "out of sight, out of mind" does not mean that the waste is really gone. Outer space may seem infinite, but perhaps more thought is required before just throwing out the garbage into what may someday become our own backyard.

Energy crisis and the hazardous waste problem could be of great social benefit to all people of Earth, whether they are citizens of space-faring States or not. Furthermore, an appropriate legal regime for the commercial development of outer space could also level the playing field and enable undeveloped States to compete with developed States, thereby promoting the social benefit of equality for Earth-bound States.

Space has, however, offered the scientific, industrial, commercial and social benefits discussed in Part II.A since the inception of the Space Age five decades ago. The difference between then and now is that space activity was once prohibitively expensive, so much so that only sovereign superpowers could entertain such activities. NASA served well when the only possible financier was the U.S. government, but now, space activity is far more affordable, and innovative business models can be realistically financed. Simply put, private commercial space enterprise can get the job done just as well as national space agencies, but more efficiently. Private commercial space enterprise also offers a uniquely egalitarian system by which undeveloped nations may benefit from the exploration and use of outer space as much as developed nations. As discussed in Part I, private commercial space enterprise has recently demonstrated that it is as capable as and arguably cheaper than national space agencies when it comes to exploring and developing outer space. SpaceShipOne, constructed in pursuit of the Ansari X-Prize, blasted off into space with three people onboard and subsequently returned safely twice in two weeks. Its financier, Microsoft co-founder Paul Allen, financed the project with a mere \$20 million—a far cry from the exorbitant costs of a NASA project.

After the success of SpaceShipOne, its designer, Burt Rutan, joined British billionaire entrepreneur Richard Branson to found Virgin Galactic, the world's first space liner company. ³⁴ Virgin Galactic has already presold seats onboard future space liners to tour space at the relatively meagre sum of \$200,000 per seat.³⁵ Customers are already lining up—Virgin Galactic has about 200 assured passengers, \$30 million in deposits, and about 85,000 registered interested customers.³⁶ Impatient

millionaires have instead taken up offers from the Russian government, and have paid \$20 million to hitch rides on Russian Soyuz rockets on trips to the ISS. These tourist enterprises are financing human space travel by tapping into the private market, a method never used by NASA. As Virgin Galactic and the Russian government have demonstrated, the private market is a willing financier for space enterprise if there is something to gain. Perhaps in hopes of mirroring the private commercial success of the XPrize, American millionaire entrepreneur Robert Bigelow announced his own \$50 million contest entitled America's Space Prize.³⁸ The Space Prize is substantially more ambitious than the X-Prize. To win the Space Prize, a team must construct and launch a space vehicle that can bring five persons into orbit around the Earth, dock and service an inflatable private space station, and return to Earth, twice in a given period.³⁹ Bigelow's company, Bigelow Aeronautics, purchased the technology and patent rights for the inflatable space station from NASA because NASA did not have the funding necessary to continue its research and development. ⁴⁰ Already, Bigelow Aerospace has successfully put two prototypes of the station, named Genesis I and II, into the Earth's orbit.⁴¹ Bigelow Aerospace plans to eventually use the final station for commercial purposes such as research, tourism, and industrial production.⁴² NASA has recognized the success of these commercial private space endeavours and joined the party, introducing its Centennial Challenges.

However, the challenges sponsored by NASA are relatively modest, generally featuring prizes under one million dollars." The major limitation on the size of the prizes is government funding. Private commercial space enterprise is a more egalitarian model although the Russian space tourism example may indicate that national space agencies can participate in the space tourist industry, given the extraordinary discrepancy in cost to tour space between Virgin Galactic and the Russian space agency, the example simply illustrates that there is a private market willing to pay for access to space.

National space agencies for exploring and developing space too. Private commerce has enabled undeveloped countries to compete with the major space-faring nations rather than depend on them. Also, while national space agencies serve the interests of their own citizenry, private commercial space enterprise can serve their shareholders, regardless of citizenry. Thus, an undeveloped nation may employ an international space enterprise whose shareholders are in part or in whole drawn from the citizenry of the nation. For example, consider Chile, which established the Chilean Space Agency ("CSA") in 2001. As recently as 2007, the CSA began entertaining bids from international space companies regarding an Earth observation satellite project.⁴⁶ Normally, the CSA would have to politely request and dutifully pay a space-faring State like the United States or Russia to develop and launch a satellite into orbit. In addition to offending state independence and sovereignty, those payments go into the pockets of the taxpayers of the space-faring State. However, the CSA's use of an international space company to implement its own space activities highlights how a robust commercial regime could bolster participation in space independent of the most developed space-faring States. Chile need not request a space-faring State to implement their own space activities if it can turn to a space company, and the payments to the space company could ostensibly be enjoyed by Chilean citizens that are shareholders in the international space company.

Despite the lucrative and beneficial reasons for further developing outer space, and the demonstrated ability of the private sector to do so, several hurdles face private commercial space enterprise—none insurmountable. One potentially high hurdle is the legal structure governing outer space.

III. SPACE LAW'S CURRENT STRUCTURE

A. International Law, Generally The legal structure for space law has its foundations in international treaties. The grandfather of all international space law is the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies ("Outer Space Treaty"), 47 signed and ratified in 1967. Four other international treaties from the 1960s and 1970s supplement the Outer Space Treaty: (1) the 46 See COMM. ON THE PEACEFUL USES OF OUTER SPACE, International Cooperation in the Peaceful Uses of Outer Space: Activities of Member States, ¶ 4, 9, U.N. Doc. A/AC.105/907/Add.2 (Mar. 13, 2008). Opened for signature Jan. 27, 1967, 18 U.S.T. 2410, 610 U.N.T.S. 205 [hereinafter OST], reprinted in United Nations Treaties and Principles on Outer Space, 3, U.N. Doc. A/AC.105/722 (1999), available at <http://www.1rt.mw.tum.de/documents/Referenzen/RFPolitik/UNO/UNTreaties.pdf> [hereinafter U.N. Treaties].

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Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched in Outer Space ("Rescue Treaty"); 48 (2) the Convention on International Liability for Damage Caused by Space Objects ("Liability Convention"); the Convention on Registration of Objects Launched into Outer Space ("Registration Convention"); the Agreement Governing the Activities of States on the Moon and Other Celestial Bodies ("Moon Treaty"). For the purpose of this comment, the Rescue Treaty is largely irrelevant. However, the other international instruments are relevant. Part III.B will discuss the Outer Space Treaty and the Moon Treaty together, because they have important implications for property and ownership rights in outer space. Part III.C will discuss the Liability Convention and Registration Convention together, because they constitute a more specific and actively used regulatory regime for outer space activities.

B. The Outer Space Treaty and Moon Treaty First, it should be clarified why the Moon Treaty should be discussed at all. Some commentators have simply dismissed the Moon Treaty as irrelevant because it has been accepted by only a limited number of States. But, truly, it is only the lack of a major space-faring State from the number of those States accepting the Moon Treaty that really motivates such

Other international treaties and agreements exist in addition to these five, but are tangential to this discussion of space commercialization. Among those other space law agreements are: (1) the Convention on the International Maritime Satellite Organization, opened for signature Sept. 3, 1976, 31 U.S.T. 1; and (2) the Agreement Among the Government of the United States of America, Governments of Member States of the European Space Agency, The Government of Japan, and the Government of Canada on Cooperation in the Detailed Design, Development, Operation, and Utilization of the Permanently Manned Civil Space Station, Sept. 29, 1988, State Dep't No. 92-65, 1992 WL 466295. 52 See, e.g., Twibell, *supra* note 13, at 597 (noting that as of January 1, 2008, only thirteen States have ratified the Moon Treaty (Austria, Australia, Belgium, Chile, Kazakhstan, Lebanon, Mexico, Morocco, the Netherlands, Pakistan, Peru, the Philippines, and Uruguay), and another four States have signed it (France, Guatemala, India, and Romania)); see also U.N. OFFICE FOR OUTER SPACE AFFAIRS [UNOOSA], Comm. on the Peaceful Uses of Outer Space, United Nations Treaties and Principles on Outer Space and Related General Assembly Resolution, Addendum, Status of International Agreements Relating to Activities in Outer Space as at 1 January 2008, at 2, U.N. Doc.

ST/SPACE/i/Rev.2/Add.1 (Jan. 1, 2008), available at http://www.unoosa.org/pdf/publications/STSPACE_11_Rev2_AddIE.pdf.

If the United States, Russia, or China either signed or ratified the Moon Treaty, surely those same commentators would think twice before dismissing the Moon Treaty as irrelevant. However, even by that standard of relevancy, the Moon Treaty is not permanently irrelevant. The company of space-faring States is increasing in size, and the club of major spacefaring States is not as exclusive as it once was. Even among those few States who ratified or signed the Moon Treaty, space-faring status is not necessarily so far removed. India, one of the signatories to the Moon Treaty, is aggressively developing its space-faring capabilities and there is no reason to think it will not succeed sometime soon. After all, China very quickly became a space-faring State once it similarly set out to develop space-faring capabilities.⁴ But even if the Moon Treaty is not specifically relevant, the principles of the Moon Treaty reflect principles latent in the Outer Space Treaty. Collectively, the Outer Space Treaty and Moon Treaty promote a legal regime seemingly inhospitable to the commercialization of outer space.

However, the two treaties do not prohibit the commercialization of outer space outright. Rather, the two treaties resist private ownership and appropriation, and even that resistance is not absolute. Ultimately, as will soon become apparent, the two treaties do permit the private ownership and appropriation necessary to commercialize space so long as international interests are given their due consideration. As a general observation, the Outer Space Treaty is steeped in the rhetoric of a "common interest of all mankind," especially expressing the concern that one part of "all mankind"-the less-developed States-will be left out of the exploration and use of outer space while the other part of "all mankind"-the developed States-will reap all the rewards of exploiting outer space.⁵⁵ Specifically, it declares that the exploration and use of outer space is to be conducted "for the benefit and in the interests of all countries ... and shall be the province of all mankind."⁵⁶ To that end, outer space is to "be free for exploration and use by all States without discrimination of any kind, on a basis of equality and in accordance with international law, and there shall be free access to all areas of celestial space

The Outer Space Treaty opens by recognizing "the common interest of all mankind" in exploring and using outer space for peaceful purposes, and stating "that the exploration and use of outer space should be carried on for the benefit of all peoples irrespective of the degree of their economic or scientific development." OST, *supra* note 47, opening statements. Later, the Outer Space Treaty asserts that States are to "be guided by the principle of cooperation and mutual assistance and shall conduct all their activities in outer space [and on celestial bodies] with due regard to the corresponding interests of all other States"

Given the notion of "free access," it is little surprise that neither outer space nor celestial bodies are "subject to national appropriation." However, this does not directly address non-national appropriations, i.e., supra-national activities by the international community or sub-national activities by individuals. As to sub-national activities, the signatory States are required to "bear international responsibility for national activities in outer space" and on celestial bodies, which includes activities conducted by governmental entities, non-governmental entities, or both.⁵⁹ If the activities are conducted by non-governmental entities, then the appropriate State must authorize and continuously supervise such activities. However, beyond authorization and supervision, there is no indication as to what this "responsibility" means for the extent of permitted sub-national appropriation.

The Moon Treaty generally echoes the Outer Space Treaty,⁶¹ but is also more extreme. While the Moon Treaty recognizes "the benefits which may be derived from the exploitation of the natural resources of the Moon and other celestial bodies," it protects those natural resources with rhetoric more potent than a common "interest." To wit, the Moon Treaty declares that those natural

resources "are the common heritage of mankind." 63 Is a "heritage" exploitable? If so, who can exploit it-"mankind?" How does an ideal like "mankind" exploit resources? It would appear from the text of the Moon Treaty that a "heritage" is exploitable only by "mankind" and that "mankind" is roughly translated into "an international consensus." That is, the Moon Treaty establishes a default rule generally prohibiting any exploitation of the natural resources of any celestial bodies in the solar system other than Earth," and then provides for two exceptions based on "Free access" is consistent with a prohibition of national appropriation. "Free access" is later substantiated: "[a]ll stations, installations, equipment and space vehicles on [celestial bodies] shall be open to representatives of other States on a basis of reciprocity."

For example: (1) the Moon Treaty is "determined to promote on the basis of equality the further development of cooperation among States in the exploration and use of... celestial bodies," Moon Treaty, supra note 51, opening statements; (2) the Moon Treaty states that "[t]he exploration and use of the Moon shall be the province of all mankind and shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development,"; (3) the Moon Treaty emphasizes international cooperation "with due regard to the corresponding interests of all other States," id art. 2; and (4) the Moon Treaty declares, "International cooperation in pursuance of this Agreement should be as wide as possible opening statements.

First and foremost, the Moon cannot be subject to national appropriation international consensus. First, celestial bodies in the solar system other than Earth and the Moon are no longer subject to the restrictions of the Moon Treaty if contrary "specific legal norms enter into force with respect to any of these celestial bodies."66 Second, if an appropriate international regime is created, then exploitation of the natural resources of celestial bodies may proceed.

According to the Moon Treaty, an appropriate international regime for regulating the exploitation of celestial natural resources need only fulfil four purposes: (1) "the orderly and safe development of the natural resources"; (2) "the rational management of those resources"; (3) "the expansion of opportunities in the use of those resources"; and (4) "[a]n equitable sharing" of the benefits of those resources giving "special consideration" to the "interests and needs of the undeveloped countries" and also "the efforts of those countries which have contributed either directly or indirectly to the exploration of the Moon." That international regime is supposed to be established "as such exploitation is about to become feasible."In synthesis, the Outer Space Treaty and the Moon Treaty do not prohibit private property rights or forbid exploitation of natural resources in space. The Outer Space Treaty only outright prohibits "national appropriation," not supra- or sub-national appropriation, and requires that outer space be explored and used to benefit the interests of "all mankind."

The notion of "free access" does not prohibit private property rights or exploitation, either, because there is no indication of the specified level of access-it could be free access to claim the property within an international regime or free access for scientific investigation, or perhaps it means the absence of a right to exclude. The first interpretation of "free access" is perhaps best in light of the Moon Treaty, because that treaty openly recognizes the benefits inherent in the exploitation of natural resources in para. 2. Second, the Moon's surface, subsurface, and natural resources cannot become the property of any State, entity, or person, whether international or national, private or public. Third, the provisions of the Moon Treaty apply to all celestial bodies in the solar system other than Earth. Id. art. 1, para. 1. Together, these three sections create a rule, but only a default rule because article 1, paragraph 1 and article 11, paragraph 3 can be abridged.

A third exception is built into the Moon Treaty, too: States may "use mineral and other substances of the Moon" to support scientific investigative missions exception does not rest on international consensus and instead suggests that any scientific investigation is inherently compatible with, even a logical extension of, some notion of the "mankind" authorized to appropriate from the "common heritage." Nevertheless, this is largely irrelevant to a private commercial space enterprise that wishes to appropriate property for profit, not scientific investigation space and even desires such exploitation. Thus, the two treaties together simply resist unilateral appropriation or exploitation. Instead, the two treaties envision a regime, created by international consensus, which will regulate such exploitation with due regard for the interests of not only developed nations but also undeveloped nations.

C. The Liability Convention and Registration Convention The Liability Convention and Registration Convention are different from both the Outer Space Treaty and the Moon Treaty. First, the Outer Space Treaty is a more general statement of principles governing outer space activity. The Liability Convention and Registration Convention are more topic-specific and detailed. Second, even though the Moon Treaty is also topic-specific and detailed like the Liability Convention and Registration Convention, the Moon Treaty is rarely applicable because the use and exploitation of the Moon is not a regular activity. By contrast, the Liability Convention and Registration Convention are regularly because the potential for damage caused by space objects and the need to register any space launch are regular activities, notably for the placement of communication satellites in the Earth's orbit.

The Liability Convention and the Registration Convention also differ from the Moon Treaty in another important respect: the Conventions are effective regulations because they are content-specific and are each accompanied by an authorized and duly established regime for administering the rules promulgated by their respective provisions. For example, the Liability Convention specifically holds States "absolutely liable . . . for damage caused by its space object . . ."7 and provides that claims regarding damage be presented through direct or indirect "diplomatic channels" 72 within one year of the claimant's actual knowledge. While the Liability Convention has not yet been actually invoked, it was used to threaten liability in the case of the Soviet Cosmos.

The threat of liability is, nevertheless, both a regular and an important issue. The Registration Convention is very clearly regularly applied, though. According to Article II, whenever "a space object is launched into Earth orbit or beyond, the launching State shall register the object."

If diplomatic channels fail, then an alternative is provided for in the form of a Claims Commission, composed of three members—one each selected by the two parties and the third by mutual agreement. If the parties cannot mutually agree on the third choice, either party may request the Secretary-General of the United Nations to appoint the third member. The Claims Commission then is to decide the merits of the claim and the the damage." Similarly, the Registration Convention specifically requires that a State register any space object launched by it "by means of an entry in an appropriate registry which it shall maintain," and report to the Secretary-General of the United Nations certain basic information regarding the space object, launch, and orbit. Furthermore, "[t]he Secretary-General of the United Nations shall maintain a Register in which the information furnished [by the launching States] shall be recorded." The Moon Treaty is relatively specific and accompanied by an authorized regime for administering its rules, but the authorized regime is neither satisfactorily described nor duly established.

IV. WHAT THE CURRENT STRUCTURE OF SPACE LAW MEANS FOR PRIVATE COMMERCIAL SPACE ENTERPRISE

A. What Private Commercial Space Enterprise Can and Cannot Do

The current structure of space law establishes some of the ground rules for the participation of private commercial space enterprise. First, private commercial space enterprise cannot be entirely selfish and ignore the international community. International law clearly requires international cooperation and consideration, especially with respect to undeveloped States. This suggests that an international commercial space enterprise may be better suited for space exploration and exploitation than a United States, Russian, or other national commercial space enterprise. The only question is whether the international activity envisioned by space law is public (i.e., a consortium of different national governments) or private (i.e., a consortium of different national individuals) or both.

Second, private commercial space enterprise probably can appropriate outer space and celestial bodies, but only in certain circumstances. While the Outer Space Treaty generally prohibits such appropriation, that prohibition is limited to "national" appropriation. Similarly, the Moon Treaty, where applicable, prohibits appropriation unless executed according to an international regime. The two treaties are policing not against appropriation per se, but against unilateral appropriation contrary to international interests and appropriate compensation, if any.

Of course, the Moon Treaty is not formally binding on the United States or other nations that have neither signed nor ratified it, but it could become binding if the nation eventually did sign and/or ratify it. For this comment, I have assumed that the Moon Treaty could be relevant to more forcefully argue that even if signed and/or ratified by the United States or other nations, it still would not prohibit private commercial appropriation.

Third, and most importantly, private commercial space enterprise can exploit the resources of the Moon, and eventually other celestial bodies in the solar system, provided that the enterprise does so according to an appropriately established international regime. The Moon Treaty permits the exploitation of natural resources from the celestial bodies in our solar system provided that an appropriate international regime governs the process. For the Moon, the most important requirement of such a regime is that there be an "equitable sharing" between developed active States and undeveloped passive States. For other celestial bodies, there need only be "specific legal norms" in place regarding the body. So long as an international consensus is established, private commercial space enterprise can indeed exploit the natural resources of the Moon and other celestial bodies.

B. What Private Commercial Space Enterprise Needs

As argued above, private commercial space enterprise is not prevented from participating in outer space activities or even from exploiting the natural resources of outer space. However, private commercial space enterprise has not exactly been given the keys to the Moon or any other celestial body, either. What private commercial space enterprise needs to effectively exploit outer space is for the international community to come together and to establish an international regime to govern the exploitation of outer space resources.

Such an international regime could take a number of different forms. The important thing to recognize is that the "equitable sharing" required of an international regime is not necessarily hostile to private commercialization. As the Moon Treaty readily admits, "equitable sharing" considers the

interests of two parties: those who directly or indirectly contribute to the exploitive activity and those who are unable to so. Nothing in the language of the Moon Treaty requires that there be a half-and-half split of any profit earned while exploiting outer space, nor any other sort of mechanical division. While it is ultimately up to international consensus to determine what sort of division is equitable, common sense dictates that the vast majority of the profits go to the parties that invested the time, risk, and money necessary to actually exploit outer space resources. That all the profits do not go to the investing parties seems a small price to exact to validate their authority to lay claim to those exploited resources.

V. SUGGESTED REFORMS

Other commentators have recognized the need to open up space exploration and exploitation to private commercial enterprise. While their suggested reforms are generally laudable, some are more desirable than others. The reforms least desirable are the ones that buck the clear intention of international law to prevent unilateral exploitation of outer space. Those reforms misunderstand international law's tolerance for private commercialization in outer space and ignore the possibility that the current structure may accommodate private commercial space enterprise without being bent or broken.

A potential barrier to private commercial space enterprise is the status of property rights in outer space. The Outer Space Treaty and Moon Treaty prohibit the establishment of any property rights regime in outer space unless subjected to the theory of a "common heritage of mankind."

According to Ty S. Twibell, the inability to appropriate stifles commercialization of outer space, because the lack of sovereignty means too much uncertainty exists." The rationale is as follows: any uncertainty of property ownership incapacitates private investors, because without the guarantee that appropriated property or developed intellectual property is their own to profit from or use, investors lack a motivation to participate in space-related activities.⁷⁹ Twibell is correct to identify uncertainty as a disincentive to private commercialization, but his suggested reforms are largely misguided because he interprets international law to effectively prohibit exploitation. However, as argued in Part IV.A and IV.B, international law considers exploitation desirable, and may permit private commercial enterprises to do the work so long as this is done according to an appropriate international regime. Twibell suggests that the Outer Space Treaty requires amendments to remove the non-appropriation language and the language of communal property. So if that stalls, he suggests that the United States act unilaterally "without the complexity and difficulties of passing new or amended international law." These are unnecessary reforms that ignore established international law, some of which the United States is legally bound to. International consensus should also not be ignored if the United States wishes for any validation of its authority in outer space. Twibell does make a third suggestion, however, which is more useful: applying the laws of offshore drilling to outer space mining could encourage private companies to begin mining operations.⁸² Claims for particular mining interests, once identified, would be enforceable in the international community according to the principles of reciprocity, and those claims would be strictly limited to the nearby area around the mining facilities. This resembles the sort of International space law and domestic law following it, prohibit appropriation of celestial property. It is this prohibition and the uncertainty in the limited property rights that stifle the commercialization and industrialization of outer space.

Twibell is not the only commentator concerned about the restrictions imposed on private commercial enterprise by the "common heritage of mankind" doctrine implicit in the Outer Space Treaty and explicit in the Moon Treaty. William Lee Andrews, III fears that the lack of private property in space could deter space settlers because at any time "earthbound governments could

determine that the settlement would better 'benefit all mankind' through some other use." 84 Jonathan Thomas has also roundly criticized the notion of a "common heritage of mankind," noting that States who spent the time and resources to explore and appropriate outer space resources would have to compensate States that spent nothing. However, the Andrews criticism presupposes that the language of "benefit all mankind" is completely open-ended, but international law actually envisions "all mankind" to be a consensus of sorts, and there is no reason to think that any spacefarers will be excluded from the consensus of "all mankind." 86 The Thomas criticism presupposes that an "equitable sharing" of outer space profits with non-contributing party is inconsistent with any conception of equity. However, equity is a broad concept that could and should embrace more than just the results of participation in outer space activities-it can and should encompass the reasons for not participating in outer space activities. It would not be unreasonable for the international community to conclude that an "equitable sharing" of outer space profits with non-participating parties, particularly non-developed nations, should amount to a nominal share. Besides, developed contributing parties would be receiving something valuable in return for sharing nominal profits-validation of their authority to exploit outer space.

Of course, no international regime has yet been composed to determine exactly what constitutes "equitable sharing." Such a regime should be created.

"[I]n outer space, unless a *corpus juris spatialis* changes, future colonists will never have traditional property rights and much like our ancestral American colonists, will be faced with taxation without representation."). Individual contributions of a State to the establishment of space exploration or celestial appropriation, under the Moon Treaty a noncontributing State will receive a benefit and an interest."). For a skeptical critique of the realizability of a "common heritage of mankind," ("While there is little past precedent to justify it, and little present sentiment to support it, the current *corpus juris spatialis* clings to the idea that in the future, humans will be able to share the resources of space in common.").

Whether such spacefarers might be under-represented rather than excluded in the determination of what is to benefit "all mankind" is a different concern and perhaps what Andrews was implying.

VI. A REFORM CONSISTENT WITH INTERNATIONAL LAW: AN INTERNATIONALLY AUTHORIZED SPACE DISTRICT

The international community should soon establish an appropriate international regime to govern the exploitation of outer space resources. Private commercial space enterprise is poised to explore, use, and develop outer space, the Moon, and other celestial bodies in our solar system, and private commercial space enterprise should be given the green light to do so-for their own profit and for the benefit of all mankind. That exploitive activity is only authorized if an appropriately established international regime governs the process, something that is not yet in place. Thus, because private commercial space enterprise is poised to and should exploit outer space, an international regime should be established. The important question is: "What sort of regime is desirable and is that regime possible?" To answer this, it is appropriate to begin with what the regime must do. It must (1) appeal to international consensus ("all mankind"); and (2) encourage private commercial space enterprise. The regime could come in many different sorts varying in degree from the rhetorical to the material. On the rhetorical extreme, the regime could be a document-either a constitution or a detailed treaty-that establishes what sort of exploitation may be done by whom in which places according to what processes for establishing claims, profits, and equitable sharing. On the material

extreme, the regime could be instituted by a living organization, composed of elected or appointed administrators, with the resources necessary to such governance at hand—chief and foremost, a judicial or arbitration facility.

Either sort of regime could be agreed upon by international consensus, and in fact in the past, both have been the subject of international consensus. The Moon Treaty itself is heavier on rhetoric, because it is totally absent of any administrative regime. The Liability Convention and Registration Convention, by contrast, are heavier on material, being accompanied by complete administrative regimes. Here, the material sort would better encourage private commercial space enterprise because the exploitation of outer space will require a flexible and responsive regime to accommodate the enterprises' developing needs. If a rhetorical regime were drafted, the Moon Treaty would perpetuate its own shortcomings. It would be unresponsive to developing needs and would require further amendment, elaboration, or interpretation to respond to private commercial space enterprise's needs as they come up. In the hope of encouraging discussion about what kind of material regime would best consider international interests while freely encouraging private commercial exploitation of outer space resources, I now suggest a skeleton for a potential international regime. Rather than settling for drafting another principled document, the international community could establish a more concrete, material regime in the form of a physical space district. This space district would be independent of any particular State sovereignty, instead of being dependent on an international consensus. Because the implementation of such a space district would be completely novel and its implications potentially far-ranging, the mere idea of such an international regime is indeed delicate. Notwithstanding those delicacies, an independent, international space district could potentially resolve the conflicts between developed space-faring States and undeveloped Earthbound States and between public sovereigns and private enterprise.

A space district, to be of any use, would first have to appeal to the international community. Developed space-faring States may resent the fact that the authority for exploiting outer space resources is subject to the discretions of undeveloped Earth-bound States, that their unique "right" to exploit, created and paid for by commitments to economic, scientific, and technological development, could be reduced to a "privilege" by those who have not made and paid for such commitments. Undeveloped Earth-bound States, on the other hand, may find it appealing that the developed spacefaring States are so restricted from unilaterally exploiting space to their own advantage. The key to making the space district appeal to all sides is to establish the space district in a manner of sovereign neutrality. Sovereign neutrality may perhaps be accomplished by having an international administration independent of particular sovereigns' influence govern the space district. That administration could perhaps be composed of a governance board of representatives of which half is appointed by certain member States of the United Nations and half is elected by all the member States. Or perhaps neutrality could be ensured by distinguishing participation in the space district by a certain kind of citizenship. That citizenship could resemble a sort of first "international citizenship," which could be either inclusive (a citizenship that can be maintained in addition to one's own original citizenship[s]) or exclusive (a citizenship that can be maintained only in alternative to one's own original citizenship[s]). That citizenship need not be structured as "international" either, if such an extension of citizenship is too novel and dramatic for too many national sovereigns. Less dramatic, although still novel in its own respect, would be to construct the citizenship as an altogether new citizenship independent of any other. That is, the international community would not be creating an international entity, but instead a new national entity created by the international community. After all, no rule states that a new nation can only be created by rebellion and secession—why not the peaceful creation of a nation, whose creation benefits all mankind? I will term this sort of "nation" as neither international nor exactly national, but instead

the politics of where such a space district would be established is indeed itself a high hurdle. However, if an international consensus is really a valuable and practical method for decision-making, then through this method the international community could eventually settle on a location for a space district that appeals to as many States as possible.

How a space district could benefit all mankind is an important issue to address too. After all, to comply with the principles inherent in the Outer Space Treaty and Moon Treaty, this space district must "equitably share" whatever profits or benefits exploitation of outer space produces. Whether the space district is structured as international or supra-national, it must maintain some sort of relationship with "all mankind." Particularly if the space district is structured as an international entity, the simplest way to relate the space district to the international community would be by taxes. The proceeds of a space-district-targeted tax would be subject to distribution in the international community with due regard for each sovereign's involvement in space exploitation and also the inability to be so involved.

If the space district is structured as a supra-national entity, the simplest way to relate the space district to the international community would be by corporate distributions.⁸⁸ That may be best affected by, in addition to offering a unique brand of citizenship, offering companies a unique brand of incorporation. The benefits and profits of exploiting outer space could be purposefully funneled through international space corporations authorized to operate in the space district. As long as shareholding status is freely open to all citizens of the world-or if only to citizens of the space district, as long as the space district's citizenship is open to all the world the citizens of any country, developed or undeveloped, would be freely able to invest in the exploitation of space and equitably receive a share of the returns.

In addition to being internationally appealing, a space district must also effectively encourage private commercial space enterprises to exploit outer space. Perhaps, most dramatically, the space district could be given exclusive rights to exploit the resources of outer space. Private commercial space enterprise would then necessarily flock to the space district to operate rather than in their national contexts, provided the space district regulated space enterprise as effectively as sovereign States.

A space district would also have benefits inherent in physical consolidation that could encourage private commercial space enterprise. Specifically, the infrastructure and governance of all aspects of the space industry could be consolidated. Satellites and space vehicles could be constructed, tested and evaluated, launched, tracked, and returned in the same location. And the governing regulatory authority could be there through the entire development, launch, and return process to ensure compliance.

But why would all space enterprise, private or otherwise, want to ⁸⁸ Taxes would not be appropriate here, as an international tax on a single targeted sovereign would hardly seem to advance international equality-it favours one sovereign at the cost of another's oppressive subjugation operate in a space district? Perhaps a very powerful reason would be tax incentives. If companies and individuals living and operating in the space district were tax-favoured, perhaps even tax-free, the space district could essentially serve as a space industry incubator-it would be a creative extension of zoning laws to incentivize a certain sort of development. While these are all merely suggestions, they aptly demonstrate how the structure of a space district could be very flexibly adapted to address the concerns of a diverse international community as well as of the private commercial community. It is my hope that the concept of a space district spurs the development of

an international regime to govern the private commercial exploitation of outer space. We can all benefit from this.

VII. CONCLUSION

Commercial participation in the space industry has recast the Space Race, once a public and national endeavour, as a private and commercial endeavour. Private commercial space enterprise is poised to cheaply, and ostensibly fairly, exploit many natural resources of outer space. Such exploitation is desirable because of the potential benefits exploitation would have for science, industry, commerce, and society. But international law does not encourage private commercial space enterprise to exploit outer space. However, international law does not prohibit exploitation. Instead, international law requires an international regime to be established to govern the process of exploitation, particularly to oversee the "equitable sharing" of the benefits. Other commentators have suggested major revision or abandonment of international law. But this would undermine international law, an unnecessary and undesirable result. Instead, an international regime can and should be established. A space district could potentially resolve many of the important problems confronting the establishment of such a regime.