SPACE IS GETTING CROWDED: THE LAWS GOVERNING THE NEW COMMERCIAL SPACE RACE

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I. Introduction

Following the fall of Nazi Germany, the United States of America (USA) and the United Soviet Socialist Republics (USSR) recruited former Nazi rocket scientists through clandestine missions.[1] Their original goals were to take Nazi weapons and use them for the allies.[2] When the first V-2 rocket hit London, lead scientist Wernher von Braun opined that his rocket worked perfectly, but it had simply landed on the wrong planet[3]. The United States recruited Von Braun to work on their own space program.[4] However, the Americans were beaten to space when, on October 4, 1957, the Soviet Union launched Sputnik 1 into low earth orbit.[5] The Soviet Union fired the starting gun, launching the space race. Sputnik 1 stayed in orbit around the Earth for about three months, with constant monitoring by earthbound radio operators.[6] Finally, on January 4, 1958, Sputnik 1 burned up while reentering Earth's atmosphere.[7]

Every year since 1957, Earth's sky has been filling up with space junk, ranging from astronauts' misplaced tools to derelict satellites in graveyard orbits.[8] After Sputnik's launch, North American Aerospace Defense Command (NORAD) began compiling a database of all known rocket launches and objects reaching orbit.[9]. As of 2017, the National Aeronautics and Space Administration (NASA) was tracking more than 500,000 pieces of debris in Earth's orbit.[10] Each piece of debris can travel up to 17,500 miles per hour, fast enough for even a tiny piece of debris to damage a satellite or spacecraft. [11]

In 1978, American astrophysicist Donald J. Kessler, first raised the issue of space junk accumulating in Earth's atmosphere with no reliable way to retrieve the debris.[12] He surmised that this accumulation could lead to higher and higher rates of collisions between objects, creating even

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[1] *Records of the Secretary of Defense*, NATIONAL ARCHIVES (last visited July 7, 2021), https://www.archives.gov/iwg/declassified-records/rg-330-defense-secretary.
[2] The Secret Operation to Bring Nazi Scientists to America, (last visited January 22, 2022), *https://www.npr.org/2014/02/15/275877755/the-secret-operation-to-bring-nazi-scientists-to-america*
[3] Alejandro De La Garza, How Historians are Reckoning with the Former Nazi Who Launched America's Space Program, TIME (July 18, 2019, 11:27 AM), https://time.com/5627637/nasa-nazi-von-braun/.
[4] *Id.*
[5] *NASA Space Science Data Coordinated Archive*, NASA, https://nssdc.gsfc.nasa.gov/nmc/spacecraft/display.action?id=1957-001B (last visited July 7, 2021).
[6] *Id.*
[7] *Id.*
[8] Jonathan C. McDowell, *General Catalog of Artificial Space Objects*, JONATHAN'S SPACE REPORT (last updated Oct. 22, 2021), https://planet4589.org/space/gcat/.
[9] *Space Trash and Satellites*, NOAA: SCIENCE ON A SPHERE (May 30, 2016), https://sos.noaa.gov/datasets/space-trash-and-satellites/.
[10] *Space Debris and Human Spacecraft*, NASA (last visited July 7, 2021), https://www.nasa.gov/mission_pages/station/news/orbital_debris.html.
[11] *Id.*
[12] Louis de Gouyon Matignon, *The Kessler Syndrome*, SPACE LEGAL ISSUES (March 27, 2019), https://www.spacelegalissues.com/space-law-the-kessler-syndrome/.

more debris, and ultimately restricting the United States spacecraft, satellites, or other space bound objects from being launched. [13] This was named Kessler Syndrome.[14]

In 1991, Mr. Kessler published "Collisional Cascading: The Limits of Population Growth in Low Earth Orbit."[15] Using previous studies by the United States Air Force about the creation of debris, he observed that most objects in the sky at the time were 1 kilogram (2.2 pounds) or heavier.[16] This type of impact would create further debris weighing 1 kilogram or more travelling at 17,500 miles per hour.[17] If the creation of these pieces is greater than their orbital decay[18], this could lead to situation where existing pieces of debris are more likely to cause even more debris to accumulate in the atmosphere more quickly than they can be destroyed.[19] This could create a field of unusable space around our planet, where no satellites, stations, or other vehicles could orbit without fear of disastrous collisions.[20] This could impact the everyday life of most of the world by reducing or eliminating current satellite communications, including satellite tv, internet, and GPS.

In the early days of space exploration, only governments and their direct agents had the ability to launch objects into space.[21] Today, however, more private companies are attempting to enter the space arena.[22] SpaceX began developing what it calls a satellite internet constellation in 2015.[23] On October 15, 2019, the United State Federal Communications Commission (FCC) submitted filings to the International Telecommunications Union on behalf of SpaceX to request approval for an additional 30,000 satellites in addition to its existing 12,000 approved satellites.[24] This singular satellite constellation would be five times more than the number of satellites ever launched.[25] However, SpaceX is not the only company looking to use space for commercial purposes. OneWeb, a company headquartered in London but with offices in the United States,

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[13] *Id*.
[14] *Id.*
[15] Donald J. Kessler, *Collisional Cascading: The Limits of Population Growth in Low Earth Orbit*, 11 ADV. SPACE RES. 12(63), 12(63) (1991).
[16] *Id.*
[17] *Id*.
[18] Orbital decay is the gradual decrease of a satellite's, space craft's, debris', tool's, etcetera distance between itself and the Earth typically caused by gravity and atmospheric drag. Atmospheric drag is the force exerted on an object by the Earth's atmosphere, typically causing it to slow down, allowing gravity to pull the object to the Earth's surface.
[19] Kessler, *supra* note 17, at 12(65)-(66).
[20] *Id.*
[21] The History of Space Exploration, https://www.nationalgeographic.org/article/history-space-exploration/.
[22] Matt Weinzierl & Mehak Sarang, *The Commercial Space Age is Here*, HARV. BUS. REV. (Feb. 12, 2021), https://hbr.org/2021/02/the-commercial-space-age-is-here.
[23] Melody Petersen, *Elon Musk and Richard Branson Invest in Satellite-Internet Ventures*, L.A. TIMES (Jan. 16, 2015, 5:21 AM), https://www.latimes.com/business/la-fi-satellite-entrepreneurs-20150117-story.html.
[24] Caleb Henry, *SpaceX Submits Paperwork for 30,000 More Starlink Satellites*, SPACENEWS (last updated Oct. 15, 2019), https://spacenews.com/spacex-submits-paperwork-for-30000-more-starlink-satellites/.
[25] *Id.*

petitioned the FCC for approval of a constellation with over 6,000 satellites.[26] The FCC granted Amazon approval to move forward with their "Project Kuiper", a constellation of 3,236 satellites in Low-Earth Orbit.[27] Additionally, operating under an apparent code name "GW," China has requested for nearly 13,000 satellites from the International Telecommunications Union to create a similar internet satellite constellation.[28]

This increased privatization of space puts pressure on existing governments to regulate this new market with old tools that may not be equipped to handle these new challenges. Additionally, private actors entering the space race represent a threat to everyone on Earth if not properly regulated and controlled, including the issue of space debris and its possible liability requirements. This comment looks at the existing international and domestic legal framework for commercial space exploration and attempts to recommend solutions to the legal challenges ahead.

II. International Legal Framework

Space is incredibly vast. It would be impossible for any single country to claim ownership of or to possess everything in our solar system, let alone all of space. To that effect, the United Nations has accepted five documents regarding the joint use of space by all countries, informally known as: The Outer Space Treaty, the Rescue Agreement, the Liability Convention, the Registration Convention, and the Moon Agreement.[29] The initial treaty laid a foundation, to which subsequent agreements and conventions have expanded on the concepts in the initial treaty.[30]

Unfortunately, none of these documents are very specific, but were created to foster an association of cooperation among all nations.[31] However, the current core issue regarding international laws of space is whether space is governed by the concept of "res communis" or "res nullis."[32] The current international framework of space law is governed by "res communis", or a desire that space should be declared a common heritage of mankind to be shared by everyone.[33] Because of the large amount of capital to reach space and the vast amount of resources available

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[26] *OneWeb Streamlines Constellation*, ONEWEB (Jan. 13, 2021), https://www.oneweb.world/media-center/oneweb-streamlines-constellation.

[27] *Amazon receives FCC approval for Project Kuiper satellite constellation*, AMAZON NEWS (July 30, 2020), https://www.aboutamazon.com/news/company-news/amazon-receives-fcc-approval-for-project-kuiper-satellite-constellation.

[28] Larry Press, *A New Chinese Broadband Satellite Constellation*, CIRCLEID (Oct. 2, 2020), https://www.circleid.com/posts/20201002-a-new-chinese-broadband-satellite-constellation/.

[29] *Space Law Treaties and Principles*, UN: OOSA (last visited July 7, 2021), https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties.html.

[30] Id.

[31] Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, Jan. 27, 1967, 18 UST 2410; 610 UNTS 205; 6 ILM 386 (1967) [hereinafter Outer Space Treaty].

[32] "Res Communis" means "a common thing" or in Louisiana civil law nomenclature see La. Civil Code Article 449: "Common things may not be owned by anyone. They are such as the air and the high seas that may be freely used by everyone." "Res nulius" is derived from private law whereby an object can be owned by possession but is currently ownerless.
Outer Space Treaty, *supra* note 32, at art. 1.

[33] Outer Space Treaty, *supra* note 32, at art. 1.

in space, there seems to be a push towards "res nullis" by private parties in space to claim this wealth. [34]

A. Outer Space Treaty

At the height of the space race, there were only two global powers with the ability to launch objects into space, the United States and the Soviet Union. However, the United States, the Soviet Union, and the United Kingdom anticipated that more countries would eventually make their way up to space. They opened a treaty for signatures to other nations that would eventually become the backbone for international space law, the "Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies."[35] This treaty is nicknamed the "Outer Space Treaty" (OST) and was signed and enacted in 1967.[36] It has 89 signatory nations and is based on the idea of "res communis;"[37] that space belongs to everyone and everyone has a duty to do no harm to the celestial bodies of our solar system and other people in space.[38]

The OST is relatively short at just 17 articles long.[39] For comparison, the Convention of the Law of the Sea - a set of rules governing the use of the world's oceans - is over three hundred articles long.[40] Despite its short length, the OST attempts to lay the groundwork for space exploration by any country on Earth.[41] However, because of its brevity, it leaves much for interpretation.[42] While the treaty is relatively short, the entire treaty is outside the scope of this comment, which will focus only on a few of the OST's articles relating to the current commercialization of space.

Articles one and two of the Outer Space Treaty exclude space and celestial bodies from ownership claims by sovereign nations.[43] Article one states that the exploration and use of outer space shall be accessible for the benefit and in the interests of all countries.[44] Additionally, outer space and the moon shall be free for exploration and use by all states without discrimination.[45] Article two states that outer space, including the moon, is not subject to national appropriation by claims of sovereignty, means of use or occupation, or by any other means.[46] A reading of these articles would seem to exempt asteroids, comets, planets, or moons from ownership rights by countries.[47] However, the treaty does not define the above celestial bodies and what those

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[34] Wian Erlank, *Rethinking Terra Nullius and Property Law in Space*, 18, no. 7 POTCHEFSTROOM ELEC. L. J. 2503, 2514 (2015).
[35] Outer Space Treaty, *supra* note 32.
[36] *Id.*
[37] *Id.;* United Nations Office for Disarmament Affairs*, https://treaties.unoda.org/t/outer_space.*
[38] Outer Space Treaty*, supra note 32.*
[39] *Id.*
[40] United Nations Convention on the Law of the Sea, Dec. 10, 1982, 1833 U.N.T.S. 397.
[41] Outer Space Treaty, *supra* note 32.
[42] *Id.*
[43] *Id.*
[44] *Id.* at art. 1.
[45] *Id*. at art. 1.
[46] Outer Space Treaty, *supra* note 32, at art. 2.
[47] *Id*. at art. 1-2.

designations include.[48] The wording of those articles is left intentionally vague so as to cast a wide net to potentially dissuade any possible ownership rights.[49]

Articles six and seven of the OST establish that every party to the treaty shall bear responsibility for their national activities in space, whether the activities are carried on by governmental agencies or non-governmental entities.[50] Parties to the treaty are required to supervise the activities of their particular non-government organizations in space.[51] Additionally, each state which is party to the treaty is liable for any damage they cause to another state that is also a party to the treaty.[52] This damage may include debris, satellites, or other items that may fall to Earth and damage the area of a country that is party to the treaty.[53] The term "non-government entities" seems to target private persons' or corporations' activities in space and make the parties' home countries liable for the party's actions.[54] Thus, Articles six and seven attempt to hold countries liable for the actions of any resident citizen non-state actor who causes damage to another actor, regardless of whether the responsible party acts on the government's behalf.[55]

Under to the context of Articles one and two, Articles six and seven seem to disallow private ownership of entire or specific parts of celestial bodies by any government or non-government entities.[56] Unfortunately, there is there is not a consensus on how to interpret the language of the treaty. For example, Ram Jakhu, professor at McGill University's Institute of Air and Space Law,[57] stated in an interview that "natural resources [in space] should not be allowed to be appropriated by anyone - states, private companies, or international organizations."[58] Mr. Jakhu asserts that the purpose insinuates that "there really shouldn't be any private property rights in outer space."[59] In contrast, Mr. Rickey Lee, an Australian lawyer who wrote his doctoral thesis on the property rights of outer space, takes a more literal approach to the OST.[60] Specifically, he states that the treaty only forbids appropriations of celestial bodies by nation stations because including private individuals in this prohibition forbid would make other provisions of the treaty redundant.[61] He cites an example where companies are already making for-profit use of space by launching satellites into orbit around the Earth.[62] This argument is only bolstered by the fact that

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[48] *Id.*
[49] *Id.*
[50] *Id.* at art. 6-7.
[51] Outer Space Treaty, *supra* note 32, at art. 6-7.
[52] *Id.*
[53] *Id.*
[54] *Id.*
[55] *Id.*
[56] Outer Space Treaty, *supra* note 32, at art. 6-7.
[57] *Curriculum Vitae: Ram S. Jakhu*, https://www.mcgill.ca/law/files/law/ram_jakhu_cv_2019.pdf (last visited July 7, 2021).
[58] *U.S. space-mining law seen leading to possible treaty violations*, CBC (last updated Nov. 27, 2015), https://www.cbc.ca/news/technology/space-mining-us-treaty-1.3339104.
[59] *Id.*
[60] Ricky Lee, *Article II of the Outer Space Treaty: Prohibition of State Sovereignty, Private Property Rights, or Both?*, 11 AUST. I.L.J. 128, 128-142 (2004).
[61] *Id.*
[62] *Id.*

there are a limited number of these orbits available for use, meaning by their nature, these orbits are limited and cannot be shared by everyone.[63]

For a more appropriate understanding of how ownership and property rights should work in space, we should look back to our planet's oceans. The Convention on the Law of the Sea broadly declares that the oceans are the common heritage of mankind and thus are exempt from appropriation.[64] Space and its celestial bodies, like the sea before it, should be considered res communis and immune from appropriation.[65] However, the sea's resources (e.g., fish) can be appropriated, and are considered res nullius.[66] In the same way, minerals and other valuable resources should be considered res nullius only to the extent that taking those resources does not destroy or substantially alter the intended celestial body.

Regardless of what articles one, two, six, and seven of the OST state, the United States Congress passed the Commercial Space Launch Competitiveness Act (CSLC) in 2015.[67] This update to United States (US) law explicitly allows US citizens and industries to "engage in the commercial exploration and exploitation of space resources."[68] The act's purpose seems to be to promote and specifically allow celestial mining of space objects, specifically the moon, asteroids, comets, or other items that may contain valuable resources such as precious metals or iron.[69] The US claims that this act does not violate the OST because the CSLC states that "the United States does not assert sovereignty, or sovereign or exclusive rights or jurisdiction over, or the ownership of, any celestial body."[70] Justification for the SPACE Act focuses on the specific language of Articles one and two which only mention governmental entities' claims of ownership while ignoring Articles six and seven, which make non-governmental entities liable for damages.[71] Further, it pushes the law of space further towards a "res nullius" interpretation in that potential resources are to be claimed by anyone who can get to space.

B. Rescue Agreement

The second document adopted by the UN, the "Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space," (casually known as the Rescue Agreement) is even shorter than the original Space Treaty at only seven articles in length.[72] The Rescue Agreement was ratified in 1968 and as of 2019, 98 states have signed the agreement.[73] As the name implies, the Rescue Agreement elaborates on article five and eight of the Outer Space Treaty by focusing on the process by which signing states are required to help or

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[63] Michael J. Finch, *Limited Space: Allocating the Geostationary Orbit*, 7 NW. J. INT'L L. & BUS. 788, 189 (1986).
[64] Convention on the Law of the Sea, Dec. 10, 1982, 1833 U.N.T.S. 397.
[65] *Id.*
[66] *Id.*
[67] U.S. Commercial Space Launch Competitiveness Act, 51 U.S.C. §§ 10101-51302 (2015).
[68] *Id.*
[69] *Id.*
[70] *Id.*
[71] *Id.*
[72] Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space, December 3, 1968, 19 U.S.T. 7570, 672 U.N.T.S. 119, 7 I.L.M. 149 (1968) [hereinafter Rescue Agreement].
[73] *Id.*

rescue other states' astronauts, satellites, or retrieve debris from a crash site, in the event of an accident.[74]

The Rescue Agreement Provides guidance for situations where space explorers or equipment fall into the lands or control of a nation that may be politically at odds with the persons' or equipment's origin.[75] The Rescue Agreement requires its signers to notify either the launching nation or make a public announcement that a spacecraft is in danger if they make such a discovery and take all possible steps to rescue the craft or crew and render them necessary assistance. Additionally, the rescuing nation must disclose all steps they are taking to the launching state and the UN secretary general and promptly return the craft and crew to the launching state as safely as they can.[76] While this agreement was passed to elaborate on certain articles in the Outer Space Treaty with the intent to ensure the safety of people and objects that get sent to space, it reaffirms the ownership rights of the people and objects that nations send to space by ensuring that objects originating from a certain nation are returned to their original nation.[77]

However, this agreement doesn't address an important issue – ownership of objects retrieved from space and brought back for scientific or economic purposes.[78] Are items retrieved from space included with this obligation to return space objects to their launching state? If we take a broad interpretation of this agreement in conjunction with Articles one and two of the OST[79], then one state could appropriate an object retrieved from space that lands in their territory even if it was acquired by another state because this agreement seems to only create an obligation to return objects from Earth launched into space, not objects retrieved from space. Additionally, because Articles one, two, six and seven of the OST (when considered together) possibly outlaw appropriation by all individuals, retrieval of space objects is even more perilous if the intent is to bring the space objects back to Earth, as the Rescue Agreement does not require the return of those captured space objects if they land outside of the launching nation.[80]

C. Liability Convention

1. General Framework

The Liability Convention, or the Convention on International Liability for Damage Caused by Space Objects, was ratified in 1972.[81] It is the longest of all of the international documents regarding the use of space by individuals and states at twenty-eight articles.[82] The concept of the convention can be inferred from the name, but generally the convention attempts to codify the rights, duties, and processes for one nation to request compensation for damages caused by another nation's activities in space.[83]

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[74] *Id.*
[75] *Id.*
[76] *Id.*
[77] Rescue Agreement, *supra* note 73.
[78] *Id.*
[79] *Id*.
[80] *See id*.; Rescue Agreement, *supra* note 73.
[81] Convention on International Liability for Damage Caused by Space Objects, Mar. 29, 1972, 24 U.S.T. 2389, 961 U.N.T.S. 13810 [hereinafter Convention on Liability].
[82] *Id.*
[83] *Id.* at 2391.

The first article lists definitions of exactly four terms used in the treaty: damage, launching, launching state, and space object.[84] Under the treaty, damage means, "loss of life, personal injury or other impairment of health; or loss of or damage to property of States or of persons, natural or juridical[85]. Launching is defined as both actually launching an object and the attempt to launch an object.[86] Finally, "space object" includes component parts of a space object as well as its launch vehicle and parts thereof.[87]

The second article of the convention addresses the issue of liability by holding launching states absolutely liable to pay compensation for damages caused by its space objects to the surface of the earth or to aircraft in flight.[88] Simply put, if a launching nation's satellite falls to earth and damages another nation in some way, the launching nation is absolutely liable for those damages.[89] However, Article three softens the liability requirement a bit. [90] If the damage is caused somewhere other than the earth's surface, the launching state is liable only if the damage can be attributed to the nation or persons acting on the nation's behalf.[91]

2. Problems Establishing Liability

Unfortunately, there are a few glaring holes regarding the establishment of liability of space activities.[92] The first problem is that the convention potentially removes liability from a responsible party and transfers it to the nation where the launch occurred.[93] With an increase in commercial activities in space, there is a proportionate escalation in potential liability for the large-scale structures in space.[94] Additionally, it creates the potential for companies to move their operations and launching facilities to less regulated countries to avoid oversight of their space activities.[95] This waiver of personal liability for the company in favor of liability for the launching nation is problematic because in the event of a collision on Earth from space debris, the launching country will be held absolutely liable for the damages, and the offending company will be free to leave the responsible nation without incurring any fault for the damage.[96] The commercialization

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[84] *Id*. at 2392.
[85] Convention on Liability, *supra* note 82.
[86] *Id at 2392.*
[87] *Id.*
[88] *Id.*
[89] *Id.*
[90] *Id.*
[91] *Id.*
[92] Convention on Liability, *supra* note 82, at 2392.
[93] *Id.* at 2394.
[94] Currently in the United States, the amount of liability exposure and any necessary insurance for any given space mission is determined by the Secretary of Transportation (relying on experts from the Office of Commercial Space Transportation and Federal Aviation Administration), experts in the field of commercial space exploration, and insurance providers. Originally this amount was $500 million in 1988, but there is no limit as of current law, only the amount required by the above listed experts. *See* Commercial Space Launch Act Amendments of 1988, Public Law 100-657, Sec. 16 (a)(1)(A), 102 Stat. 3900; *See* the U.S. Commercial Space Launch Competitiveness Act, Public Law 114–90, Nov. 25, 2015.
[95] Convention on Liability, *supra* note 82, at 2394.
[96] *Id.* at 2393.

of space makes it easier for companies to acquire capital and the technical ability for space launches. A company looking to shield itself from liability could create a separate company in a smaller country to launch from, placing the liability on the smaller country, who may not have the capital to pay in the event of such damages.

The second problem relates to the definitions or lack thereof for certain words and phrases. Article five states that when two or more states jointly launch a space object, they shall be jointly and severally liable for any damages caused.[97] A launching state that has paid compensation for damage shall have the right to present a claim for indemnification to other participants in the joint launching.[98] The previously mentioned OneWeb company set their launching facilities in the United States while being headquartered in the United Kingdom.[99] The convention does not define "joint launching."[100] Does OneWeb's establishment of their launching facilities in the US while being headquartered in the UK as a "joint launch" under the meaning of the treaty?[101] If this qualifies as a "joint launch," then any damages caused by OneWeb would render both the United States and the United Kingdom jointly and severally liable to a third nation.[102] To make matters worse, in March of 2020, OneWeb filed for Chapter 11 bankruptcy protection and laid off most of their employees.[103] While OneWeb's story seemingly has a happier ending,[104] its bankruptcy raises glaring issues. Who should be responsible for a private company's satellites if the company has dissolved or no longer exists? The Liability Agreement would place that responsibility on the launching nation.[105] But what would happen if the nation, such as the USSR or the other Soviet States, no longer exists?[106] The Agreement does not provide an answer to this question.

Another concern regarding the Liability Convention relates to its definition of "space objects."[107] Space objects are not outright defined in the Agreement, but the Agreement states that "space objects" include component parts of a space object as well as its launch vehicle and parts thereof.[108] The term "space objects" seem to point to man-made objects launched into space, not natural objects already in space.[109] The Liability Agreement seems to try to protect nations from the fall of rockets, satellites, or other parts of manmade objects that might fall down and cause

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[97] Convention on Liability, *supra* note 82, at 2394.
[98] *Id.*
[99] *Company*, ONEWEB (last visited Jul. 7, 2021), https://www.oneweb.world/company.
[100] Convention on Liability, *supra* note 82, at 2394.
[101] *Id.*
[102] *Id.*
[103] *OneWeb Files for Chapter 11 Bankruptcy Protections*, CALEB HENRY, (last visited Jan. 23, 2022), https://spacenews.com/oneweb-files-for-chapter-11-bankruptcy/.
[104] *OneWeb Successfully Emerges From Chapter 11, Announces New CEO and Recommences Satellite Launches*, ONEWEB (Nov. 20, 2020), https://www.oneweb.world/media-center/oneweb-successfully-emerges-from-chapter-11-announces-new-ceo-and-recommences-satellite-launches.
[105] Convention on Liability, *supra* note 82, at 2394.
[106] International law recognizes the Russian Federation as the successor state to the Soviet Union, so under international law, the Liability Convention remains in force for Russia. However, a successor state is allowed to denounce a treaty from its prior state under general international law. So, the question of liability of a potentially dissolved state is still a question.
[107] Convention on Liability, *supra* note 82.
[108] *Id.*
[109] *Id.*

damage to neighboring nations.[110] This convention does not contemplate the possibility of debris or "space objects" created from the mining of asteroids of other celestial bodies.[111]

On July 11, 2019, Japanese scientists with the Japan Aerospace Exploration Agency (JAXA) successfully landed a small asteroid explorer, the Hyabusa 2, on the asteroid, Ryuga.[112] The explorer successfully drilled into the asteroid and took samples of material.[113] Then, it sent the mined materials back to Earth for scientists to study.[114] Effectively, JAXA is the first group to have mined an asteroid, thus proving that it is possible.[115] Asteroids often contain metals such as iron, nickel, cobalt, and precious metals including platinum and gold.[116] Two companies, Planetary Resources and Deep Space Industries, were formed with the intention of scanning asteroids that are relatively close to the Earth for these desirable metals.[117] Their ultimate goal is to use automated systems to mine these asteroids and transport the materials to other locations in space or back to Earth on an as-needed basis.[118]

Legally, there is the question of liability regarding these mined materials. As discussed above, there is the issue of whether these mined materials can be owned by an individual.[119] Additionally, the Liability Agreement makes the launching nation absolutely liable for any damages to another country by the launching nations' space craft, launcher, or other man made object.[120] However, the core liability concern for this type of commercial enterprise what happens to the leftover debris created by the mining activities.[121] If not properly accounted for, small space debris created from asteroid mining could create a "debris stream" where the area of the mining makes it impossible for other nations to pass by without injury to their craft or equipment.[122] Worse, the current Liability Agreement does not assign responsibility for creating these streams

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[110] *Id*.
[111] *Id.*
[112] Yoko Wakatsuki & Ben Westcott, *Japan lands spacecraft on distant asteroid to collect samples*, CNN (last updated Jul. 11, 2019, 9:58 AM), https://www.cnn.com/2019/07/11/asia/japan-hayabusa-2-asteroid-intl-hnk.
[113] *Id.*
[114] Mike Wall, *Japanese space capsule carrying pristine asteroid samples lands in Australia*, SPACE.COM (Dec. 5, 2020), https://www.space.com/japan-hayabusa2-asteroid-samples-land-australia.
[115] *Id.*
[116] J. M. Brenan & W. F. McDonough, *Core formation and metal-silicate fractionation of osmium and iridium from gold*, NATURE GEOSCIENCE (Oct. 18, 2019), www.nature.com/naturegeoscience.
[117] *U.S. space-mining law seen leading to possible treaty violations*, CBC NEWS (last updated Nov. 27, 2015), https://www.cbc.ca/news/technology/space-mining-us-treaty-1.3339104.
[118] *Id.*
[119] The Outer Space Treaty, art. 1, 2, 5, and 6, 18 U.S.T. 2410 610 U.N.T.S. 205, 61 I.L.M. 386 (1967).
[120] Convention on Liability, *supra* note 82.
[121] Logan Fladeland et al., *Meteoroid Stream Formation Due to the Extraction of Space Resources from Asteroid*s, https://arxiv.org/ftp/arxiv/papers/1911/1911.12840.pdf, (last visited Jul. 7, 2021).
[122] *See id.*; *See supra* note 17.

of debris.[123] If another nation's probe, satellite, or craft is damaged by this space litter, there is currently no recourse for this other nation because the Liability Agreement defines "objects" as those that are man-made, not naturally occurring materials.[124]

In practice, the convention has only been used once. In 1978, a Soviet satellite, Cosmos 954, fell to Earth in the northwest of Canada.[125] This collision concerned the entire world because the satellite was equipped with a nuclear reactor, which could have posed a serious nuclear contamination of Canada.[126] The Canadian Armed Forces and the Atomic Energy Control Board of Canada launched a major search and recovery operation for the fallen satellite dubbed "Operation Morning Light."[127] The total costs incurred for the joint Canadian and American search and cleanup efforts were over fourteen million Canadian dollars.[128] However, Canada submitted a claim to the USSR for only six million dollars.[129] Their claim was partially based on the terms of the liability agreement and partially on general international law.[130] Instead of going through the procedure prescribed by the Liability Agreement, Russia negotiated through diplomatic channels and negotiated a settlement with Canada.[131] The settlement agreement was for three million dollars, less than a third of the total fourteen million Canadian dollars that Canada and the United States spent to clean up the radioactive satellite.[132] The Soviet Union claimed that it was not absolutely liable for damages to Canada because its satellite had been hit by another object, rendering it only partially liable under the Liability Convention.[133] But their argument in this incident to avoid full payment of the clean-up exposes an obvious flaw in the Liability Convention.[134] Should a country be absolutely liable for damage to another nation for the damage caused by their space object if another country's negligence caused the crash? The Liability Convention would seemingly hold the object's country absolutely liable while offering a form of comparative negligence to a country that could be described as the proximate cause of the collision. While the damage caused by the downed satellite was cleaned up and corrected for in this case, that might not be true every time.[135]

In 2009, two satellites, an Iridium satellite owned by an American company and Kosmos-2251, a derelict Russian military satellite, collided in low earth orbit above Siberia.[136] The Iridium satellite was still operational and in use for commercial purposes.[137] Kosmos-2251 had gone out

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[123] Convention on Liability, *supra* note 82.
[124] *Id.*
[125] Alexander F. Cohen, *Cosmos 954 and the International Law of Satellite Accidents*, 10 YALE J. INT'L L. 78, 78-80 (1984).
[126] *Id.*
[127] *Id*.
[128] *Id.*
[129] *Id*.
[130] *Id*.
[131] Cohen, *supra* note 127.
[132] *Id.*
[133] *Id*.
[134] *Id.*
[135] *Id.*
[136] U.S. Satellite Destroyed in Space Collision, Space.com, https://www.space.com/5542-satellite-destroyed-space-collision.html, (last visited July 7, 2021).
[137] *Id.*

of service in 1995, had no propulsion system, and had been abandoned as space junk.[138] The collision destroyed both satellites and created a total cataloged debris field of about 2500 pieces.[139] The resulting debris field threatened Chinese satellites in sun-synchronous orbits[140] and the International Space Station (ISS).[141] In March of 2011, the ISS had to perform a maneuver to avoid the debris field of the two satellites.[142] One year later, another piece of the satellite debris passed within 400 feet of the ISS, forcing the astronauts on the station to evacuate to two detachable escape crafts until the debris had passed.[143] As of 2020, no one has filed a claim through the Liability Convention for any damages suffered as a result of the satellite collision.

3. Intentional Destruction and Liability

The final problem with the Liability Convention is that it does not include any guidance on how to address the purposeful destruction of third-party property or human life in space.[144] In the late 1950s, the United States began testing Anti-Satellite Weapons or ASATs.[145] The USA conducted its first successful ASAT weapon test in 1985, but it terminated these weapon tests because the tests created hazardous debris in space.[146] However, they likely continued to develop these ASAT weapons in secret, as evidenced in 2008 when the US Navy successfully shot down a malfunctioning spy satellite using a ship-mounted missile.[147] China has also demonstrated their ability to intercept satellites; for example, they successfully used their own ASAT weapon to destroy one of their own weather satellites in 2007.[148] China's satellite destruction was the single biggest debris-generating event above the Earth.[149] The Liability Convention would theoretically impose strict liability on this type of behavior, however the intentional destruction of another

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[138] *Id.*
[139] *Id.*
[140] China on alert on U.S.-Russian Satellite Collision, Chinaview.en, https://web.archive.org/web/20090213132717/http://news.xinhuanet.com/english/2009-02/12/content_10809710.htm, (last visited July 7, 2021).
[141] International Space Station Again Dodges Debris, Orbital Debris Quarterly News published by National Aeronautics and Space Administration, Vol. 15, Issue 3, July 2011.
[142] *Id.*
[143] Astronauts evacuate the International Space Station during space debris close-call, https://news.yahoo.com/blogs/technology-blog/astronauts-evacuate-international-space-station-during-space-debris-005610186.html, (last visited October 31, 2021).
[144] *Supra* note 122.
[145] Eugene Saad and Adam Mount, Phd., *Air-Launched Ballistic Missiles*, Report from the FEDERATION OF AMERICAN SCIENTISTS, accessed through https://fas.org/wp-content/uploads/2019/11/FAS-ALBM.pdf, (last visited July 7, 2021).
[146] Paul Glenshaw, The First Space Ace, F-15 vs. Satellite, AIR AND SPACE MAGAZINE, April 2018.
[147] *Id.*
[148] *Id.*
[149] T.S. Kelso, *Analysis of the 2007 Chinese ASAT Test and the Impact of its Debris on the Space Environment*, Technical Paper, Advanced Maui Optical and Space Surveillance Technologies Conference.

nation's space objects could constitute an act of war, and so the Liability Convention may not have jurisdiction over this.[150]

The Liability Convention is the current backbone that structures liability claims. It is a solid foundation, but if we intend to engage in the large-scale commercialization of space, we will need to expand this convention to address the above issues.

D. Registration Convention

The Registration Convention, or the Convention on Registration of Objects Launched into Outer Space, was adopted in 1975.[151] It contains twelve relatively short articles which detail the procedure for tracking objects launched into space.[152] Specifically, it requires that launching nations provide: (a) the name of launching State or States; (b) an appropriate designator of the space object or its registration number; (c) the date and territory or the location of the launch; (d) the basic orbital parameters; and (e) the general function of the space object.[153] This convention's main focus is to allow scientists and researchers to track known space objects to prevent collisions before they happen however, it does not address issues following collisions.[154] Instead, it relies on the Liability Convention to assign duties after a collision.[155]

The most glaring issue with this document is that there are no penalties assigned to launching states or commercial entities that fail to register their space items. [156] This creates a system of registration based largely on an honor code with nothing to enforce the rules of registering space objects.[157] The drawbacks of this honor code system of registration can be seen in the previously discussed Cosmos 2251- Iridium 33 satellite collision.[158] The Iridium 33 satellite was not registered with the U.N. as required by the Registration Convention.[159] An American company licensed the Iridium 33 satellite through the American government but used a Russian rocket to launch it from a facility in Kazakhstan.[160] Under the Registration Convention, all three countries would be launching states responsible for registering the satellite, and under the Liability Convention, all three would be jointly and severally liable for any resulting damages.[161] But the satellite was not registered, and even though this issue highlighted the glaring lack of penalties against the responsible parties, no parties of the Registration Convention have made any efforts to assign punishments to guilty parties or amend the Convention to account for similar problems in

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[150] *Supra* note 122.
[151] Convention on Registration of Objects Launched into Outer Space, 28 U.S.T. 695, 1023 U.N.T.S. 15, 14 I.L.M. 43 (1975).
[152] *Id.*
[153] *Id.*
[154] *Id.*
[155] *Id.*
[156] *See* Convention on Registration of Objects Launched into Outer Space, 28 U.S.T. 695, 1023 U.N.T.S. 15, 14 I.L.M. 43 (1975).
[157] *Id.*
[158] Jakhu, Ram S., *Iridium-Cosmos Collision and its Implications for Space Operations*, Yearbook on Space Policy: 2008/20092010, pp. 254-275.
[159] *Id.*
[160] *Id.* at 255.
[161] *Id.*

the future.

E. Moon Agreement

1. General Framework

The Moon Agreement (The Agreement) is also known as the Agreement Governing the Activities of States on the Moon and Other Celestial Bodies.[162] It is the last document adopted by the U.N. and didn't come into force until 1984, eight years after the Registration Convention.[163] Again, it is relatively short, at only twenty-one articles long.[164] Additionally, only eighteen States have signed the treaty[165], with only one actively engaged in spaceflight or having any plans to pursue spaceflight. The Agreement describes who can access the Moon and other celestial bodies and restricts permitted parties to activities for scientific and noncommercial purposes.[166] By having the fewest signatories, this agreement is the least influential to international law regarding space, even though it has the potential to alleviate the most issues presented by the proliferation of commercial interests of space.[167]

The Agreement's first article Explicitly outlines the limits of the agreement's enforceability.[168] Specifically, the Agreement applies to the moon, other celestial bodies of our solar system (excluding Earth), and any orbits around the moon and other bodies.[169] However, it excludes extraterrestrial materials which reach the surface of the Earth by natural causes.[170] This article conveys that the treaty will govern every celestial object other than the Earth, which is overly broad under the best of circumstances.[171] Our solar system has eight bodies recognized as planets,[172] five dwarf planets,[173] over 200 recorded "natural satellites" or moons,"[174] and over 1

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[162] Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, 1363 U.N.T.S. 22, 18 I.L.M. 1434 (1979).
[163] *Id.*
[164] *Id.*
[165] The current eighteen states who have signed are Armenia, Australia, Austria, Belgium, Chile, Kazakhstan, Kuwait, Lebanon, Mexico, Morocco, Netherlands, Pakistan, Peru, Philippines, Saudi Arabia, Turkey, Uruguay, and Venezuela. Only India has an active space program. Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, *supra* note 165.
[166] *Id.*
[167] *Id.*
[168] *Id.*
[169] *Id.*
[170] *Id.*
[171] *Id.*
[172] Robert Roy Britt, Solar System Planets: Order of the 8 (or 9) Planets, SPACE.COM, https://www.space.com/16080-solar-system-planets.html (last visited July 7, 2021).
[173] Mike Wall, *Meet the Solar System's Dwarf Planets*, SPACE.COM
, https://www.space.com/12694-dwarf-planets-solar-system-tour-countdown.html (last visited July 7, 2021).
[174] *Planetary Satellite Physical Parameters*, (Oct. 27, 2021, 10:07 AM), https://ssd.jpl.nasa.gov.

million asteroids.[175] The first article of the Agreement asserts that The Agreement's jurisdiction is over every one of these bodies, except the Earth.[176]

The third and fourth articles restrict the use of the Moon to peaceful purposes.[177] They specifically restrict any threat or use of force or any other hostile act either on the Moon's surface or using the Moon to carry out such acts.[178] Articles three and four also forbid military bases, installations, or fortifications from being installed on the Moon or other celestial bodies.[179] Additionally, the articles go on to state that, generally, the exploration and use of the Moon shall be the province of all mankind and shall be carried out for the benefit of all countries, irrespective of their economic or scientific development.[180]

Finally, Article 11 states that the Moon and its natural resources are the common heritage of mankind, exempting the Moon from national appropriation by any claim of sovereignty.[181] Additionally, neither its surface or subsurface nor any part thereof shall become the property of any State, international governmental, or non-governmental organization.[182]

2. Problems and Concerns with the Moon Agreement

The Moon Agreement's central feature, and its largest vice preventing wider acceptance, is that the Moon Agreement would classify the Moon and all other celestial bodies as common objects, such as the air or high seas, not subject to private ownership.[183] The problem with trying to exclude private ownership of these bodies is that they are incredibly valuable; they are filled with natural resources.[184] For example, the smallest near-Earth asteroid, called 3554 Amun, is two kilometers in diameter.[185]The iron and nickel in Amun have a market value of about $8 trillion, the cobalt content adds another $6 trillion, and the platinum-group metals add another $6 trillion.[186] Beyond the economic implications of flooding the market with these materials, these figures illustrate the abundance of these materials available in asteroids. While it may be impractical to

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[175] *Overview Asteroids NASA Solar System Exploration*, NASA, https://solarsystem.nasa.gov/asteroids-comets-and-meteors/asteroids/overview/ (last visited July 7, 2021).

[176] Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, *supra* note 165.

[177] *Id.* at art. 3 – 4

[178] *Id.* at art. 3.

[179] *Id.*

[180] *Id.* at art. 4.

[181] *Id.* at art. 11.

[182] Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, *supra* note 165, at art. 11.

[183] *Id.*

[184] *See generally*, John S. Lewis, *Mining the Sky: Untold Riches from the Asteroids*, *Comets, and Planets* (1997).

[185] *Id.* at 112.

[186] *Id.*

send these resources back to Earth (however not outside the realm of possibility)[187], they could be refined and used for building other useful objects in space.[188]

Currently, the official position of the United States is that the Moon Agreement is not the correct framework to utilize space and its resources.[189] In 2020, President Donald Trump signed an executive order explicitly stating that the Moon agreement is not "an effective or necessary instrument to guide nation states regarding the promotion of commercial participation in the long-term exploration, scientific discovery, and use of the Moon, Mars, or other celestial bodies."[190]

With the high value of raw materials available in celestial objects, it seems that large-scale commercialization of space is a necessity for a growing space economy.[191] However, the current legal attitude is fairly laissez-faire. There are as many solutions to the problem of ownership as there are celestial bodies in our solar system. There is a middle ground between the manifest destiny of space and its resources being completely off-limits to commercial endeavors. A straightforward solution is to create a governing body that would grant a license to a country over a particular celestial object's resources without granting ownership of the object itself. The United Nations does something similar already regarding orbital paths of satellites and member nations with the International Telecommunication Union, as discussed in the following section.[192]

F. International Telecommunication Union

The International Telecommunication Union (ITU) began as the International Telegraph Union in 1865 to deal with issues regarding the international standards for the technology of the telegraph.[193] The ITU was created to universalize equipment to transmit messages across national borders so that operators did not need to alter messages to comply with different transmission systems.[194] They worked with governments and private businesses to standardize the equipment, operating instructions, and accounting rules for the operating of telegraphs.[195] As technology changed and improved, the ITU changed and improved as well. For example, the telephone was patented in 1885, however, calls had to go over cables, and these lines were limited.[196] In order to

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[187] Mike Wall, *Japanese space capsule carrying pristine asteroid samples lands in Australia,* SPACE.COM, https://www.space.com/japan-hayabusa2-asteroid-samples-land-australia, (last visited July 7, 2021).
[188] Mark Sonter, *Asteroid Mining: Key to the Space Economy*, SPACE.COM, https://www.space.com/2032-asteroid-mining-key-space-economy.html, (last visited July 7, 2021).
[189] *Executive Order on Encouraging International Support for the Recovery and Use of Space Resources* (Apr. 6, 2020) https://trumpwhitehouse.archives.gov/presidential-actions/executive-order-encouraging-international-support-recovery-use-space-resources/, (last visited July 7, 2021).
[190] *Id.*
[191] *See* Sonter, *supra*, note 191, at 26.

[192] *Overview of ITU's History (1),* https://www.itu.int/en/history/Pages/ITUsHistory.aspx, (last visited July 7, 2021).
[193] *Id.*
[194] *Id.*
[195] *Id.*
[196] *Id.*

prevent any one country or group from monopolizing the telephone lines, the ITU drew up regulations for its members: the length of any call was to be limited to ten minutes if there were other requests to use the telephone line.[197] Over time, more technologies were introduced to their purview as well, most notably the radio.[198] To signal that they were responsible for more than just telegraph communications, the ITU officially changed its name to the International Telecommunications Union in 1934.**[199]** Finally, in 1949, the United Nations recognized the ITU as the specialized agency for regulating the broad and relatively new field of telecommunications.[200]

The ITU, using the information required by the Registration Convention, keeps track of satellites and other objects in space.[201] In the same way that there were limited telephone and telegraph lines in the 1800s, there are currently limited numbers of radio frequencies and satellite orbits.[202] The most prime real estate in the sky is geostationary orbit because the speed of the orbit allows the satellite to appear in a fixed position in the sky, allowing them to ensure continuous service.[203] However, to avoid collisions, the geostationary spots are limited to one thousand and eight hundred because there needs to be a distance of at least one thousand kilometers between each spot.[204] Allocation of these spots are given on a first-come, first-served basis and do not cost anything to reserve.[205] While this allocation does not confer rights of ownership of this orbital position to the filer, the filer has the option to refile for the same orbital position, essentially "reserving" the orbital spot indefinitely.[206]

The problems with this legal framework should be obvious. No previous space law confers actual ownership to any organization. However, as long as the organization continuously applies for its own orbital position, it will receive it.[207] The ITU grants de facto ownership of the orbital position as long as the organization complies with the bureaucratic requirements.[208] This goes against the current international legal framework whereby space is a common thing for all mankind.[209] Current law envisions space as an endless ocean where two passing ships can give each other room to pass without any interference.[210] And while that may be true for deep space,

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197 *Id.*
198 Overview of ITU's History (3), https://www.itu.int/en/history/Pages/ITUsHistory-page-3.aspx, (last visited July 7, 2021).
199 *Id.*
200 *Id.*
201 *ITU-R: Managing the radio-frequency spectrum for the world,* ITU- COMMITTED TO CONNECTING THE WORLD, https://www.itu.int/en/mediacentre/backgrounders/Pages/itu-r-managing-the-radio-frequency-spectrum-for-the-world.aspx, (last visited July 7, 2021).
202 Louis de Gouyon Matignon, *Orbital Slots and Space Congestion*, SPACE LEGAL ISSUES, https://www.spacelegalissues.com/orbital-slots-and-space-congestion/, (last visited July 7, 2021).
203 *Id.*
204 *Id.*
205 *Id.*
206 *Id.*
207 *Id.*
208 *Id.*
209 *See* The Outer Space Treaty, 18 U.S.T. 2410 610 U.N.T.S. 205, 61 I.L.M. 386 (1967).
210 *See Id.*

real estate of the celestial bodies and the best orbitals around them is limited.[211] A fairer option could be to treat the orbitals or other celestial bodies to leases, whereby a person, country, or organization would lease the area for a fee depending on its use. This leasing system could be progressive in that it could be more expensive for higher value commercial purposes and less so for scientific purposes that would not generate as much (if any) money from its use. In addition, to leases, we could put limits on the number of times that any one company or country could reserve an orbital position. Right now, the operational lifetime of a satellite in geostationary orbit is about fifteen years,[212] so a single refiling of the orbit would limit any one person, group, or country to a period of thirty years. This would give that company or country ample time to make money or conduct any experiments they would like to, while also ensuring that there is space available for another country when or if they choose to launch an object into space.

Similar to the problems with limited orbitals, there is limited space on asteroids or other celestial objects. It may be fair to simply say that some objects are off-limits to commercial enterprises, such as the Moon, instead of restricting business from all celestial objects. A leasing system should be created where anyone can request the rights to the natural resources of a specific celestial object (asteroid, comet, etc.), excluding culturally significant objects, such as the Moon. This kind of leasing system is already in place in the United States for things like mining for natural resources or for harvesting oysters in Louisiana.[213]

III. United States Framework

The United States is a pioneer in space travel. In that regard, the United States has recognized that the future of space exploration will include commercial ventures.[214] The problem with that mindset is that space exploration requires us to solve new problems that require a high degree of technical understanding,[215] however the United States is moving forward using an outdated framework.[216]

A. The Advent of Commercial Space Travel in the United States

The Commercial space sector of the United States began roughly in the 1970s with the launching of satellites for communications.[217] In order to launch, a company would need to contract with NASA to launch their payloads, and in turn, NASA would contract with one of four companies to build an expendable launch vehicle for the original company to launch their satellite.[218] The United States government (through NASA) was the only provider of launch

[211] Matignon, *supra*, note 205, at 27.
[212] *Id.*
[213] *See* 30 U.S.C.A. §181; La. Rev. Stat. §56-424 (2014).
[214] Pub. L. No. 114–90, 129 Stat. 704 (2015).
[215] *See* Matt Weinzerl & Mehak Sarang, *The Commercial Space Age Is Here*, HARV. BUS. REV. (Feb. 21, 2021), https://hbr.org/2021/02/the-commercial-space-age-is-here, (last visited
[216] *About the Office of Commercial Space Transportation*, FEDERAL AVIATION ADMINISTRATION, https://www.faa.gov/about/office_org/headquarters_offices/ast/ (last visited July 7, 2021).
[217] *Origins of the Commercial Space Industry*, FEDERAL AVIATION ADMINISTRATION, https://www.faa.gov/about/history/milestones/media/Commercial_Space_Industry.pdf (last visited July 7, 2021).
[218] *Id.*

services to western companies.[219] However, in 1982, Space Services Inc. of America (SSIA) launched the first completely private rocket.[220] This launch required the approval of the U.S. Department of State, the Bureau of Alcohol, Tobacco, and Firearms, the Federal Aviation Administration, the Federal Communications Commission, NASA, and various elements of the Department of Defense.[221] At the time, there was no formal or informal U.S. policy or legislation that would cover this activity.[222] In response to this launch and pressure from President Ronald Reagan, Congress passed the Commercial Space Launch Act of 1984.[223] Its stated goal was to streamline the process for commercial activity in space, directly related to satellite launches, by creating the Office of Commercial Space Exploration (AST) to oversee commercial activity in space.[224] The AST was assigned to the Department of Transportation (DOT).[225] Even though this act has been amended twice, the Department of Transportation still oversees private commercial launches through the Federal Aviation Administration (FAA).[226]

B. Addressing Liability, or Rather Not Addressing It

As previously stated, the initial Commercial Space Launch Act's goal was to make it easier for private companies to engage in commercial space flight.[227] However, the original 1984 act did address the issue of liability, only that the Secretary of Transportation may require that a company purchase liability insurance.[228] This was updated in the 1988 Amendment, but only regarding the limits of liability insurance that a company would be required to purchase to indemnify themselves against any particular claim.[229] The largest problem with this amendment to the 1984 Act is that it doesn't define companies' liability to pay insurance.[230] The Liability Convention provides a standard of strict liability for any injury or damage caused by a space object to a person or object on the surface of the Earth.[231] However, this standard of liability is not confirmed in this update to United States space law.[232] Because there is no presumption of absolute or strict liability granted by a federal statute, presumably, a United States citizen would need to initiate a lawsuit in federal court and prove negligence from either a private company and/or from one of the licensing federal agencies. A party from another country that is injured by a launch from the United States would

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[219] *Id.*
[220] *The launch of Conestoga 1*, SPACE SERVICES INC OF AMERICA, https://www.spaceservicesinc.com/conestoga-1 (last visited July 7, 2021).
[221] *Id.*
[222] *Id.*
[223] Commercial Space Launch Act, Pub. L. No. 98-575, 98 Stat. 3055 (1984).
[224] *Id.*
[225] *Id.*
[226] *See* Commercial Space Launch Act Amendments of 1988, Pub. L. No. 100-657, 102 Stat. 3900; *See* Commercial Space Launch Amendments Act of 2004, Pub. L. No. 108-492, 118 Stat. 3974 (2004).
[227] *Supra* note 99.
[228] *Id.*
[229] Commercial Space Launch Act Amendments of 1988, Pub. L. No. 100-657, 102 Stat. 3900 (1988).
[230] *Id.*
[231] *Convention on International Liability for Damage Caused by Space Objects*, Mar. 29, 1972, 24 U.S.T. 2389, 961 U.N.T.S. 13810.
[232] Commercial Space Launch Act Amendments of 1988, *supra* note 232.

potentially have an easier time being compensated than a citizen of the United States who was injured in a similar manner. Functionally, this puts an injured American citizen in a worse position than a similarly injured foreign citizen. In 1997, Lottie Williams, a woman walking in a park in Tulsa, Oklahoma was struck by a piece of a Delta II rocket that had re-entered the atmosphere.[233] The limits of this liability were not tested at the time because she was not injured by the debris. [234]

C. Most Recent Laws

In 2015, Congress passed the U.S. Commercial Space Launch Competitiveness Act (CSLCA).[235] The name of Title I was cleverly named the Spurring Private Aerospace Competitiveness and Entrepreneurship Act of 2015 or SPACE Act of 2015.[236] It's stated purpose is to "to facilitate a pro-growth environment for the developing commercial space industry by encouraging private sector investment and creating more stable and predictable regulatory conditions."[237] It propelled commercial space flight toward those goals by directly addressing the issues of indemnification of space flight participants. Additionally, it made the acquisition of launch licenses more flexible, directed orbital traffic management from the United States, and established standards for commercial space safety requirements.[238]

A significant hurdle with the CSLCA is that it regulates commercial space travel with existing federal agencies.[239] For example, in order for any company to launch a satellite into space with their own launch vehicle, they would have to go through the following agencies. The actual rocket and launch would have to be licensed and approved by the Secretary of Transportation but routinely delegates the approval to the Administrator of the Federal Aviation Administration.[240] The satellite would need to be approved by the Federal Communication Commission, and under the new regulations, would have to have a plan to mitigate possible space debris, including a plan to deorbit the satellite into a controlled descent to Earth's oceans.[241] Finally, if the mission would include humans, then NASA would need to approve the designs, development, and construction of the vehicle. [242] Even if the vehicle would not be transporting humans, the vehicle must still meet

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[233] Woman Hit by Space Junk, Lives to Tell the Tale, FOX NEWS (OCT. 21, 2011) https://www.foxnews.com/science/woman-hit-by-space-junk-lives-to-tell-the-tale.
[234] *Id.*
[235] U.S. Commercial Space Launch Competitiveness Act, Pub. L. No. 114–90, 129 Stat. 704 (2015).
[236] *Id.*
[237] *Id.*
[238] *Id.*
[239] *Id.*
[240] *SpaceX Starship Super Heavy Project at the Boca Chica Launch Site*, FEDERAL AVIATION ADMINISTRATION, https://www.faa.gov/space/stakeholder_engagement/spacex_starship/ (last visited July 7, 2021).
[241] *See generally Report and Order and Further Notice of Proposed Rulemaking*, IB Docket No. 18-313, FEDERAL COMMUNICATIONS COMMISSION (Apr. 24, 2020), https://docs.fcc.gov/public/attachments/DOC-363486A1.pdf.
[242] *NASA and SpaceX Complete Certification of First Human-Rated Commercial Space System*, NASA (Nov. 10, 2020), https://www.nasa.gov/feature/nasa-and-spacex-complete-certification-of-first-human-rated-commercial-space-system.

the standards set by NASA, even though NASA would not be directly overseeing the vehicle. [243] Currently, the launch of a single satellite requires the approval and oversight of at least three government agencies.[244] This oversight and approval does not include any insurance that a party must purchase for potential damage caused by the launch.[245] The CSLCA does attempt to streamline the approval process; however, it still divides the approval process unnecessarily.[246] The ideal approval process would include a single government agency that oversees regulating space travel, commerce, and environmental protection.

1. CSLCA Grants Property Rights in Space

The most controversial part the legislation is that it granted property rights for Americans to mine resources from celestial bodies (asteroids, comets, etc.) from our solar system.[247] Specifically, the law states that any United States citizen that is "engaged in commercial recovery of an asteroid resource or a space resource under this chapter shall be entitled to any asteroid resource or space resource obtained, including to possess, own, transport, use, and sell the asteroid resource or space resource obtained in accordance with applicable law, including the international obligations of the United States."[248] This is a clear rejection of the idea that space resources are "res communis" and a declaration that they are "res nullius." The most interesting part is the qualification "engaged in commercial recovery" because that language seems to limit the rights over space objects to individuals who are actually engaged in commercial activity and does not allow for individuals to simply register random asteroids in an attempt to sell them to mining companies.[249] Additionally, the language of the law does not grant the right to own the entire asteroid or celestial object and instead uses "asteroid" and "space" as modifiers for "resource."[250] In this way, the law does not grant individuals the right to appropriate the actual celestial object, but rights to the resources extracted from the object so that the law complies with its obligations within the Outer Space Treaty.[251] This interpretation is in agreement with the single instance of case law available.

In 2003, Mr. Gregory Nemitz attempted to sue NASA for "parking" or "storage" fees of twenty cents per year after NASA landed their NEAR spacecraft on "his" asteroid, designated as asteroid 433 or "Eros."[252] Mr. Nemitz alleged that the registry of the asteroid conferred property rights of the asteroid to him as his own personal property, seemingly relying on the Registration

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[243] *See generally Space Flight System Design and Environmental Test*, ARC-STD-8070.1, NASA (Dec. 18, 2018), https://www.nasa.gov/sites/default/files/atoms/files/std8070.1.pdf (last visited July 7, 2021).
[244] *Id.*
[245] U.S. Commercial Space Launch Competitiveness Act, Pub. L. No. 114-90, 129 Stat. 704.
[246] *Id.*
[247] *Id.*
[248] *Id.*
[249] *See id.*
[250] *Id.*
[251] U.S. Commercial Space Launch Competitiveness Act. *supra* note 32.
[252] Nemitz v. United States, No. CV-N030599-HDM (RAM), 2004 WL 3167042 at *1 (D. Nev. Apr. 26, 2004) aff'd sub nom;*see also*Nemitz v. N.A.S.A., 126 F. App'x 343 (9th Cir. 2005).

Convention and the Outer Space Treaty. [253] The court held that a registry alone does not create a property interest in an asteroid; a registry is a means to catalog existing rights.[254] Additionally, Mr. Nemitz stated in his opposition that he was "not seeking a declaration from this Court that he has an ownership interest in Asteroid 433."[255] At the time, his best argument would have been to assert private ownership over the asteroid in some way, but Mr. Nemitz denied that he was seeking ownership.[256] He could not prove that he was owed fees by NASA because he could not prove ownership rights.[257] This holding is in line with the newer law granting a right to the resources of the asteroid or object only to a company engaged in commercial recovery.[258] Under the CSLCA, a company engaged in commercial recovery is afforded rights to the resources, not to the asteroid or body as a whole.[259] Even under the new law, Mr. Nemitz, assuming that he claimed to be engaged in the commercial recovery of space resources, would likely still lose because the right to recover resources does not afford him the right to charge parking or storage fees to other groups on the same asteroid or celestial body.

2. Liability Insurance Under the CSLCA

The CSLCA contains two distinctions to liability: liability to third parties and liability to individuals involved in the launch of space objects.[260] The second distinction is the easiest to understand, and the problem with it is the most obvious. Regarding liability to individuals involved in the launch of space objects, the CSLCA contains a blanket negligence waiver and informed consent requirement that shifts almost all legal liability onto spaceflight participants for death or bodily injury caused by an operator's negligence.[261] Specifically, the act requires a private company "to make a reciprocal waiver of claims with applicable parties involved in launch services or reentry services under which each party to the waiver agrees to be responsible for personal injury to, death of, or property damage or loss sustained by it or its own employees."[262] This waiver's problem is the same as the Liability Convention's: its terms are overly broad and undefined.[263] What exactly does it mean to be "involved in launch or reentry services?"[264] Those terms are general and nonspecific enough to include support staff or generally anyone working for the private company engaged in commercial space flight. While spaceflight is inherently

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[253] Nemitz, 2004 WL 3167042 at *1 (Mr. Nemitz registered his "rights" through a private company, the Archimedes Institute, not through any governmental agency. It is unknown if the outcome would have changed if he had attempted to register the asteroid with the US Government or the UN in some way through the Registration Convention). *Id.*

[254] *Id.*
[255] *Id.*
[256] *Id.*
[257] *Nemitz*, 2004 WL 3167042 at *1.
[258] *See id.*; *See also* U.S. Commercial Space Launch Competitiveness Act, *supra* note 248.
[259] Commercial Space Launch Competitiveness Act, *supra* note 148.
[260] *Id.*
[261] *Id.*
[262] *Id.*
[263] *Id.*
[264] *Id.*

dangerous, a waiver of all negligence claims by anyone involved in launch or reentry services is too broad.

The second discussion of liability is a bit more positive in that the CSLCA removed a previous cap of liability insurance required by commercial space companies and instead mandated that each commercial space enterprise be evaluated by the FAA, NASA, and insurance providers to determine adequate insurance amounts for each space activity by the company.[265] Any amount of liability above this new amount would be covered by the U.S. Government.[266] Even though the U.S. Government removed this cap by private companies, the amount of insurance needed may still be too low. In 2018, the Government Accountability Office conducted a report evaluating the maximum probable loss (MPL) and the methodology currently used by the FAA, NASA, and insurance providers to evaluate the MPL.[267] Specifically, the GAO found that the FAA had not updated the amount used for the cost of an individual casualty, undervaluing that amount.[268] The GAO estimated that this undervaluing of individual casualties potentially made the U.S. government liable for $3.1 billion in the event of an accident.[269] Even with this exposure, the previous cap removal is a positive step towards shifting responsibility for commercial space activities to the private companies that stand to gain the most from the new commercial space race.

IV. Conclusion

There is a solid footing for commercial space law, both internationally and domestically. Addressing the concerns raised in this comment would ensure that any exploitation of space for commercial purposes is done fairly. As more countries join the few existing countries in space, equity and fair dealing will be necessary to ensure there is enough "space" for everyone.

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[265] *Id.* The previous insurance requirement was capped at $500,000,000 per commercial space activity. *See* Commercial Space Launch Act Amendments of 1988, Public Law No: 100-657, 102 Stat. 3900.

[266] *See supra* note 267.

[267] *Commercial Space Launch Insurance: FAA Needs to Fully Address Mandated Requirements*, GAO-18-57 (Jan. 16, 2018), https://www.gao.gov/products/gao-18-57 (last visited July 7, 2021).

[268] *Id.*

[269] *Id.*