THE CONTOURS OF PERMISSIONLESS INNOVATION IN THE OUTER SPACE DOMAIN

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ABSTRACT

A permissionless innovation regulatory model, importantly featuring a default presumption of approval of innovators' new activities, is credited with fostering the development of the Internet. For the first time, this regulatory model is being explored for adoption in the outer space domain, a reasonable choice given the amount of innovation by commercial entities in that sector. However, translation of the model to outer space is complex because permissionless innovation is contextual, and the outer space domain differs from the cyber domain in important respects. First, international obligations require the U.S. government to authorize and supervise commercial space activities. Second, national security concerns are raised by everyday, non-illicit space activities. Third, space business investors actually demand enhanced regula-

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tory certainty given the risk, and often long-time horizons, of their investments.

New on-orbit space activities, such as asteroid mining, satellite servicing, debris removal, and lunar habitats and research facilities, currently fall within a regulatory gap—the Executive Branch lacks express Congressional delegation to regulate such activities. This situation may appear to be a victory for proponents of a nearly pure or unadulterated version of permissionless innovation. Indeed, to protect the status quo, permissionless innovation advocates are ignoring long-established and agreed upon rules of treaty interpretation to argue that the U.S. government is not under an obligation to authorize and supervise U.S. commercial space companies' activities.

The irony is that the current gap actually undermines the benefits of permissionless innovation. The Executive Branch faces a Hobbesian choice of following Congressional intent and standing aside as new on-orbit activities are engaged in or complying with international obligations and addressing potential national security concerns by continuing to leverage existing authorities in an attempt to reach on-orbit activities. U.S. commercial space businesses—the innovators—are left in a similarly difficult situation: facing a risk of foreign government retaliation in the event of the U.S. government's non-compliance with international obligations, or being forced to engage in costly and time-consuming litigation if the U.S. government blocks their proposed activity by stretching existing authorities. Fortunately, the U.S. Congress can enact a solution that fills the gap—providing compliance with international obligations, protection of national security, and regulatory certainty for U.S. space businesses—and at the same time ensure that permissionless innovation thinking and esprit de corps control the interagency approval process, including a default presumption in favor of approval.

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1. INTRODUCTION

A permissionless innovation regulatory model is credited with growing the Internet. This model allows new technologies to be developed and deployed without government permission, or as little permission as possible.[1] Recently, for the first time, policymakers are raising the question of whether a permissionless innovation regulatory model is possible in the increasingly commercialized outer space domain, particularly for new activities, and if so, what would it look like and what would its limits be. As House Science Committee Space Subcommittee Chairman Brian Babin stated recently:

> [T]his question of how we will regulate our private sector activities is not simply academic. I believe it is one of the fundamental space policy questions of our time. America is great because it is a country where you have the freedom to create without government permission. We are all free, unless we chose, through our legislative process, to limit our freedoms.[2]

Of course, permissionless innovation is rarely pure in the sense of being an argument for no regulation. Rather, it is a way of thinking that runs counter to the precautionary principle[3]—a principle that promotes regulation to protect from harms not yet proven or identified.

While permissionless innovation has framed regulatory debates in the cyber and telecommunications arena for decades, its transition to the space domain is recent—driven by viable new

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[1] *See generally* ADAM THIERER, PERMISSIONLESS INNOVATION: THE CONTINUING CASE FOR COMPREHENSIVE TECHNOLOGICAL FREEDOM (2016) (arguing for a public policy allowing for permissionless innovation in the modern tech industry).

[2] *See* Brian Babin, Chairman, Space Comm. of the H. Sci. Comm., Remarks to FAA Commercial Space Transportation Conference, 16-17 (Feb. 7, 2017), transcript available at http://groundbasedspacematters.com/wp-content/uploads/2017/02/CBB-speech-to-FAA-conference-Feb-7-2017.pdf [https://perma.cc/7H4S-VJUJ] (stating that the space sector is not unique in this respect as the same questions are being raised with respect to a whole host of new technologies and their associated business models, including autonomous vehicles, the sharing economy, robots, and 3D printing, among others).

[3] Thierer, *supra* note 1.

business models and technologies that will expand commercial activities in the space domain. *New space activities* beyond the traditional satellite communications and remote sensing markets are drawing significant investment and displaying rapid technological development. These new space businesses are engaged in the pursuit of commercial human space flight,[4] space resource mining,[5] commercial habitats in-orbit and on the Moon,[6] lunar rovers,[7] and on-orbit servicing of satellites,[8] including refueling and repairs.

However, technology and business model innovation is also occurring in *traditional sectors* of the space economy, including launch, remote sensing, and communications sectors. Reusable booster rocket systems are on the way, with multiple companies successfully landing first stages, and one even contracting to reuse a first stage for a satellite launch.[9] Similarly disruptive, several companies are developing new, low-cost launch vehicles for small satellites.[10] Ever-improving technologies are leading to higher res-

[4] *See, e.g.*, VIRGIN GALACTIC, http://www.virgingalactic.com/ [https://perma.cc/GT62-VFMW] (last visited Feb. 24, 2017) (proposing tourism-supported spaceflight); *see also* BLUE ORIGIN, https://www.blueorigin.com/ [https://perma.cc/XZ4V-7C2P] (last visited Feb. 24, 2017) (proposing technology for commercial spaceflight).

[5] *See, e.g.*, PLANETARY RESOURCES, http://www.planetaryresources.com [https://perma.cc/ZZ5U-MSSU] (last visited Feb. 24, 2017) (presenting itself as the future leading provider of resources in space); DEEP SPACE IND., INC., http://deepspaceindustries.com/ [https://perma.cc/L9EB-EHNG] (last visited Feb. 24, 2017) (introducing asteroid mining and its impact on the space economy).

[6] *See, e.g.*, BIGELOW AEROSPACE, http://www.bigelowaerospace.com/ [https://perma.cc/S5XQ-K9RC] (last visited Feb. 24, 2017) (calling for the building of new types of space station).

[7] *See, e.g.*, MOON EXPRESS, http://moonexpress.com/ [https://perma.cc/4TX5-SE37] (last visited Aug. 11, 2017) (intending to use the Moon's resources for the benefit of humanity).

[8] *See, e.g.*, Juliet Van Wegenen, *In-Orbit Services Experts See Bright Future, Challenges*, VIA SATELLITE (Sept. 3, 2015), http://www.satellitetoday.com/technology/2015/09/03/in-orbit-services-experts-see-bright-future-challenges/ [https://perma.cc/6A7U-JGP9] (describing how in-orbit servicing of satellites is a critical part of space infrastructure).

[9] *See, e.g.*, Peter B. de Selding, *SpaceX's Reusable Falcon 9: What Are The Real Cost Savings For Customers ?*, SPACENEWS (Apr. 25, 2016), http://spacenews.com/spacexs-reusable-falcon-9-what-are-the-real-cost-savings-for-customers [https://perma.cc/RE6F-3EVV] (announcing that SpaceX would be the first, after NASA, to successfully reuse rocket hardware cost-effectively).

[10] Doug Messier, *Multiple Small Satellite Launch Vehicles Under Development*, PARABOLIC ARC (Sept. 23, 2015), http://www.parabolicarc.com/2015/09/23/multiple-small-satellite-launch-vehicles-development/ [https://perma.cc/65VB-WJBM] (declaring that at least

olutions for remote sensing space systems.[11] Small satellites are now capable of more sophisticated imagery, and imaging companies offer big data analytics based on more continuous imagery.[12] In communications, ideas for large Low Earth Orbit (LEO) constellations providing satellite internet are on the table and are at various stages of implementation by several companies.[13] These new constellations can lead to potential spectrum battles between more traditional Geostationary Orbit (GEO) satellites and LEO satellites, and among competing LEO systems. New developments in the race to 5G terrestrial wireless also create spectrum competition (as well as potential sharing models) with satellite systems,[14] both GEO and LEO. Collectively, all these developments and plans create predictions for large increases in the number of launches over the next decade.[15]

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twenty launch vehicles for small satellites are currently under development around the world).

[11] *See* Colin Clark, *DigitalGlobe, Eager for Foreign Biz, Presses NOAA for Quarter Meter Resolution*, BREAKING DEF. (Aug. 23, 2013), http://breakingdefense.com/2013/08/digitalglobe-hoping-for-foreign-biz-presses-noaa-for-quarter-meter-resolution/ [https://perma.cc/C9VS-GUKG] (revealing that the digital satellite imagery industry, dominated by DigitalGlobe, is adapting image resolution to the demands of the international market).

[12] *See, e.g.*, Kevin M. O'Connell, President and CEO, Innovative Analytics & Training, LLC and Outgoing Chair of NOAA's Federal ACCRES, Testimony before H. Sci. Comm. Space Sub-Comm.: "Commercial Remote Sensing: Facilitating Innovation and Leadership" (Sept. 7, 2016) (transcript available at https://science.house.gov/sites/republicans.science.house.gov/files/documents/Kevin%20M.%20O%27Connell%20House%20Science%20Committee%20Testimony%20Final.pdf) [https://perma.cc/W5U8-SRF8] (calling for the update of U.S. policy and regulatory mechanisms to keep leadership in the space area).

[13] *See, e.g.*, Jeff Foust, *The Return of Satellite Constellations*, THE SPACE REV. (Mar. 23, 2015), http://www.thespacereview.com/article/2716/1 [https://perma.cc/9VXY-QNP7] (describing the effort by several competing companies to create broadband communications services using space technology).

[14] *See, e.g.*, Peter B. de Selding, *Satellite Sector Mulls How to Live with FCC's 5G Decision*, SPACENEWS (July 22, 2016), http://spacenews.com/satellite-sector-mulls-how-to-live-with-fccs-5g-decision/ [https://perma.cc/6SBY-7H78] (retelling the reactions to the FCC's ruling denying protected status to satellite systems that have been investing in Ka-band spectrum).

[15] *See* FAA, 2015 COMMERCIAL SPACE TRANSPORTATION FORECASTS (Apr. 2015), transcript available at https://www.faa.gov/about/office_org/headquarters_offices/ast/media/Commercial_Space_Transportation_Forecasts_2015.pdf [https://perma.cc/D7ET-G37N] (discussing geosynchronous and non-geosynchronous orbit launch demand forecast).

In creating regulatory approaches for *new* activities, and examining existing regulatory approaches for *traditional* activities, the question is whether the U.S. can adopt a permissionless innovation regime and if so, what it would look like, and what its limits or bounds would be. In answering these questions, one must realize the unique nature of the outer space domain *vis-à-vis* the cyber domain and appreciate the differences between activities in these two domains. First, in the outer space domain, the U.S. is under an international obligation to "authoriz[e]" and provide "continuing supervision" for its non-governmental (commercial) space activities, and further is made "[internationally] responsib[le]" for such activities.[16] There is no such obligation in the cyber domain; indeed there are few international laws governing the cyber domain at all.[17] Second, everyday, non-illicit activities in the space domain, and even the mere act of getting to outer space, more directly implicate national security concerns than everyday cyber activities. Most activities in the cyber domain, except theft of national secrets and trade secrets of the industrial complex, or interference with critical infrastructure (or elections), do not implicate national security concerns. Third, the capital investment dynamics of the two domains are different. Investment in space activities is not only risky but many projects have incredibly long time-horizons to profitability. Space investors worry about regulatory risk if permissionless innovation models do not, at a minimum, create a stable, transparent process that is consistent with U.S. international obligations and U.S. national security concerns. For all these reasons, (nearly) pure versions of permissionless innovation would create substantial risks for the growth and development of the U.S. commercial space industry.

Thus, maintaining the regulatory status quo featuring a gap in the U.S. government regulatory authority over on-orbit space activities will defeat the purposes of permissionless innovation despite appearing to create a (nearly) pure form of permissionless innovation. The Congress made clear back in 1997 that it did not

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

[17] *See, e.g.*, Jason Healy & Hannan Pitts, *Applying International Environmental Legal Norms to Cyber Statecraft*, I/S J. 356, 359-62 (2012) (noting "little" law governing the technical approach to the internet and the lack of global adherence to the Budapest Convention addressing criminal aspects of cyber security).

wish to allocate regulatory authority over on-orbit activities (other than remote sensing and spectrum use) to the Executive Branch.[18] Yet, the Executive Branch is keenly aware of its international obligation to authorize and supervise such activities as well as the potential national security implications of such activities.[19] The status quo leaves a Hobbesian choice for the Executive Branch. When a new activity is proposed, the Executive Branch can stand aside, fully yielding to Congressional intent, to the detriment of U.S. compliance with its international obligations and potential national security concerns. Alternatively, the Executive Branch can seek to leverage its existing payload review authority to block or authorize (depending on circumstances) post-payload deployment on-orbit activities, ensuring compliance with U.S. international obligations and protection of national security, but exceeding Congress' delegation. For the industry, the innovators, the situation is no better. They may engage in an activity that was not properly authorized as required by U.S. international obligations and risk foreign actions that might block their markets or businesses from cooperating with the U.S. innovator. Alternatively, U.S. space businesses may be forced to resort to litigation to challenge the U.S. Executive Branch action. Litigation can consume valuable time and money and is undertaken with the realization that the U.S. government is a substantial customer of U.S. commercial space businesses. Fortunately, with some adjustments to current Executive Branch and Congressional proposals for regulating new on-orbit activities, the Hobbesian choice can be eliminated. Better still, permissionless innovation thinking can still pervade the U.S. regulatory approach to such activities while complying with U.S. international obligations, protecting U.S. national security, and providing adequate regulatory certainty for space industry investors.

Section 2 of this paper discusses the concept of permissionless innovation, giving examples from the cyber domain that contain potential lessons for the outer space domain. Section 3 discusses the current status of permissionless innovation in the U.S. regulation of *traditional* activities in the space domain, looking at the ex-

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[18] *See generally* H.R. REP. NO. 105-347 (1997).

[19] *See* Letter from John Holdren, Dir. & Asst. to President for Sci. and Tech., to Sen. Thune and Rep. Smith (Apr. 4, 2016) (on file with author) https://obamawhitehouse.archives.gov/sites/default/files/microsites/ostp/csla_report_4-4-16_final.pdf [https://perma.cc/5XHL-VQHJ] (proposing legislation to ensure compliance with OST Article VI).

amples of launch, remote sensing, and communications licensing regimes. Section 4 analyzes three key risks to pursuing a (nearly) pure version of permissionless innovation in regulating *new* on-orbit activities. Section 5 examines the three significant proposals released in the past two years to fill the regulatory gap that exists with respect to new on-orbit activities—one emerging from the Obama Administration's Office of Science and Technology Policy (OSTP) through an interagency process, one arising from a Congressman recently nominated to be the next NASA Administrator, and one adopted by the U.S. House Science Committee. Section 6 proposes eight friendly amendments to the approaches on the table that maximize permissionless innovation thinking and esprit de corps while at the same time ensuring compliance with U.S. international obligations, protection of U.S. national security, and regulatory certainty for companies. It also recommends against two other amendments or approaches that have been proposed by (nearly) pure permissionless innovation advocates. Part 7 concludes.

2. THE ESSENCE OF PERMISSIONLESS INNOVATION

Permissionless innovation as a concept evades exact definition or categorization. Sometimes the term refers to avoiding private permissions (e.g., from patent holders) as well as authorization from the government. In this article, the concept will only be used to refer to avoiding (or limiting) the need for government permission to develop and deploy technology.

One of the leading studies on permissionless innovation[20] frames the discussion by contrasting it with precautionary principle thinking—that calls for regulation even in the absence of identifiable, provable harms. Importantly, it is a concept in which a range of actual regulatory policy approaches can fit. Indeed, one can view permissionless innovation regulatory approaches along a continuum.[21] A pure or unadulterated version of permissionless innovation would mean that the development and deployment of technology is subject to no regulation or government approvals

[20] Thierer, *supra* note 1, at 1–3.

[21] *See id.* at 105–107 (labeling permissionless innovation on a risk response continuum).

(i.e., "you may develop and deploy the technology how you wish and where you wish"). On the opposite end of the continuum would be a hyper-precautionary principle (or anti-permissionless innovation), involving a complete prohibition of the development and deployment of technology (i.e., "you may neither develop nor deploy the technology anywhere at anytime"). We find few examples of technology regulation at the far ends of the continuum, although there are a few, such as prohibitions on certain genetic cloning on the one side. Some believe that the current U.S. approach to new space activities, which is essentially a regulatory gap, comes close to a pure permissionless innovation approach. However, the situation is a bit more clouded in reality.

As a variety of regulatory approaches are plotted along the continuum, it is important to view permissionless innovation as a frame of mind or way of thinking. The way of thinking emphasizes the default should be to allow technology development and deployment in the absence of identified, serious harms.[22] The essence of permissionless innovation thinking can be detected not only where permission is the policy default, but also by a variety of related factors, including where trust is placed in industry self-regulation, insurance markets, educate and empower solutions, and the common law to solve legal problems. Where such solutions fail, targeted legal solutions are adopted after conducting a "benefit-cost analysis."[23] One might add as corollaries that permission decisions, to the extent needed, will be timely, transparent, and afford opportunities to cure defects found in initial proposals or applications. Innovation is stifled by delays, hidden rationales for decisions, and the inability to adjust proposed innovation to public policy concerns.

Permissionless innovation debates historically and even today are on display most prominently in the cyber domain. Three recent examples from the cyber domain contain possible lessons for the new debate over permissionless innovation possibilities in the outer space domain. First, use of the term in the cyber domain

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[22] *See id.* at 4 (discussing the risk response continuum wherein regulation of technological development should be avoided in the absence of identified harms).

[23] *See* Adam Thierer & Michael Wilt, *Permissionless Innovation: A 10-Point Checklist for Public Policymakers*, GEO. MASON (Mar. 31, 2016), https://www.mercatus.org/publication/permissionless-innovation-10-point-checklist-public-policymakers [https://perma.cc/UGD2-95RH] (eliminating some factors on their list that are specifically or mostly geared towards the cyber domain).

helps one understand that a regulatory approach can fit within a permissionless innovation framework even if it is not a pure version. For example, leading telecommunications companies assert that so-called "Part 15 rules" (more specifically 47 C.F.R. Ch. 15 rules of the FCC governing unlicensed spectrum transmissions) qualify as a permissionless innovation framework.[24] But even here, devices that rely on unlicensed spectrum to operate must meet minimal standards so as not to interfere unnecessarily with other devices or with Wi-Fi connections relying on the same unlicensed spectrum. The recent complaint by large telecommunications companies concerning LTE-U devices that use the unlicensed spectrum is that meeting existing Part 15 criteria may no longer be sufficient and that they may now have to go through additional interference testing, creating in their words a "Mother-may-I" situation.[25] The worry of the major telecommunications operators interested in LTE-U is that the Wi-Fi Alliance, a proponent of additional interference testing, is moving the pre-existing point of regulation too far along the continuum to qualify as permissionless innovation anymore.

Second, use of the concept in the cyber domain by competing industries or industries at different levels within the network may be illuminating in several contexts in the space domain, including the traditional satellite communications market and potentially new activities such as asteroid or lunar mining. Permissionless innovation, in part due to its somewhat malleable character with no single defining test, is used as a rhetorical tool by parties on both sides of the "net neutrality" debate. "Net neutrality" posits that internet service providers (ISPs) should not be able to discriminate against certain types of traffic over others.[26] Application creators and large-bandwidth using video providers argue that their innovation will be stifled if ISPs can slow their traffic or charge excessive fees for transmitting such traffic. ISPs argue that their innovation, in both technology and pricing/business model structures,

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[24] *See* Joan Marsh, *A Return to Permissionless Innovation*, AT&T (Aug. 22, 2016), https://www.attpublicpolicy.com/wi-fi/a-return-to-permission-less-innovation/ [https://perma.cc/9DRN-6SQ7] (demonstrating that AT&T identifies unlicensed spectrum FCC Part 15 rules as fitting within the permissionless innovation framework).

[25] *Id.*

[26] *See, e.g.*, Justin (Gus) Hurwitz, *Net Neutrality: Something Old, Something New*, 2015 MICH. ST. L. REV. 665 (2015) (arguing against open internet rules and for handling violations of net neutrality on a case-by-case basis).

will be hindered if the government prevents them from fully considering different bandwidth demands of different applications on their networks. The net neutrality or Open Internet Order adopted by the FCC in 2015[27] that sought a middle road and still allows for "reasonable" traffic management practices, leaves ISPs guessing if their view of reasonableness ultimately comports with the FCC's view,[28] and application creators wondering if their customers will be blocked or slowed when utilizing their applications. The net neutrality debate demonstrates that a regulatory approach can, in essence, express a preference for one company's or one industry's technological or business case innovation possibilities over another or, alternatively, can strike a clouded middle ground potentially harming innovation in several companies or industries.

Third, use of the permissionless innovation concept in the approach of some Federal Trade Commission (FTC) commissioners in the cyber realm allows one to think about several important distinctions in regulatory approaches and their impact on permissionless innovation thinking: distinguishing ex ante and ex post government interventions and substantive/generally applicable versus procedural/case-by-case approaches to regulation. For example, FTC Commissioner Ohlhausen believes the FTC approach to internet concerns such as privacy, fraud, and security is superior to the FCC's approach because of the FTC's focus on ex post, case-by-case enforcement to a greater degree than ex ante substantive regulation. As she describes it:

> The FTC's process is enforcement-centric rather than rule-making-centric. As such, it is *ex post* rather than *ex ante* and case-by-case rather than one-size-fits-all. Since an enforcement action requires a complaint and a case to move ahead, the FTC's method typically focuses on actual, or at least specifically alleged, harms rather than attempt to predict future harms more generally.

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[27] *In re* Protecting and Promoting the Open Internet, FCC 15-24 (Feb. 26, 2015), https://apps.fcc.gov/edocs_public/attachmatch/FCC-15-24A1.pdf [https://perma.cc/A7RM-Y92T].

[28] *See* Randolph J. May & Seth L. Cooper, *The FCC Threatens the Rule of Law: A Focus on Agency Enforcement and Merger Review Abuses*, 17 FEDERALIST SOC'Y L. REV. 54, 55 (2016) (discussing the FCC's catch-all standard of reasonableness which states "that an internet service provider 'shall not unreasonably interfere with or unreasonably disadvantage' end users or edge content or application providers").

> Because of these structural differences, the FTC's enforcement process is less affected by the systemic knowledge problems of the FCC's prescriptive *ex ante* rulemaking approach. . .
>
> Thus, the FTC's approach facilitates . . . "permissionless innovation," . . . better than a prescriptive rulemaking approach. The proof, as they say, is in the pudding. As the Internet—the most dynamic technological environment in history—has become an increasingly integral part of society, the FTC's enforcement-centric approach has enabled it to protect consumers and competition online even while industry has continued to innovate. In fact, the FTC is already addressing major Internet-centric concerns, including new issues in privacy, fraud, advertising and other consumer protection issues, along with competition issues.[29]

The regulation of space activities in a permissionless innovation manner needs to be distinguished from what Commissioner Ohlhausen sees in FTC regulation of the cyber domain. Regulation of space activities in contrast to cyber activities does not involve the full expanse of every industry. True, there are a variety of industries in the space sector, but they are not nearly as expansive as all those industries active in the cyber domain. Additionally, in looking at space activities, the greater possibility of national security harms from every-day, non-illicit activities dictate advanced consideration of an activity's impact. Indeed, what currently exists for traditional space activities (launch, remote sensing, communications) are licensing regimes in which the applicant provides information that is reviewed for its potential impact on national security and a limited number of other factors. In other words, regulation of traditional activities in space involves most prominently an ex ante, case-by-case analysis, and the industry specific expertise of regulators as well as national security concerns justifies the ex ante approach in the space domain. National security harms outweigh all other harms—and provide the easiest justification for ex ante examination. The case for ex ante examination of space activities is further buttressed by U.S. international obligations requiring authorization—official permission in advance according to

[29] Maureen Ohlhausen, *The Procrustean Problem with Prescriptive Regulation*, 23 COMMLAW CONSPECTUS 1, 7 (2014)

the ordinary meaning of that term—of space activities engaged in by U.S. commercial companies. A leading permissionless innovation study places "anticipatory regulation" to include "licensing and permits" closer to precautionary principle thinking than permissionless innovation thinking.[30] However, where the license applications are subject to a narrow review and benefit from default presumption of approval, and where decisions are timely, transparent, and appealable, and also incorporate at least one private or market mechanism, such as giving deference to industry standards, it is hard to see why such a "light touch" approach does not fall within the permissionless innovation thinking end of the continuum.

A more detailed examination of the current licensing regimes in place for traditional activities– launches, remote sensing and spectrum usage by communications satellites—follows below.

3. EXISTING U.S. REGULATION OF TRADITIONAL ACTIVITIES: LAUNCH, REMOTE SENSING, AND COMMUNICATIONS

Practically speaking, the United States government is aware of every American space asset launched, as Congress requires all launches to be licensed by the FAA, with a payload review as part of that process,[31] and all radio frequency used by satellites for communication with Earth must be licensed by the FCC.[32] Congress imposes an additional layer of licensing on all commercial remote sensing space systems,[33] an obligation interpreted in the past several years to include any satellite *capable* of sensing the Earth in the broadest sense instead of only those that *intend* to image the planet's surface. This interpretation was adopted due to concerns over the national security implications of satellites that could take imagery of valuable military and diplomatic installments and personnel.

Thus, Congress has expressly allocated licensing authority for spectrum usage and remote sensing, but not for other on-orbit activities. New on-orbit activities currently sit in a regulatory

30 Thierer, *supra* note 1, at 105–07.

31 51 U.S.C. §§ 50903–04 (2012).

32 47 U.S.C. §§ 701–69 (2012).

33 51 U.S.C. § 60101 (2012); 15 C.F.R. pt. 960 (2016).

"gap."[34] Indeed, the legislative history of amendments to the 1998 Commercial Space Launch Act indicates that Congress did not intend to allocate licensing authority to the FAA for on-orbit activities.[35] Outside of spectrum use and remote sensing licensure, currently no Executive agency maintains clearly delineated authority to license or regulate on-orbit activities.[36] For new space activities like asteroid mining, on-orbit servicing of satellites, space debris remediation, space hotels, and private research labs in space, the existing National Oceanographic and Atmospheric Administration's (NOAA) and FCC licensing regimes are insufficient in some instances to guarantee American compliance with the provisions of Art. VI of the Outer Space Treaty (OST). The OST is the seminal treaty addressing outer space activities that has over 100 countries party to it, including all major space powers.[37]

In contrast to other activities, the lack of on-orbit or in-space licensing authority likely does not impact sub-orbital flights because one might say the launch and reentry of such vehicles are relatively seamless—with tourists enjoying 5-10 minutes of weightlessness. Indeed, the regulations actually define "launch" of a reusable launch vehicle for sub-orbital flight as only ending when the vehicle touches down.[38] Thus, the launch license already covers the entire activity. In essence, at least from a regulatory perspective, there is no on-orbit or in-space activity or reentry in such a case. Congress has legislated an elaborate scheme governing human space flight applicable to both sub-orbital and orbital flights. While commercial human space flight is nascent with no paid flights in the sub-orbital domain yet having taken place and only

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[34] *See* Michael Gold, *Statement at the House Subcommittee on Aviation Hearing on "FAA Oversight of Commercial Space Transportation,"* SPACEREF (June 22, 2016), http://spaceref.com/news/viewsr.html?pid=49019 [https://perma.cc/22Z3-EVB8] (noting that all other countries with national space laws have a single national framework that is not divided into silos for specific activities); *see also* Frans von der Dunk, *Effective Exercise of 'In-Space Jurisdiction': The U.S. Approach and the Problems it is Facing*, 40 J. OF SPACE LAW (questioning if the broad structure of space regulation effectively applies to the modern space industry, especially within the United States).

[35] H.R. REP. NO. 105-347 (1997).

[36] Holdren Letter, *supra* note 19.

[37] UNCOPUOS, 55th Sess., Status of International Agreements Relating to Activities in Outer Space, U.N. Doc. A/AC.105/C.2/2016/CRP.3 (Apr. 4, 2016), http://www.unoosa.org/documents/pdf/spacelaw/treatystatus/AC105_C2_2016_CRP03E.pdf [https://perma.cc/C9KV-83JB].

[38] 51 U.S.C. § 50902 (2012); 14 C.F.R. § 401.5 (2016).

eight commercial orbital flights to date, all involving flights aboard Russia's Soyuz craft to the ISS for a cost of roughly $20 million per trip,[39] due to its extensive existing regulation by the United States it will be discussed along with the traditional activity of space launch. But for the other new on-orbit space activities, there is ongoing debate whether the United States Executive Branch needs legislation granting it new authority in order to meet its OST obligation to "authorize" and provide "continuing supervision" for its nationals' space activities.

3.1. Permissionless Innovation and FAA Launch (and Re-Entry) Licensing & Regulation of Human Space Flight

Any space launch or re-entry requires an FAA license.[40] This is appropriate because orbital launch vehicles contain fuel that weighs around twenty times that of the rocket itself, and the size of re-entering first stages can equal that of six buses combined.[41] In other words, space launch vehicles are essentially ballistic missile technology used for other purposes.[42]

In deciding whether to award a license, the FAA conducts a policy review to determine whether there are any national security, foreign policy, or international obligation concerns; a safety review to assess any third party risk; a payload review;[43] and an environ-

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[39] *See* Rich McCormick, *Russia's Space Agency Plans to Resume ISS Tourist Flights in 2018*, THE VERGE (Mar. 24, 2015), http://www.theverge.com/2015/3/24/8286409/russias-space-agency-roscosmos-space-tourist-flight-2018 [https://perma.cc/8GP6-53JB] (discussing that between 2001 and 2009, there were eight private trips made to the ISS).

[40] *See* 51 U.S.C. § 50904 (2013) (detailing the various restrictions on launches, operations, and reentries).

[41] *See* SPACEX, http://www.spacex.com/falcon9 [https://perma.cc/RE6F-3EVV] (last visited Feb. 26, 2017) (describing SpaceX's Falcon 9 rocket as being 229 feet high and 12 feet wide).

[42] *See* Karl Tate, *How Intercontinental Ballistic Missiles* Work, SPACE (Feb. 1, 2013), http://www.space.com/19601-how-intercontinental-ballistic-missiles-work-infographic.html [https://perma.cc/49Q2-EQCT] (explaining how modified intercontinental ballistic missiles (ICBM) work and noting that they were used by early Soviet and American manned orbital missions).

[43] *See* 14 C.F.R. §§ 415.1 to .70 (2016) (prescribing requirements for obtaining a license to launch a launch vehicle, other than a reusable launch vehicle (RLV))

mental review.[44] Further, a launch licensee is financially responsible to a large degree for third-party damages. Namely, the launch licensee must procure third-party liability insurance equivalent to maximum probable loss (MPL) and insurance to cover any government liability, including damage to government property.[45] Federal law also requires the launch operator to engage in a series of cross-waivers of liability with its suppliers and contractors, its customers, and its customers' suppliers and contractors.[46] Consequently, due to the federal cross-waiver regime, neither the companies nor the individuals involved in the manufacture, operation, or purchase of launch services can sue one another for negligence nor gross negligence should an accident occur.[47]

The FAA also conducts similar reviews for re-entry licenses. This is no longer theoretical because an American company has developed a launch vehicle in which the first stage—the largest and most-expensive stage—of the rocket is reentered for ultimate

[44] *See id.* §§ 415.201-.400 (providing FAA requirements for environmental review).

[45] Matthew Schaefer, *The Need for Federal Preemption and International Negotiations Regarding Liability Caps and Waivers of Liability in the U.S. Commercial Space Industry*, 33 BERKELEY J. INT'L L. 223, 230–241 (2015) ("[T]he U.S. third-party liability regime is broken into three tiers. First, the U.S. government requires . . . that commercial space-flight operators obtain third-party liability insurance in the amount of the maximum probable loss (MPL), according to a calculation performed by the FAA . . . . Second, if third-party liability claims exceed the [MPL], the government has in essence made a statutory promise to pay for the next tier, or tranche, of up to $2.8 billion dollars in any third-party liability claims faced by a space-flight entity. In the third tier, where third-party claims exceed the MPL plus the amount of promised government indemnification, liability reverts back to the operator."); *see* 51 U.S.C. §§ 50914–50915 (2013) (listing liability insurance and financial responsibility requirements, as well as U.S. government paying claims exceeding liability insurance and financial responsibility requirements of the licensee).

[46] *See* 51 U.S.C. § 50914(b) (describing requirements relevant to reciprocal waiver of claims); *see also* Schaefer, *supra* note 45, at 245–48 (describing the liability of Space Flight Participants (SFPs) under the Commercial Space Launch Amendments Act of 2004).

[47] Schaefer, *supra* note 45, at 245–48.

reuse.[48] Moreover, another company has tested first stage re-entry.[49]

Evidence suggests that launch licenses almost operate with a *de facto* presumption of approval, and Congress has even established a separate category of experimental permits to ensure that less well tested vehicles can undergo testing and innovation.[50] Additionally, Congress recently made clear that a company can operate under and maintain an experimental permit to continue testing improvements while also maintaining a launch license for the same launch vehicle.[51]

While Congress has not put forth a legal presumption of approval, it has declared in numerous enactments the importance of developing a vibrant commercial space launch capacity in the United States.[52] The U.S. government even went so far as to help fund the development of new commercial space launch vehicles through milestone payments for technological improvements using

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[48] *See, e.g.*, Romain Dillet, *SpaceX Successfully Lands its First Stage Falcon 9 Rocket at Cape Canaveral*, TECH CRUNCH (Feb. 19, 2017), https://techcrunch.com/2017/02/19/spacex-successfully-lands-its-first-stage-falcon-9-rocket-at-cape-canaveral/ [https://perma.cc/9AQC-CL5D] ("SpaceX . . . successfully landed the first stage of its Falcon 9 rocket at Cape Canaveral.").

[49] *See* Dominic Gates, *Bezos Says Blue Origin Achieves 'Holy Grail of Rocketry,'* SEATTLE TIMES (Nov. 24, 2015), http://www.seattletimes.com/business/boeing-aerospace/jeff-bezoss-blue-origin-reaches-milestone-with-reusable-rocket/ [https://perma.cc/PKB4-S67V] ("Blue Origin space-travel company successfully sent a rocket 62 miles up into space and then . . . landed it upright just four-and-a-half feet from the center of its launchpad.").

[50] *See* 14 C.F.R. §§ 437.1–.17 (prescribing requirements for obtaining an experimental permit and maintaining a permit).

[51] U.S. Commercial Space Launch Competitiveness Act, Pub. L. No. 114-90, § 104, 129 Stat. 704, 706-07 (2015) (codified as amended in scattered sections of 51 U.S.C.).

[52] 51 U.S.C. § 50901(a)(7)–(8) (2011) ("(7) the United States should encourage private sector launches, reentries, and associated services and, only to the extent necessary, regulate those launches, reentries, and services to ensure compliance with international obligations of the United States and to protect the public health and safety, safety of property, and national security and foreign policy interests of the United States; (8) space transportation, including the establishment and operation of launch sites, reentry sites, and complementary facilities, the providing of launch services and reentry services, the establishment of support facilities, and the providing of support services, is an important element of the transportation system of the United States, and in connection with the commerce of the United States there is a need to develop a strong space transportation infrastructure with significant private sector involvement.").

"other transaction authority" under NASA's statutory authority.[53] In fact, there are new media reports that Elon Musk, SpaceX's owner, is engaging in "permissionless innovation" through his development of reusable first stage boosters,[54] although it bears mentioning that the claim may be due to a misunderstanding that SpaceX's reentry landings—first done on barges in the ocean—still require FAA approval.

With respect to human space flight, federal law only requires space operators to obtain informed consent from space flight participants ("SFPs").[55] Congress recently added SFPs to the full federal cross waiver through 2025, such that SFPs will not be able to sue, at least for the next ten years, for personal injury or death unless resulting from intentional misconduct by the launch operator.[56] This overcomes the problem that had developed wherein a patchwork of state laws, riddled with gaps and ambiguities, sought with uncertain success to provide immunity to space launch operators from SFP suits.[57]

Instead, insurers have begun offering SFPs liability insurance that SFPs may purchase.[58] Whether the premium pricing of such insurance will be attractive to SFPs is still left to be seen. Additionally, a so-called regulatory moratorium on launch vehicle design regulations aimed at protecting persons aboard those launch vehicles, originally enacted in 2004, was extended in 2015, and it

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[53] *See generally* COM. ORBITAL TRANSP. SERVS., A NEW ERA OF SPACE FLIGHT (2014) (providing a history of the NASA Commercial Orbital Transportation Services (COTS) program from 2006 to 2013).

[54] Joe Colangelo, *What the SpaceX Landing Says About Elon Musk–and Federal Regulators*, DAILY CALLER (Apr. 20, 2016), http://dailycaller.com/2016/04/20/what-the-spacex-landing-says-about-elon-musk-and-federal-regulators/ [https://perma.cc/LFY5-UN9Q] ("Musk is practicing 'permissionless innovation,' which . . . means disrupting first and asking for permission later, exploiting regulatory blind-spots.").

[55] *See* 51 U.S.C. § 50905(a)(5) (2012) (listing the requirements for the holder of a license or a permit to launch or reenter a space flight participant).

[56] *See* U.S. Commercial Space Launch Competitiveness Act, *supra* note 51, § 107 (describing requirements relevant to cross waivers).

[57] *See* Schaefer, *supra* note 45, at 245–55 (outlining liability issues relevant to SFPs under the Commercial Space Launch Amendments Act of 2004, contractual waivers under state common law, and state legislation granting space operators partial immunity from liability).

[58] *See* Matthew Schaefer, *The Intersection of Insurance Markets and Liability Regimes Regarding Third-Parties and Space Flight Participants in Commercial Space Activities*, 57TH IISL COLLOQUIA OF LAWS OF OUTER SPACE OF THE IISL (2014).

will now remain in effect until the end of 2023.[59] Instead of government regulations, the FAA worked with industry and NASA to issue a non-binding set of guidelines regarding human space flight.[60] To be sure, there are a few issues that have arisen that cause launch companies concern. For example, the reusable launch vehicle regulations were really designed with Shuttle-type vehicles in mind and instead it is operational reusablilty (i.e. reuse of first stages) that is occurring first and so the current regulations are not a perfect fit and require issuing a number of different waivers.[61] Another issue that will likely arise as the small launch vehicle sector grows is a potential licensing bottleneck if each individual launch is treated as an individual activity.[62]

Overall, the launch licensing process falls within a range of the continuum that qualifies as permissionless innovation, and even goes to the extent of incentivized permissionless innovation. In other words, approval is required for these activities but is essentially never denied, and the government has used resources and space act agreements to incentivize development of the launch sector.

When accidents occur, the government works with the private sector under the companies' own FAA-approved accident investigation plan to promptly resume activity.[63] New reentry technologies for first stage boosters are facilitated. Launch companies can operate vehicles under both an experimental permit and a launch license.[64] Companies are indemnified by the government for any massive third-party damage caused by a space launch, and they are also protected from negligence and gross negligence claims

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[59] *See* U.S. Commercial Space Launch Competitiveness Act, *supra* note 51, § 111 (outlining a regulatory framework relevant to standards and extension of certain safety regulation requirements).

[60] FAA, RECOMMENDED PRACTICE FOR HUMAN SPACE FLIGHT OCCUPANT SAFETY (2014) ("The purpose of this document is to provide a compilation of practices that the [FAA] believes are important and recommends for commercial human space flight occupant safety.").

[61] Discussions at 10th Annual University of Nebraska Washington D.C. Space Law Conference, Sept. 15, 2017.

[62] *See id*.

[63] *See* FAA, FACT SHEET—COMMERCIAL SPACE TRANSPORTATION ACTIVITIES (2017) ("The FAA requires commercial operators to file an investigation plan that meets FAA regulations and contains the operator's procedures for reporting and responding to launch accidents, launch incidents, or other mishaps that may occur. The FAA approves and oversees compliance with these plans.").

[64] U.S. Commercial Space Launch Competitiveness Act, *supra* note 51, § 107.

from those aboard the spacecraft.[65] Regulation of design features to protect occupants is not allowed (at least, for an initial period), but industry standards (or government–industry standards) are encouraged.

Thus, the approach to launch licensing and human spaceflight meets many of the principles espoused by permissionless innovation proponents: pushing for self-regulation, waiting for insurance markets to address problems, promoting education to minimize risks, relying on existing legal regimes including the common law of torts, reducing the immediate constraining impact of existing tort regimes, and adopting targeted, limited legal measures.

3.2. Permissionless Innovation and NOAA Licensing of Remote Sensing Satellites

Unlike FAA's launch licensing regime and commercial human space flight regulations, the remote National Oceanographic and Atmospheric Administration's (NOAA) sensing licensing regime under the Department of Commerce is never referred to in the press or by industry as an example of permissionless innovation thinking. The National and Commercial Space Programs,[66] in essence the slightly updated version of the 1992 Land Remote Sensing Policy Act,[67] states that "no person that is subject to the jurisdiction or control of the United States may . . . operate any private remote sensing space system without a license."[68]

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[65] 14 C.F.R. § 440.17(b) (2016) ("The licensee . . . shall implement a reciprocal waiver of claims . . . under which each party waives and releases claims against all the other parties to the waiver and agrees to assume financial responsibility for property damage it sustains and for bodily injury or property damage sustained by its own employees, and to hold harmless and indemnify each other from bodily injury or property damage sustained by its employees, resulting from a licensed or permitted activity, *regardless of fault*." (emphasis added)); Schaefer, *supra* note 45, at 246 ("There is a statutory exception for 'willful misconduct' to the waivers of liability, and the FAA has interpreted this language to mean that the waivers prevent claims based on negligence as well as gross negligence claims.").

[66] *See generally* Act of Dec. 18, 2010, Pub. L. No. 111-314, 124 Stat. 3328 (codifying existing laws related to national and commercial space programs).

[67] *See generally* Land Remote Sending Policy Act of 1992, Pub. L. No. 102-555, 106 Stat. 4163 (establishing a new national land remote sensing policy, among other purposes).

[68] Act of Dec. 18, 2010, *supra* note 64, § 60122(a).

Federal regulations define a remote sensing system to mean any satellite or system that "is capable of actively or passively sensing the Earth's surface."[69] Over the past several years, this provision has been interpreted literally to account for all satellites capable of Earth-imaging. This interpretation is in response to concerns over the proliferation of high-resolution imagery of high-value national security and diplomatic targets especially in the wake of a significant relaxation of the resolution limitations on commercial remote sensing imagery. Under this interpretation and with changes in space technology, the number of licenses NOAA is taking under consideration has grown considerably—a phenomenon described as an "explosion" by NOAA officials.[70] All license applications must also be reviewed by the Department of Defense, the Department of the Interior, the Department of State, and the broader intelligence community to address their singular concerns.[71]

Once granted, licensees must operate systems in a way so as to preserve U.S. national security, foreign policy, and international obligations. Moreover, licensees must maintain operational control from within the U.S., maintain records of operations, limit collection and dissemination of data as required, notify NOAA of foreign agreements to capture or sell imagery, report deviations and anomalies, make data available to the Department of Interior, dispose of the system in a manner approved by NOAA, and submit a data protection plan. NOAA conducts audits at various stages and requires reports to ensure compliance with laws, regulations, and license conditions.[72] In the event of noncompliance, NOAA is authorized to revoke the license and suspend all sales of imagery captured by the system in question.[73]

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[69] 15 C.F.R. § 960.3 (2017).

[70] Alan Robinson, NOAA, NOAA'S COMMERCIAL REMOTE SENSING REGULATORY AFFAIRS (2016).

[71] *See* Glenn Tallia, *NOAA's Licensing of CubeSats as Private Remote Sensing Space Systems Under the National and Commercial Space Policy Act (2012)*, AMERICAN BAR ASSOCIATION (Jan. 20, 2012), http://www.americanbar.org/content/dam/aba/administrative/science_technology/1_20_12_licensing.authcheckdam.pdf [https://perma.cc/JS8E-9MN7] (describing, *inter alia*, general license conditions relevant to NOAA's licensing of cubesats as private remote sensing space systems).

[72] *Id.*

[73] *See* 15 C.F.R. § 960.15 (2013) (listing penalties and sanctions if a licensee substantially failed to comply with Title II of the Land Remote Sensing Policy Act of 1992 (15 U.S.C. 5601 *et seq.*) (Pub. L. No. 102–555, 106 Stat. 4163)).

Two of the major challenges facing remote sensing licensing are the proliferation of small satellites—as well as the corresponding increase in license applications[74]—and some high-profile delays in licensing decisions.[75] Indeed, the proliferation of small satellites creates a unique issue for NOAA license reviewers. First, while many of the small satellites are technically capable of sensing the Earth, they generally pose no serious national security or diplomatic concerns. Additionally, many small satellites are not technologically capable of complying with orders from the Secretary of Commerce to limit collection or dissemination of such imagery. Together with increasingly long waits for license decisions, these issues are creating pressure for licensure process reform.

Some suggest that re-interpreting the "capable of" language to mean those satellites that will be designed and operated to image the Earth could significantly alleviate the burden of license review. Others suggest a green light "presumptive" licensing test, whereby, although the government is given a certain amount of time to deny a license, an acceptance is assumed. There is always the risk, though, that interagency gridlock will remain a barrier to a speedy process. Moreover, some believe that small satellites are not so innocuous; ideas for a constellation of satellites capable of taking imagery of the same point on the surface multiple times a day, combined with high-level data analytics, pose potential serious national security and foreign policy issues.

House Science Committee members have expressed frustration that NOAA is not meeting deadlines for licensing decisions.[76] Law requires a decision within 120 days, but, in some high profile cases involving major companies and systems, decisions have taken over

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[74] *See, e.g.*, Jeff Foust, *Smallsat Constellations Spark Investor Interest, Regulator Concerns*, SPACENEWS (Mar. 24, 2015), http://spacenews.com/smallsat-constellations-spark-investor-interest-regulator-concerns/ [https://perma.cc/GP4R-6ZW6] ("Small satellites have already been constituting a significant part of the FCC's workload on the licensing side . . . . There has been every indication that this workload is going to continue to increase.").

[75] *See, e.g.*, COMM. ON SCI., SPACE & TECH., SMITH, BABIN QUESTION NOAA'S DELAY OF SATELLITE IMAGERY PROVIDER'S LICENSE (June 6, 2016) ("[C]ommercial satellite imagery provider DigitalGlobe is still awaiting a license approval to sell . . . imagery data . . . almost three years after submitting the initial request, well beyond the 120 day requirement.").

[76] *See id.* ("NOAA regulations state that the agency must give a reason for [delays] and an estimate of when its review will be completed . . . [T]he Committee would also like to know what has caused the delay in this application and when NOAA anticipates this licensing action will be closed out.").

three years.[77] For example, Digital Globe, the largest provider of imagery to the U.S. government, waited over three years for a decision on its Worldview 3 satellite.[78] Some of the concern stems from the fact that these delays might lead to outsourcing of the remote sensing business to foreign countries. There are recent efforts within the Executive Branch in the form of a new interagency Memorandum of Understanding to improve the process and avoid lengthy delays,[79] but Congress is considering more significant reforms.[80]

Unlike the launch licensing regime, the remote sensing licensing process currently does not seem to be driven by permissionless innovation thinking. Permission is not *de jure* or *de facto* the default position. Long overdue decisions and missed deadlines hold up projects without transparency in the decision-making, and without an opportunity to cure defects, through discussions pertaining to alternatives. It is understandable—given national security concerns—that reliance is not placed on industry self-regulation, insurance markets, or "educate and empower" solutions.

Yet, efforts to enhance timely decisions, transparency of rationales in decision-making, and the opportunity to cure defects would be improvements, as would the elaboration of an updated benefit-cost analysis over national security concerns. For example, a two-tiered approach to licensing could be considered—one for cube satellites unlikely to have the technology to raise national security concerns (e.g., more akin to obtaining a driver's license) and one for larger, more sophisticated satellites. More generally, decision-makers in the interagency process may need to update benefit-cost analyses by considering whether the proliferation of remote sensing satellites globally (as well as other methods for deriving infor-

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[77] *See id.* (referring explicitly to a "120 day requirement").

[78] *Id.* ("DigitalGlobe is still awaiting a license approval . . . almost three years after submitting the initial request.").

[79] *See* Jeff Foust, *NGA Director Supports Commercial Remote Sensing Regulatory Reform*, SPACENEWS (Aug. 8, 2017), http://spacenews.com/nga-director-supports-commercial-remote-sensing-regulatory-reform/ [https://perma.cc/4BXJ-8684] ("[T]he Departments of State, Defense, Commerce and Interior, as well as the intelligence community, have updated a memorandum of understanding (MOU) regarding [NOAA's] interagency review.").

[80] *See* American Space Commerce Free Enterprise Act of 2017, H.R. 2809, 115th Cong. (2017) (proposing an amendment "to title 51, United States Code, to provide for the authorization and supervision of nongovernmental space activities, and for other purposes.").

mation) make restrictions on U.S. commercial remote sensing companies a detriment to U.S. competitiveness without corresponding increases in U.S. national security. The remote sensing licensing regime highlights that permissionless innovation is a frame of mind that must permeate policy-makers in the interagency discussions of applications. This latter element is why we might think of the creation of an esprit de corps of permissionless innovation thinking in interagency discussions.

3.3. Permissionless Innovation and FCC Licensing of Spectrum

Numerous spectrum battles and controversies arise out of new space technologies and business models, including: controversies connected to potential large increases in the number of launches, disputes between potential LEO and existing GEO satellite operators,[81] competition amongst the various LEO satellite proposals,[82] competition between terrestrial 5G wireless demands and satellites,[83] and the potential increase in the use of optical communications (laser) in satellite plans.[84] There are few legislative proposals that touch on these controversies that are being handled through FCC proceedings. Spectrum battles tend to be resolved in an area of the regulatory continuum quite far from the purest forms of permissionless innovation. Due to the limited nature of spectrum

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[81] *See, e.g.*, Peter B. de Selding, *One Web Fails (At Least for Now) to Soothe Satellite Interference Fears*, SPACENEWS, Sept. 18, 2015, http://spacenews.com/oneweb-fails-at-least-for-now-to-soothe-satellite-interference-fears/ [https://perma.cc/S8A6-WFDM] (mentioning the potential issues to current and future satellites by increasing the number of LEO and GEO satellite systems).

[82] *See, e.g.*, Klint Finley, *Internet by Satellite is a Space Race with No Winners*, WIRED, June 12, 2015, https://www.wired.com/2015/06/elon-musk-space-x-satellite-internet/ [https://perma.cc/7KR5-FKRC] (detailing that competition between OneWeb and SpaceX in their race to provide internet to rural populations).

[83] *See, e.g.*, Peter B. de Selding, *FCC Chairman to Satellite Industry: Shut Up*, SPACENEWS MAG., Aug. 1, 2016, https://www.spacenewsmag.com/the-bottom-line/fcc-chairman-to-satellite-industry-shut-up/ [https://perma.cc/2D82-WHML] (stating that the FCC Chairman discouraged criticism of the 5G FCC ruling).

[84] *See* Finley, *supra* note 82 (noting that SpaceX applied to the FCC to begin testing).

and the potential for interference from overlapping spectrum uses, spectrum allocations require heavy ex ante government involvement in most instances. Communications satellites, due to the expensive capital investment, must have dedicated, licensed spectrum to justify the business case. Additionally, a GEO satellite will need the International Telecommunications Union (ITU) to allocate the orbital slot and frequency for the satellite, but importantly ITU permission is usually provided on a first-come, first-served basis.[85] Similar to use of permissionless innovation arguments by the two competing sides in the net neutrality debate in the cyber domain, in many of the space and satellite examples detailed below permissionless innovation might be advocated for by those with competing interests. As in the case of the net neutrality debate, providing greater permissionless innovation for one party's interest in the space domain concerning spectrum may negatively impact the ability for the competing technology or business model to engage in permissionless innovation.

3.3.1. Spectrum for An Increased Number and Cadence of Commercial Launches

Concern is growing that increased launches from the United States may create further procedural bottlenecks and administrative burdens with respect to spectrum needed for commercial space launch activities. Currently, spectrum for launch vehicles is allocated under special temporary authority by the FCC on the basis of experimental authorizations. The spectrum allocated is federal spectrum and can only be used on a non-interference basis.[86] This concern over administrative burdens in obtaining spectrum

[85] *See, e.g.*, FRANS VON DER DUNK, LEGAL ASPECTS OF SATELLITE COMMUNICATIONS, HANDBOOK OF SPACE LAW 475–84 (VON DER DUNK & TRONCHETTI eds., 2015); FRANCIS LYALL & PAUL B. LARSEN, SPACE LAW: A TREATISE 236–39 (2009) (noting some reforms of the ITU's first-come, first-served approach); Lawrence D. Roberts, *A Lost Connection: Geostationary Satellite Networks and the International Telecommunications Union*, 15 BERKELEY TECH. L.J. 1095, 1111–14 (2000) (noting the problems of the ITU regulatory regime with regard to geostationary satellites); Patrick S. Ryan, *The ITU and the Internet's Titanic Moment*, 8 STAN. TECH. L. REV. 1, 85–86 (2012) (discussing the history of the ITU and the differences between the ITU's past regulatory subjects and the internet).

[86] FCC, DA 13-446, GUIDANCE ON OBTAINING EXPERIMENTAL AUTHORIZATIONS FOR COMMERCIAL SPACE LAUNCH VEHICLES, (2013).

for space launch vehicles is reflected in Rep. Bridenstine's proposed Space Renaissance Act (HR4945) in Section 309(h). The bill calls upon the FCC and Department of Commerce to ensure the process for obtaining authorization to use spectrum for a space launch is "standardized and clearly defined" and to "minimize the number and complexity of such authorizations required per launch mission."[87] In light of its goal of assured access to spectrum for commercial launches it also calls for the allocation of spectrum of launch activities on a "co-primary, interference-protected basis."[88]

3.3.2. Spectrum Battles Arising from LEO Satellite Constellations

Numerous companies have plans at various stages for large constellations of LEO satellites to provide broadband internet and other services. There are concerns in at least certain portions of the globe that the LEO systems could cause interference with existing GEO systems.[89] Such concerns are exacerbated by the growing number of LEO satellite business plans being developed.[90]

Concerns exist that "spectrum warehousing" or "paper satellite" strategies may occur through the use of foreign telecom administrations to delay or block the most likely LEO satellite constellations and systems. More specifically, there are concerns that the ease of acquiring spectrum rights through some foreign administrations' requests to the ITU can create "false competitors who are out to impede . . . serious space companies."[91] Possible reforms

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[87] American Space Renaissance Act, H.R. Res. 4945, 114th Cong. § 309(h) (2016)

[88] *Id.*

[89] *See* Jeff Faust, *Low Earth Orbit Constellations Could Pose Interference Risk to GEO Satellites*, SPACENEWS, Oct. 25, 2015, http://spacenews.com/low-earth-orbit-constellations-could-pose-interference-risk-to-geo-satellites/ [https://perma.cc/GMQ4-F66X] (noting that even if new satellites comply with ITU rules they can cause problems for newer and more sensitive satellites).

[90] *See, e.g.*, Alan Boyle, *5G or not 5G? Boeing Joins the Battle Over Broadband Satellite Spectrum*, GEEKWIRE, June 23, 2016, http://www.geekwire.com/2016/boeing-battle-broadband-internet-satellite/ [https://perma.cc/Z6G3-AZJ4] (stating that Boeing plans to put over 1,000 satellites into low Earth orbit).

[91] *See, e.g.*, Jason Koebler, *SpaceX Warns Fake Competitors Could Disrupt Its Space Internet Plan*, MOTHERBOARD, Mar. 9, 2015, https://motherboard.vice.com/en_us/article/bmj34d/spacex-warns-paper-satellites-could-disrupt-its-space-internet-plan [https://perma.cc/JG33-E3M2]

within the ITU include increasing the number of satellites that must be launched and operated within a set number of years and creating milestones for contracting and constructing satellites to better distinguish between "paper satellites" and genuine endeavors.[92] Issues are also raised regarding the interaction between the FCC and ITU approaches. The current FCC approach is to use a processing round procedure for LEO satellite spectrum applications in contrast to the first-come, first-served approach for GEO satellite spectrum allocations through the ITU.

3.3.3. Spectrum Battles Between Satellite and Terrestrial 5G

Recently departed FCC Chairman Wheeler leaned hard on the satellite industry to cooperate with potential future 5G terrestrial users of 28GHz spectrum on potential sharing of that spectrum.[93] At ITU's World Radio Conference in 2015 (WRC-15), the satellite industry successfully defended their 28GHz rights; however this frustrated the FCC, which was looking for more willingness for a study on possible sharing of the spectrum with terrestrial 5G users in the band.[94] It appears, regardless of what happens internationally—WRC-19 will likely re-examine the issues—that the U.S. is going to be seeking spectrum sharing in the 28GHz band, although new FCC Chairman Pai has not yet addressed the issue in detail.[95]

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[92] *See* Faust, *supra* note 89 ("[S]ome raised questions about another aspect of ITU rules regarding NGSO systems. Current regulations consider an NGSO system to be brought into use, and its frequency rights confirmed, when the first satellite of a constellation is launched, regardless of the number of satellites in the constellation. 'This makes sense when you have a constellation of 10 or 12 satellites,' said Jose Albuquerque, chief of the satellite division of the Federal Communication Commission's International Bureau. 'But when you're talking about constellations of 800 or 4,000 satellites, you cannot acquire rights by bringing one satellite into service.'"); On the issue of paper satellites, *see generally* Von der Dunk, *supra* note 85, at 485–87; Lyall & Larson, *supra* note 85, at 236–39.

[93] *See* de Selding, *supra* note 14 (noting that Chairman Wheeler advocated studying the possibility of sharing the 28GHz spectrum at the World Radiocommunication Conference).

[94] *Id*.

[95] *See* Caleb Henry, *Trump's FCC Chairman Favors Simpler Satellite Licensing Rules*, SPACENEWS, Jan. 24, 2017, http://spacenews.com/trumps-fcc-chairman-favors-simpler-satellite-licensing-rules/ [https://perma.cc/T9JW-EUTN] (noting the appointment of FCC chairman Ajit Pai and his desire to close the digital divide as well as state he has not made clear how satellites will fit into his broadband goal).

Separately, a coalition of 5G terrestrial broadband companies in June 2016 petitioned the FCC to remove 500MHz of Ku-band (between 12.2 GHz and 12.7 GHz) that currently gives priority access to LEO satellite internet constellations.[96] Sharing within the Ku-band between 5G and LEO satellites will not be possible, but sharing with direct broadcast GEO satellite signals in the band with 5G users may be possible, although this is also in dispute.[97]

3.3.4. Possibility of Laser Communications

Some new satellite ideas may seek to use laser communications to avoid the need for spectrum rights, particularly for inter-satellite communications. Laser communications[98] have the potential benefit of a faster and higher capacity movement of data than RF communications.[99] However, laser communications have unique features that must overcome challenges like cloud cover, turbulence, and other atmospheric disturbances.[100] NASA has already demonstrated the technology for Moon-Earth communications and is proceeding with space-to-space and space-to-ground applications.[101] Space optical communications are currently unregulated, and there

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[96] *See* Peter B. de Selding, *Dish Network Battles OneWeb and SpaceX for Ku-Band Spectrum Rights*, SPACENEWS, June 9, 2016, http://spacenews.com/dish-network-battles-oneweb-and-spacex-for-ku-band-spectrum-rights/. [https://perma.cc/8AKU-EDK4] (detailing that Dish Network and other companies asked U.S. regulators to strip certain satellites of their priority access to 500 MHz of Ku-band spectrum).

[97] *Id*.

[98] *See, e.g.*, Nicholas Gerbis, *How Laser Communication Works*, HOWSTUFFWORKS, Feb. 24, 2017, http://science.howstuffworks.com/laser-communication.htm [https://perma.cc/T7QY-AG66] (describing how laser technology works).

[99] *See, e.g.*, Donald Cornwell, *Space-Based Laser Communications Break Threshold*, OPTICS & PHOTONICS NEWS, May 2016, http://www.osa-opn.org/home/articles/volume_27/may_2016/features/space-based_laser_communications_break_threshold/ [https://perma.cc/HJA6-AMM3] (stating that satellite lasers can communicate at "[i]nternet-like speeds.").

[100] *Id*.

[101] *See* NASA, *Laser Demonstration Reveals Bright Future for Space Communications*, NASA, Dec. 23, 2103, https://www.nasa.gov/content/goddard/laser-demonstration-reveals-bright-future-for-space-communication [https://perma.cc/B3MM-R9LQ] (noting that lunar laser communication missions have revealed the possibility of expanding capabilities in space laser communications).

is a debate as to what extent the FCC could exercise authority over lasers.[102] However, questions of interference could embolden the FCC to fill the void.

3.3.5. Summary

Technology development that needs or concerns licensed spectrum—and the satellite business demands the certainty of licensed spectrum—due to its limited, finite nature—will always involve a good deal of ex ante government permissions from both the FCC and the ITU. Whether it is additional more certain spectrum for the increased cadence of space launches, new large constellation LEO satellite plans, terrestrial 5G wireless intrusions into high frequency satellite spectrum, or even laser communication proposals, the FCC and ITU will be rather heavily involved on the regulatory front. For GEO systems, orbital slots and allocations are largely first-come, first-served rewarding first-moving innovators. For LEO systems, the FCC conducts a processing round seeking to accommodate interests of both first-movers and those that soon after also declare interest and the ITU regulates interference issues to a degree. Resorting to industry self-regulation, insurance markets, common law (of torts), and educate and empower solutions are largely avoided given the dynamics, although there are some elements that encourage cooperation among competing industries in the 5G terrestrial versus satellite situation rather than the government imposing a solution.

4. PERMISSIONLESS INNOVATION FOR NEW ON-ORBIT ACTIVITIES: THE INTERNATIONAL OBLIGATION LIMIT, THE NATIONAL SECURITY LIMIT, AND THE INVESTOR CERTAINTY LIMIT

Thus, for *traditional* space activities we observe a range of regulatory models: 1) an FAA launch and reentry and human space flight framework that certainly is closest to the permissionless in-

[102] *See generally* Joel Thayer, *Lasering in on the Federal Communications Commission: Can the FCC Regulate Laser Communications*, 6 AM. U. INTELL. PROP. BRIEF 99–128 (2015) (arguing the FCC does have authority under current law to regulate laser communications and is the proper agency to regulate them).

novation ideal; 2) a NOAA remote sensing regime that is perhaps overbroad, impacting innovative small satellite ideas, and that struggles with establishing a permissionless innovation esprit de corps in the interagency process as participants have yet to fully reassess benefit-cost analysis of national security concerns in an environment where foreign remote sensing systems are increasingly sophisticated; and 3) an FCC spectrum licensing regime that by necessity, given the properties of spectrum and the demands of the satellite business case, must have significant ex ante government involvement. All those regulatory models are long-established and will take considerable effort to change.

In contrast, regulating *new* on-orbit space activities begins with a relatively clean slate. There is no formal regulatory framework in place, although the government has leveraged its launch licensing authority, especially its payload review prong, to a degree to partially fill the gap. The only other exception to this clean slate is that for well over a decade NOAA and the FCC have imposed debris mitigation requirements on licensees—presumably relying on their "public interest" authority to do so—although some believe even this limited on-orbit regulation constitutes "competence creep."[103] Staunch permissionless innovation advocates might say this essentially clean slate is a victory and should be maintained. In essence, companies are free to conduct new on-orbit activities if they so choose, and the government need not authorize those activities, nor may the government prohibit those activities. In fact, permissionless innovation advocates might say this is almost an ideal scenario, in that the current state of affairs achieves (near) pure or unadulterated permissionless innovation. However, the irony is that the benefits of permissionless innovation will not be achieved in this (nearly) pure state.

There are at least three major risks to allowing calls for a pure or unadulterated permissionless innovation regulatory model with respect to new on-orbit activities. First, it is very clear that U.S. international obligations require "authorization" of and the provision of "continuing" supervision, by the government of commercial activities in outer space. Thus, any pure version of permissionless innovation would run afoul of U.S. international obligations in the primary space treaty, the Outer Space Treaty. Second, with the national security implications of many space ac-

[103] *See* von der Dunk, *supra* note 34, at 171–73.

tivities, it is unrealistic to expect adoption of a pure permissionless innovation regulatory model to govern such activities; the industry largely recognizes this dynamic. Third, a large number of businesses and investors in the space sector seek a minimal amount of regulation to ensure a transparent framework for approval of their on-orbit activities so that regulatory uncertainty and foreign hostility to their activities is minimized.[104] For each of these reasons, a failure by Congress to create explicit "light touch" authorization and supervision authority in an Executive Branch agency will actually defeat the purposes of permissionless innovation.

Of course, the Executive Branch will have incentives to continue to leverage its payload review authority to try to ensure that U.S. international obligations are met and that U.S. national security is not endangered, and to give companies and their investors a degree of regulatory approval and certainty they desire. Chairman Babin and former FAA officials have argued that because the OST's Article VI is not a self-executing international obligation, and thus not automatically part of the U.S. legal system, the Administration cannot seek to authorize or supervise new on-orbit space activities unless Congress passes a law delegating authorization and supervision responsibility to the Executive Branch.[105] This may well be true but the situation is slightly more complex. Congress has already delegated payload review authority to the FAA,

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[104] *See* Marcia Smith, *Bridenstine: This is Our Sputnik Moment & the Moon Will Ensure U.S. Preeminence in Space*, SPACEPOLICYONLINE (Nov. 2, 2016 12:00 AM), http://www.spacepolicyonline.com/news/bridenstine-this-is-our-sputnik-moment-the-moon-will-ensure-u-s-preeminence-in-space. [https://perma.cc/PR4Q-VMF4] (explaining that a significant private investment in space could be stopped by the U.S. State Department due to actions and protests in foreign countries).

[105] *See* Babin, *supra* note 2 ("The previous Administration failed to remember that the *Outer Space Treaty* is not self-executing. The executive branch, unless explicitly authorized by Congress, should not deny an American citizen the right to explore and use *Outer Space*."); *See also* Laura Montgomery, *Article VI of the Outer Space Treaty is not Self-Executing and Should Not be Treated as an Obstacle to Private Space Activity*, GROUND BASED SPACE MATTERS (Oct. 14, 2016), http://groundbasedspacematters.com/index.php/2016/10/14/article-vi-is-not-self-executing-and-should-not-be-treated-as-an-obstacle-to-private-space-activity/ [https://perma.cc/KW4P-4FYH] ("[N]ot all provisions of the Outer Space Treaty are self-executing, so until Congress acts, those treaty provisions don't bind private operators. That logic applies to the treaty's Article VI as well.").

and a factor to consider under a payload review is U.S. international obligations.[106]

One might argue ensuring no violation of international obligations (self-executing or not) is thus an objective the FAA can consider in a payload review. However, the counterpoint is that the Executive Branch lacks the power to consider international obligation compliance for on-orbit activities because Congress, when granting re-entry licensing authority in 1997, indicated it did not want to grant on-orbit authority at that time.[107] This places the U.S. Executive Branch in a difficult position—the Hobbesian choice of complying with international obligations or acting consistently with apparent Congressional intent.

Similarly, space businesses—the innovators—are also put in a poor position. They could simply seek to pursue any on-orbit activity they like, and then pursue litigation if the Executive Branch blocks an activity that, for example, the government believes would violate U.S. international obligations or endanger U.S. national security. The "pursue and litigate" strategy is not an attractive option for many space companies. Litigation consumes time and money, and global competitors may advance during that time. Additionally, the dynamics of the space business are such that the government is always a considerable part of the customer base, and suing one's customer is not necessarily an attractive option. If the U.S. Executive Branch chooses the alternate path and stands down by not blocking the activity nor authorizing it, then space businesses, particularly those involved with international partners or an international customer base, would need to worry about potential foreign government actions for failure by the U.S. government to meet international obligations. For example, a foreign government might block cooperation by a partner or prevent customers in its territory from purchasing goods or services connected with the activity. That is why on-orbit businesses have been "knocking on the door" of various agencies, including the State Department, the last several years, in essence asking who will give them a stamp of approval. It is an uncertain process currently—

106 *See* 14 C.F.R. § 415.51 (2016) (stating that the FAA reviews payloads for adherence to "U.S. national security or foreign policy interests, . . . international obligations of the United States . . . [and] safety requirements.").

107 *See* H.R. REP. NO. 105–347 (1997) (noting that a license is not required for an "on-orbit operation" completed "after a launch . . . and before reentry[.]").

one that U.S. space businesses desire to be made certain and transparent.

We explore each of these three risks—international obligation risk, national security risk, and regulatory uncertainty risk—below, with particular emphasis on meeting U.S. international obligations. Particular emphasis is placed on meeting U.S. international obligations because it appears that a drive for a (nearly) pure form of permissionless innovation is leading to misguided treaty interpretations of the Outer Space Treaty that do not respect long-standing rules of treaty interpretation binding the United States and constitutes a development that can damage U.S. interests in other treaty regimes too. The analysis below reveals that the U.S. Congress can establish an authorization regime that meets U.S. international obligations, allows the U.S. government to protect national security, and provides regulatory certainty for U.S. space business investors, while at the same time achieving the benefits, and retaining the essence, of permissionless innovation thinking.

4.1. International Obligation Risk

The United States currently has a regulatory gap pertaining to on-orbit activities that occur between launch and reentry by its commercial actors. Outside of spectrum use (already requiring an FCC license), systems capable of sensing the Earth (already requiring a NOAA license), and debris mitigation requirements imposed by those agencies, on-orbit activities are not regulated or separately authorized. This gap creates compliance issues with U.S. international obligations under Article VI of the OST. Proof of five propositions is necessary to establish that such a gap violates U.S. international obligations and that complying with those obligations by filling the gap will not require any wholesale abandonment of permissionless innovation thinking. The five propositions are as follows:

(1) The OST requires the U.S. government to "authorize" and provide "continuing supervision" of its commercial actors' space activities, at least in part in order to ensure compliance with OST provisions;

(2) Ensuring compliance with OST obligations by its commercial actors only requires minimal, light touch regu-

lation because OST obligations are few in number, many do not implicate commercial plans, and those that do are minimally constraining;

(3) Congress made clear in the legislative history to the 1998 amendments to U.S. commercial space legislation that outside of FCC and NOAA licensing regimes for spectrum use and remote sensing, respectively, it was not granting authority to FAA or any other federal agency to regulate on-orbit activities;

(4) There are limits to how far the FAA can stretch or utilize its existing payload review process to address on-orbit issues; and

(5) Current FCC authority and NOAA authority does not allow the United States to ensure compliance by commercial actors with OST obligations.

Proof of Proposition #1

Let's start with my first claim, specifically that the OST requires the U.S. government to authorize and provide continuing supervision of its commercial space activities, in part to ensure compliance with OST provisions by its commercial actors. To begin, let's cover some basics of international law. Most international law applies to States (governments) but not to private actors directly. This is true of the vast majority of customary international law and most treaties.

There are, of course, some exceptions. Rules against piracy and genocide apply to private actors in customary international law.[108] Some treaties, such as the Montreal Convention,[109] which lays out rules for air carriers, and private international law conventions,

[108] *See, e.g.*, William S. Dodge, *Corporate Liability Under Customary International Law*, 43 GEO. J. INT'L L. 1045, 1047–8 (2012) (stating that piracy and genocide are punishable against private actors).

[109] Convention for the Unification of Certain Rules for International Carriage by Air, Nov. 4, 2003, http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:22001A0718(01):EN:HTML [https://perma.cc/AN8Y-3Z3B].

like the Convention on International Sale of Goods (CISG),[110] apply to private actors, although in the case of CISG parties can contract to opt-out of its provisions. But these are exceptions to the general rule.

Like most international law, the OST does not apply directly to private actors. Its obligations do not say "States Parties and their nationals shall . . . . " All of its requirements apply to "State Parties." For this reason, arguments are made that OST obligations do not apply to private, commercial actors at all. In an attempt to buttress this argument, proponents of this view point out that the drafters of the OST showed they knew how to make obligations applicable to nationals by directly saying so.[111] The proponents of this view point to Article IX of the OST where it says the following:

> If a *State Party* to the Treaty has reason to believe that an activity or experiment planned by *it or its nationals* in outer space, including the moon and other celestial bodies, would cause potentially harmful interference with activities of other States Parties in the peaceful exploration and use of outer space, including the moon and other celestial bodies, it shall undertake appropriate international consultations before proceeding with any such activity or experiment . . . .[112]

However, this obligation, like all others in the OST, only applies directly to State Parties. There is no obligation imposed on *nationals* of State Parties to consult with anyone. The obligation is on a State Party to consult when it or one of its nationals is planning an activity that would cause potentially harmful interference with activities of other States Parties. A State Party will presumably be aware of its national's activities in outer space because under Article VI State Parties must authorize and provide continuing supervision of their nationals' space activities.

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110 *See generally* United Nations Convention on Contracts for the International Sale of Goods, Apr. 11, 1980, 1489 U.N.T.S. 3 [https://perma.cc/6DEN-A55L].

111 *See* Laura Montgomery, *Planetary Protection and Its Applicability to the Private Sector*, GROUND BASED SPACE MATTERS (Oct. 3, 2016), http://groundbasedspacematters.com/index.php/2016/10/03/planetary-protection-and-its-applicability-to-the-private-sector/#more-133 [https://perma.cc/543X-PBJ8] ("When the drafters of the treaty intended a particular provision to apply to non-governmental entities they said so.").

112 OST, *supra* note 16, Art. IX (emphasis added).

In fact, Article VI goes further and contains a unique rule, one not found in virtually any other treaty, that pure permissionless innovation-inspired treaty interpretation ignores or misreads. Article VI provides:

> States Parties to the Treaty shall bear *international responsibility* for national activities in outer space, including the moon and other celestial bodies, whether such activities are carried on by governmental agencies *or by non-governmental entities, and for assuring that national activities are carried out in conformity with the provisions set forth in the present Treaty.* The activities of non-governmental entities in outer space, including the moon and other celestial bodies, shall require *authorization and continuing supervision* by the appropriate State Party to the Treaty . . . .[113]

Before we examine these provisions, it is useful to address the issue of state responsibility in international law more generally. The ILC Articles on State Responsibility provide in its first two articles the following:

> Every internationally wrongful act of a State entails the international responsibility of that State.[114]
>
> There is an internationally wrongful act of a State when conduct consisting of an action or omission:
>
> (a) Is attributable to the State under international law; and
>
> (b)Constitutes a breach of an international obligation of the State.[115]

Thus, for international responsibility to be incurred by a State, there needs to be an act or omission attributable to the State under international law and a breach of an international obligation. Article VI of the OST indicates that States Parties are internationally responsible for national activities in space, even when they are carried on by its commercial actors, and State Parties are also directed by Article VI to assure that national activities, including those by its commercial actors, are carried out in conformity with the provi-

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[113] *Id.* Art. VI (emphasis added).

[114] *Int'l Law Comm'n, Draft Articles on Responsibility of States for Internationally Wrongful Acts, with Commentaries, art. 1, U.N. Doc. A/56/10*, at 65-70 (2001).

[115] *Id.* art. 2.

sions set forth in the OST. Thus, if a U.S. commercial entity does something that would run counter to an OST obligation, the United States would bear international responsibility for that violation.[116]

Normally, under international law, private party activity is only attributable to the State where the State directs or assumes effective control over the activity. For example, in the ILC Articles on State Responsibility, Article 8 states:

> The conduct of a person or group of persons shall be considered an act of a State under international law if the person or group of persons is in fact acting on the instructions of, or under the direction or control of, that State in carrying out the conduct.[117]

But the first sentence of Article VI makes States Parties to the OST internationally responsible, even when they do not meet the direction or control test. To be sure, the OST Article VI's second sentence requires "authorization" and "continuing supervision" by a State party over its commercial actors' space activities, but it is unlikely that that level of involvement alone would meet the ILC Article 8 standard. In any event, the first sentence of Article VI, which makes State Parties internationally responsible, eliminates the need to answer that question definitively.

Article VI also requires States Parties to "authorize" and provide "continuing supervision" for its commercial actors' space activities, at least in part to help assure that its commercial actors comply with OST provisions.[118] The Vienna Convention on the Law of Treaties (VCLT) requires interpretation of a treaty based on the ordinary meaning of the terms of the treaty in their context and in light of its object and purpose.[119] While the United States is not a party to the VCLT, it does recognize the treaty interpretation rules (along with many other rules) in the VCLT as binding as a matter

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116 *See* IRMARD MARBOE, NATIONAL SPACE LEGISLATION, *in* HANDBOOK OF SPACE LAW 127, 131–34 (von der Dunk & Tronchetti eds., 2015) (noting that States Parties to the OST are internationally responsible for outer space activities of non-governmental entities).

117 OST, *supra* note 14, art. 8 (emphasis added).

118 MARBOE, *supra* note 114, at 131–32.

119 *See* Vienna Convention on Law of Treaties, art. 31(1), May 23, 1969, 1155 U.N.T.S. 331 ("A treaty shall be interpreted in good faith in accordance with the ordinary meaning to be given to the terms of the treaty in their context and in light of its object and purpose.").

of customary international law.[120] The first sentence of Article VI (referring to assuring conformity) provides context for the "authorize" and "continuing supervision" obligation in the second sentence.[121] When authorizing and supervising, a State Party is to, at a minimum, seek to assure conformity by its commercial space actors with OST provisions. The ordinary meaning of 'authorize' is "give official permission or approval to," or "to give official permission for something to happen."[122] The ordinary meaning of 'supervision' is to "monitor," and the ordinary meaning of 'continuing' is "occurring in a cyclical or repetitious pattern."[123] In short, authorization and continuing supervision require some process to "give official permission or approval to," and "monitor" in some "cyclical or repetitious pattern" for the purpose of assuring that commercial actors are complying with OST obligations. Thus, while there is certainly some flexibility in how to implement the Article VI obligation, permissionless innovation advocates go too far when they claim that "Article VI contains three relevant ambiguous terms [("authorization," "continuing supervision," and "activities")] that the drafters appear to have left to different countries to define as they see fit . . . ."[124] Rather, the drafters undoubtedly thought that the treaty, like all other treaties, would be interpreted in accordance with internationally binding rules on treaty interpretation as reflected in the VCLT, which was formulated at the same time as the Outer Space Treaty—the mid-1960s. The American Space Commerce Free Enterprise Act, reported by the House Science Committee on June 8, 2017, could be improved by explicitly

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120 *See* U.S. STATE DEP'T, FREQUENTLY ASKED QUESTIONS—TREATIES, https://www.state.gov/s/l/treaty/faqs/70139.htm (last accessed Feb. 24, 2017) [https://perma.cc/T7RH-4YBQ] ("The United States considers many of the provisions of the Vienna Convention on the Law of Treaties to constitute customary international law on the law of treaties.").

121 *See* MARBOE, *supra* note 114, at 132 n.14

122 MACMILLAN DICTIONARY, http://www.macmillandictionary.com/us/dictionary/american/authorize (last accessed Feb. 24, 2017) [https://perma.cc/8WE9-L4QE].

123 BUSINESS DICTIONARY, http://www.businessdictionary.com/definition/continuing.html (last accessed Feb. 24, 2017) [https://perma.cc/TFU8-8AR5].

124 Laura Montgomery, *By the Outer Space Treaty's Own Terms, The U.S. Complies with Article VI*, GROUND BASED SPACE MATTERS (Dec. 17, 2016), http://groundbasedspacematters.com/index.php/2016/12/17/by-the-outer-space-treatys-own-terms-the-u-s-complies-with-article-vi-of-the-treaty/#more-245 [https://perma.cc/ZV8E-EXDW].

acknowledging the VCLT rules when it calls upon the federal government "to interpret . . . its international obligations under the Outer Space Treaty in a manner that minimizes regulations and limitations on the freedom of United States nongovernmental entities to explore and use space . . . [and] in a manner that promotes free enterprise in space."[125] As we will see in the next section, one does not have to stray from VCLT treaty interpretation rules in order to ensure a minimally burdensome set of obligations on commercial entities under the OST.

Proof of Proposition #2: Ensuring compliance with OST obligations by its commercial actors only requires minimal, light-touch regulations.

The OST only has seventeen articles—the last four of which deal with ratification, amendment, termination, and official languages of the treaty.[126] An additional article deals with application of the treaty to "international intergovernmental organizations."[127] Taking into account Article VI's text and purposes, there are only eleven articles that could theoretically impose substantive obligations. However, Article XI is a weak obligation "to the greatest extent practicable and feasible" for States to inform the UN Secretary General and the scientific community of their space activities.[128] So in reality there are only ten articles that could impose substantive constraints on private space activities.

Yet, many of the ten remaining articles' substantive obligations do not in any way implicate private, commercial activities. Indeed,

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125 American Space Commerce Free Enterprise Act of 2017, H.R. 2809, 115th Cong. (2017) *supra* note 80 at § 3.

126 OST, *supra* note 16, arts. XIV–XVII.

127 *See id.* art. XIII ("The provisions of [the OST] shall apply to the activities of States Parties to the Treaty in the exploration and use of outer space[,] . . . including cases where they are carried on within the framework of intergovernmental organizations.").

128 *See id.* art. XI ("In order to promote international co-operation in the peaceful exploration and use of outer space, State Parties to the Treaty conducting activities in outer space . . . agree to inform the Secretary-General of the United Nations . . . to the greatest extent feasible and practicable, of the nature, conduct, locations and results of such activities.").

some actually empower those activities. Article I is empowering rather than limiting in most respects as it mandates "freedom of exploration and use" of outer space.[129] The ordinary meaning of the word "use" would include exploitation. If there is any ambiguity in that, the negotiating history confirms it. Most delegations at the time of drafting the OST agreed with the French delegate that "use" included exploitation, and the French delegate even mentioned uses of the moon, such as extraction of minerals.[130] Article I does contain additional language that the exploration "shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development, and shall be the province of all mankind." However, the "benefit" and "province of mankind" language is universally interpreted to not require, for example, any resource or profit sharing; rather, it is referring to "benefit" in the more general sense that society benefits from the exploration.[131]

Article IV's prohibition on placement of WMDs in orbit or on celestial bodies does not implicate commercial space activities.[132] Article V has an obligation for astronauts to render all possible assistance to one another in carrying out their activities, but it is often difficult for this assistance to occur in the space environment and, in any event, would only implicate human space flight activities.[133] The United States is party to the follow-on 1970 Return and Rescue Agreement laying out more detailed obligations, but, again, commercial human space flight operators are highly unlikely to be burdened by any of these obligations.

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[129] *See id.* art. I ("The exploration and use of outer space, including the moon and other celestial bodies, shall be carried out for the benefit and in the interests of all countries . . . ").

[130] *See* Paul G. Dembling & Daniel M. Arons, *The Evolution of the Outer Space Treaty*, 33 J. AIR L. & COM. 419, 431 (1967) (describing the discussions around the drafting of the Outer Space Treaty).

[131] *See* Stephen Gorove, *Implications of International Space Law for Private Enterprise*, 7 ANNALS OF AIR & SPACE L. 319, 321 (1982) (interpreting the language of the treaty as not imposing specific obligations on private enterprises to share acquired benefits); LYALL & LARSEN, *supra* note 83, at 62–63 *See also* Frans von der Dunk, *International Space Law*, *in* HANDBOOK OF SPACE L. 29, 57–59 (Frans von der Dunk & Fabio Tronchetti eds., 2015).

[132] *See* OST, *supra* note 16, art. IV .

[133] *See id.* art. V ("In carrying on activities in outer space and on celestial bodies, the astronauts of one State Party shall render all possible assistance to the astronauts of other State Parties.").

OST Article VII and the follow-on 1972 Liability Convention with more detailed rules only implicate a government's pocket book by requiring the provision of compensation for the *international* aspects of *third-party liability*.[134] Private commercial actors face no burden via these obligations. Rather, the United States has a detailed regulatory regime applicable to both domestic and international third-party liability situations, discussed briefly earlier in the Article, in which commercial launch operators are required to purchase third-party liability insurance up to the maximum probable loss (on average around $90 million in coverage with premiums at 0.1% of that amount) and the government has in place a long-term (ten-year) promise to indemnify the launch operators for the next $2.8 billion in liability.[135] All others involved in the space launch (*e.g.*, suppliers, contractors, customers, and SFPs) benefit as additional insureds on the policy purchased by the launch licensee and also benefit from the promise of government indemnification.[136] The U.S. government currently does not require the purchase of on-orbit third-party liability insurance policies, although some other countries, like the United Kingdom, do.[137] The United States could elect to enact such a requirement as part of an on-orbit regulatory scheme. Importantly, however, Article VII does not require these domestic requirements, so it is not imposing any constraints or costs on commercial private actors.

Article VIII essentially creates what many believe is an indefinite ownership rule concerning space assets which largely benefits commercial space actors by preventing theft of their assets and installations when in-orbit, on a celestial body, or even upon return

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134 *See* Schaefer, *supra* note 45, at 263–65 (explaining that the Liability Convention does not cover single rocket or single aircraft accidents); *see also* Stephan Hobe, *Legal Aspects of Space Tourism*, 86 NEB. L. REV. 439, 450 (2007) (discussing the inability for passengers to claim compensation under the Liability Convention).

135 *See* U.S. Commercial Space Launch Competitiveness Act, Pub. L. No. 114-90, 129 Stat. 704, § 102(d) ("Launch Liability Extension.—Section 50915(f) is amended by striking 'December 31, 2016' and inserting 'September 30, 2025'"); *see also* Schaefer, *supra* note 45, at 230–32 (explaining the U.S. third-party liability regime).

136 *See* U.S. Commercial Space Launch Competitiveness Act, Pub. L. No. 114-90, 129 Stat. 704, § 103 ("Indemnification for Space Flight Participants"); Schaefer, *supra* note 45, at 263 (recommending SFPs be included in the indemnification regime); *see also* 51 U.S.C. § 50914 (2011)).

137 *See* Schaefer, *supra* note 45, at 230 n.23 (explaining U.K. requirement for satellite operators to have third-party liability insurance).

to Earth.[138] In terms of on-orbit activities, the indefinite ownership rule only potentially creates problems for entities wishing to engage in active debris remediation of another nation's debris in a non-consensual fashion. Even here, potential constraints are reduced because smaller-sized space debris under ten centimeters, and even some larger debris, is of unknown origin, and thus would not require any form of consent to remediate.[139] Further, Article VIII requires a registering state to maintain jurisdiction and control over its space objects, and a separate Registration Convention, to which the United States is a party, lays out obligations on registration. Article VIII's obligation to maintain jurisdiction may be another reason for the United States to fill the regulatory gap with respect to on-orbit activities, but it does not require any particular level of regulation.[140]

What remains are Articles II, IX, X, and XII. Article X and XII obligations are worded quite softly:

> **Article X**
>
> In order to promote international co-operation in the exploration and use of outer space, including the moon and other celestial bodies, in conformity with the purposes of this Treaty, the States Parties to the Treaty *shall consider on a basis of equality any requests* by other States Parties to the Treaty to be afforded an opportunity to observe the flight of space objects launched by those States.

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[138] *See, e.g.*, Matthew Schaefer, *Analogues Between Space Law and Law of the Sea/International Maritime Law: Can Space Law Usefully Borrow or Adapt Rules from these Other Areas of Public International Law?* 55 PROC. INT'L INST. SPACE L. 316 (2012) ("[T]he ownership provision would appear to prevent any vacuum from occurring such that an entity wishing to conduct [active debris remediation] could still not seize the object. The ownership of a space object in perpetuity, even once defunct or broken apart, under Art. VIII is thus the first major element of the space law regime creating a dilemma for those interested in pursuing" active debris remediation."). S*ee* LYALL & LARSEN, *supra* note 83, at 67, 307 (stating that space objects cannot become abandoned property).

[139] *See, e.g.*, Schaefer, *supra* note 136 (discussing the difficulties of implementing liability salvage).

[140] *See* von der Dunk, *supra* note 34, at 159 ("As the current substance of obligations under international space law is relatively limited in size and scope, in particular as regards the specifics of private activities and their rights and interests, the requirement resting upon states to actually and effectively exercise and implement jurisdiction could still result in a rather 'light' version thereof.").

> The *nature of such an opportunity for observation and the conditions under which it could be afforded shall be determined by agreement* between the States concerned.[141]

Article XII

> All stations, installations, equipment and space vehicles on the moon and other celestial bodies shall be open to representatives of other States Parties to the Treaty *on a basis of reciprocity*. Such representatives shall give reasonable advance notice of a projected visit, in order that *appropriate consultations may be held and that maximum precautions may be taken* to assure safety and to avoid interference with normal operations in the facility to be visited.[142]

Article X's obligation is only an obligation to consider requests to observe the flight of space objects, not an obligation to approve such requests. Additionally, any such opportunity to observe and any conditions imposed are to be determined by agreement between the States. Similarly, Article XII's obligation has a good degree of flexibility. While it says that stations, installations, and equipment on the Moon and other celestial bodies shall be open for visits, it is only on the basis of "reciprocity," and it also makes clear that conditions can be imposed for safety and to avoid interference with operations. Thus, for example, Planetary Resources' future rovers or stations on asteroids, or Bigelow Aerospace's future lunar habitats, would only need to be open on the basis of "reciprocity," potentially limiting it to the very few other countries, if any, with similarly employed technology. But even if reciprocity is not so narrowly interpreted,[143] only a few countries with technological and financial abilities could even potentially invoke the right. Additionally, any such visit is subject to any safety and operational conditions or limits deemed necessary.[144] Finally, it is quite possible that "the context and object and purpose of the provision may

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141 OST, *supra* note 16, art. X (emphasis added).

142 *Id.* art. XII (emphasis added).

143 For the negotiating history of the article and the term "reciprocity," *see* Dembling & Arons, *supra* note 130, at 448–50 (noting that the U.S. maintained an interpretation of reciprocity that was more open to visits than the Soviets did during the negotiations).

144 For the negotiating history on these limits and conditions, *see id.*

very well indicate that it was intended to allow verification of arms control provisions of the OST, thus obviating the need for visits to U.S. commercial stations and equipment."[145] And even if it is ultimately determined that a visit is required and clears all the requisite legal and practical hurdles, the U.S. government could go a step further and agree to reimburse U.S. commercial companies for the costs incurred as a result of any such visits.

The last remaining articles, and those most frequently pointed to as potentially imposing significant limits on private activities, are Article II and Article IX. Article II states the following: "Outer space, including the moon and other celestial bodies, is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means."[146] This might at first glance be considered a limit on asteroid or lunar mining (either for in-situ resource utilization or return of materials to Earth), but the long-standing U.S. interpretation, shared by a sizeable number of countries (roughly one-third) represented in the UN Committee on the Peaceful Uses of Outer Space ("COPUOS") is that this provision does not prevent private property rights in extracted resources; rather, Article II only prevents claims of surface or sub-surface property rights.[147] Another third of countries believe there can be private property rights in some instances and would, in any event, find it less objectionable if done with proper "authorization" and "continuing supervision" of the appropriate state party as required by Article VI.[148] Indeed, Secretary of State Vance and then-Legal Adviser Owen put forth the U.S. interpretation in Congressional hearings in 1979 that private property rights were allowed with respect to extracted resources.[149] Congress recently passed legisla-

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[145] *Reopening the American Frontier: Exploring How the Outer Space Treaty Will Impact American Commerce and Settlement in Space: Hearing Before the Subcomm. on Space, Sci. & Competitiveness of the H. Comm. on Com., Sci. & Transp.*, 115th Cong. 10 (2017) (testimony of Matthew Schaefer, Co-Chair, American Branch of International Law Assoc. Space Law Committee).

[146] OST, *supra* note 16, Art. II.

[147] *See* Letter from Schaefer and Hertzfeld to Congressional Leaders (May 15, 2015).

[148] *Id.*

[149] *See* Letter from Sec'y of State Vance to Sen. Church, Chairman of Senate Foreign Rel. Comm., (Nov. 28, 1979), in *Agreement Governing the Activities of States on the Moon and Other Celestial Bodies*, Senate Comm. on Commerce, Sci. & Transp., (Nov. 28, 1979), at 313 (stating that the Moon Treaty provides no moratorium on exploitation of space resources, that Article II of the Outer Space Treaty's ban on appropriation only applies to resources in place, and that the Outer Space Treaty

tion signed into law by President Obama in November 2015 that essentially codifies this long-standing interpretation by providing the following:

> A United States citizen engaged in commercial recovery of an asteroid resource or a space resource . . . 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.
>
> It is the sense of Congress that by the enactment [of the above provision], the United States does not thereby assert sovereignty or sovereign or exclusive rights or jurisdiction over, or the ownership of, any celestial body.[150]

Thus, Article II is no barrier to asteroid mining or the establishment of lunar facilities by U.S. entities. Even though property rights in the surface or sub-surface of celestial bodies cannot be claimed under Article II, and OST Article I mandates "free access to all areas of celestial bodies," Article IX of the OST does contain some minimal obligations to help prevent mining or other operations from being interfered with by second-comers. Article IX requires "due regard" to be shown to other nations' space activities and also requires advance consultations if planning an activity that

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and Moon Agreement would allow for ownership of extracted space resources); *see also Agreement Governing the Activities of States on the Moon and Other Celestial Bodies: Hearing Before the Subcomm. on Sci., Tech., & Space of the H. Comm. on Com., Sci. & Transp.*, 96th Cong. 2–19 (1980) (testimony of State Dept. Legal Advisor Owen) ("American companies will have a continuing legal right to exploit the Moon's resources . . . . [O]nce [resources] have been extracted from the Moon, ownership can be asserted . . . [and] exploitation [can] go forward and . . . one can own what one can remove from the surface or subsurface of a celestial body . . . . [T]he negotiating history [of the Moon Agreement] makes it very clear that that was contemplated by the parties . . . . The United States took the position from the outset that such exploitation should be permitted, that such ownership after extraction should be permitted. And that . . . is an authoritative interpretation . . . . [W]e have insisted that even after [an international] regime is established [under the Moon Treaty], the right of unilateral exploitation will continue to be available to those States which choose not to participate in such a regime.").

150 U.S. Commercial Space Launch Competitiveness Act, PUB. L. NO. 114-90, 129 STAT. 704, §§ 402(b), 403 (2015).

"would cause potentially harmful interference" with another nation's space activities.

Article IX's consultation requirement arises where a second-comer miner or establisher of a lunar facility seeks to conduct a landing or engage in an activity too close to safely be accomplished next to the first-comer's mine or facility. Article IX provides that:

> If a State Party to the Treaty has reason to believe that an activity or experiment planned by it or its nationals in outer space, including the moon and other celestial bodies, would cause potentially harmful interference with activities of other States Parties in the peaceful exploration and use of outer space, including the moon and other celestial bodies, it shall undertake appropriate international consultations before proceeding with any such activity or experiment.

U.S. companies who are likely to be the first to engage in many new activities, and thus likely to be first-arrivers or first-movers, will certainly want the benefit of this obligation when it comes to foreign entities' actions as second-movers. Thus, it is important for the U.S. government to follow through with its supervision obligations under Article VI for U.S. entities. The U.S. government cannot diplomatically push other countries to live up to their Article VI obligations or other OST obligations if it does not have a plausible case to be made that it is living up to its own obligations.

Article IX also contains a two-way anti-contamination obligation. Specifically, it calls to "pursue studies of outer space, including the moon and other celestial bodies, and conduct exploration of them so as to avoid their *harmful* contamination and also *adverse changes* in the environment of the Earth resulting from the introduction of extraterrestrial matter and, where necessary, shall adopt appropriate measures for this purpose."[151] The first anti-contamination obligation implicates on-orbit activities while the latter deals with adverse changes to the environment of Earth. The latter provision can already be addressed by the FAA under the payload review of a licensed reentry because the FAA can take account of public safety in that context.[152] Those advocating a pure

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[151] OST, *supra* note 16, art. IX (emphasis added).

[152] *See* Laura Montgomery, *supra note 111* ("The FAA's payload review may arguably prevent contamination to Earth–if not from Earth–because the FAA may prevent a reentry if the reentry would jeopardize, among other things, public health and safety.").

permissionless innovation-inspired interpretation of the OST, or in other words, those who ignore the import of Art. VI of the OST, are worried about the costs that might be associated with the application of anti-contamination or planetary protection norms to new commercial space actors.[153] They argue that planetary protection standards set by COSPAR, a body of scientists,[154] could involve substantial compliance costs.[155] However, COSPAR standards concerning the Moon are quite limited. More importantly, COSPAR standards do not constitute "subsequent practice establishing the agreement of the parties" to the OST under Vienna Convention Law of Treaty interpretation rules[156] and thus do not set a floor for planetary protection that must be followed by private parties. The State Department and other agencies rejected the notion that COSPAR would set a floor during the Moon Express payload review.[157] The House Science Committee agreed, stating

[153] *Id*. ("Although it is difficult to find information about the costs of planetary protection, one expedition cost somewhere between $80 to $100 million in 2003 dollars. People are full of microorganisms. I'm no biologist, but I think there are far more than 300,000 bacterial spores on the surface of the human body, never mind what's inside us. Are we planning to prohibit people on Mars? Probably not. I hope not.").

[154] *See What We Do*, COSPAR, https://www.icsu.org/what-we-do/research-programmes/thematic-organizations/committee-on-space-research-cospar [https://perma.cc/YER5-YVXC] (explaining that COSPAR was established by ICSU in 1958 as an interdisciplinary scientific body concerned with the progress on an international scale of all kinds of scientific investigations carried out with space vehicles, rockets and balloons).

[155] *See COSPAR's Planetary Protection Policy*, COSPAR (Oct. 20, 2002) *amended* Mar. 24, 2005, http://w.astro.berkeley.edu/~kalas/ethics/documents/environment/COSPAR%20Planetary%20Protection%20Policy.pdf. [https://perma.cc/TU3B-NRPT] (detailing the planetary protection policy of COSPAR for the reference of spacefaring nations).

[156] VCLT, *supra* note 119, Art. 31(3)(b); *see also* U.N. General Assembly, *International Law Commission Report*, ¶9, U.N. Doc. A/CN.4/L.833 (June 3, 2014) ("1. An agreement under article 31, paragraph 3 (a) and (b), requires a common understanding regarding the interpretation of a treaty which the parties are aware of and accept. Though it shall be taken into account, such an agreement need not be legally binding. 2. The number of parties that must actively engage in subsequent practice in order to establish an agreement under article 31, paragraph 3 (b), may vary. Silence on the part of one or more parties can constitute acceptance of the subsequent practice when the circumstances call for some reaction."); *see generally* U.N. General Assembly, *Second Report on Subsequent Agreements and Subsequent Practice in Relation to the Interpretation of Treaties*, ¶56 U.N. Doc. A/CN.4/671 (Mar. 26, 2014).

[157] Discussions at 9th Annual University of Nebraska D.C. Space Law Conference (Oct. 2016).

in the American Space Commerce Free Enterprise Act, that "[g]uidelines promulgated by [COSPAR] may not be considered international obligations of the United States."[158] The U.S. government has flexibility to establish commercial-era norms with a lower floor than those developed by COSPAR in a predominantly science-oriented era.

In sum, the U.S. government, ensuring through authorization and continuing supervision compliance by U.S. commercial companies with the few obligations that implicate commercial space plans, will not significantly constrain nor impose significant costs on U.S. commercial companies. Thus, the authorization and supervision regime established to comply with Article VI can be "light touch," or one that is still within the range of the continuum that qualifies as in line with permissionless innovation thinking. Below is a sample checklist the FAA or other agency might use to ensure conformity with OST obligations by new on-orbit commercial applicants:

(1) Does the planned activity claim surface or sub-surface rights on a celestial body or prevent free access to all areas of a celestial body, while keeping in mind legitimate rights to be free from harmful interference?[159]

(2) Does the planned activity cause potentially harmful interference with foreign space activities?[160]

(3) Does the planned activity risk harmful contamination of a celestial body with Earthly matter?[161]

(4) Is the applicant respecting ownership rights of a foreign operator's space object?[162]

One might want to add as a fifth element, whether the applicant is willing to discuss with the U.S. government allowing visits from foreign states based on reciprocity to its stations and equipment with appropriate precautions to ensure safety and no interference with their operations. But it is an open question whether

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158 American Space Commerce Free Enterprise Act of 2017, H.R. 2809, 115th Cong. (2017) *supra* note 80 at § 3.

159 OST, *supra* note 16, arts. I, II, IX.

160 *Id*. at IX.

161 *Id*.

162 *Id*. at XIII (likely only relevant for space debris remediation).

such a fifth element of the checklist, concerning visits to stations, is required in light of the context as well as object and purpose of OST Art. XII. That is why this fifth element is phrased simply as "if the applicant is willing to discuss a visit" should such a request arise. As mentioned earlier, the U.S. government should reimburse a U.S. commercial actor for any costs associated with a visit, in the unlikely event that one occur, after clearing all legal interpretation and practical hurdles. One might add a sixth element, that the applicant is willing to take possible steps to assist astronauts in distress should a need arise, although this is likely to be impossible in most circumstances.

The above list is not onerous, particularly when one realizes that there is flexibility in how to define various terms, such as 'potentially harmful interference' and 'harmful contamination.' As will be discussed later, the U.S. government can have the commercial space industry involved in setting the standards that define those terms, provided such definitions do not stray from the ordinary meaning of those terms. To meet the continuing supervision obligation, the U.S. can require applicants to report material changes to operations or business plans and provide an annual report to the agency on its activities.

Proof of Propositions #3–5

Having established the U.S. government is required by its international obligations under the OST to ensure compliance with treaty provisions by U.S. commercial actors through authorization and continuing supervision and that any regulatory regime ensuring such compliance can be true to permissionless innovation thinking by being light-touch in nature, we turn now to the following proof of propositions #3-5:

3) Congress made it clear in the legislative history to the 1998 amendments to U.S. commercial space legislation that outside of FCC and NOAA licensing regimes for spectrum use and remote sensing, respectively, it was not granting authority to FAA or any other federal agency to regulate on-orbit activities; and

4) There are limits to how far the FAA can stretch or utilize its existing payload review process to address on-orbit activities; and

5) Current FCC authority and NOAA authority does not allow the U.S. to ensure compliance by commercial actors with the minimal OST obligations.

Proposition #3 is relatively straightforward. The FAA is perhaps hesitant to stretch the existing payload review process, i.e., leverage its authority, too far into a wholesale regulation of on-orbit activities, given the legislative history and Congressional intent surrounding the issue. House Committee Report 105-347, part of the legislative history of the 1998 amendments to the commercial space launch act that added "reentries" to FAA's "launch" licensing authority, states:

> The Committee wishes to make clear that the Secretary [of Transportation] has no authority to license or regulate activities that take place between the end of the launch phase and the beginning of the reentry phase, such as maneuvers between two Earth orbits or other non-reentry operations in Earth orbit; or after the end of a launch phase in the case of missions where the payload is not a reentry vehicle.[163]

Recently, the Executive Branch leveraged its payload review authority to satisfy its OST Art. VI obligations and approve a new on-orbit space activity. In late July 2016, the FAA approved a payload review request by Moon Express of its MX-1E spacecraft/lander that is "capable of transfer from Earth orbit to the Moon, making a soft landing on the lunar surface, and performing post-landing relocations through propulsive 'hops."' However, the Executive Branch was quick to caution that the approach may not work in all or even a majority of future instances. Specifically, the FAA release states:

> For this particular mission and set of circumstances, the FAA concludes, in concurrence with the Department of State, that the enforcement of these representations [made by Moon Express] constitutes compliance with Article VI of the Outer Space Treaty. This determination does not extend to future missions by Moon Express, Inc. or similar missions from other entities. Any future requests for a payload determination from Moon Express, Inc. or another entity will be evaluated on a case-by-case basis. The FAA

163 H.R. REP. NO. 105-347 (1997).

> made a favorable payload determination for this particular mission, however, not all non-traditional space missions may lend themselves to favorable payload determinations under the payload review authority . . . . Future missions may require additional authority to be provided to the FAA to ensure conformity with the Outer Space Treaty. . . . In the absence of legislative relief, the FAA will continue to work with the commercial space industry to provide support for non-traditional missions on a case-by-case basis when the law permits.[164]

Apparently, the limited nature of Moon Express activities made it possible to use the existing payload review process, but more sophisticated activities might cause more difficulties in using the existing payload review process. Moon Express volunteered to comply with COSPAR's planetary protection guidelines and as discussed above, those applicable to the Moon Express are quite limited, involving only a reporting requirement. There is also some question as to whether the FAA has authority to impose conditions or rather only give a thumbs up or thumbs down in a current payload review.[165] The Obama Administration's Mission Authorization framework, Rep. Bridenstine's Enhanced Payload Review determination, and the House Science Committee's American Space Commerce Free Enterprise Act all explicitly allow for a 'yes,' with conditions rather than simply approval or denial.

A year earlier, in 2015, the U.S. Executive Branch responded favorably to a Bigelow Aerospace payload review request to protect Bigelow's (future) orbital and lunar facilities from interfering operations. The FAA responded positively, indicating it would lever-

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[164] FAA, FAA Fact Sheet—Moon Express Payload Review Determination, FAA (Aug. 3, 2016), https://www.faa.gov/news/fact_sheets/news_story.cfm?newsId=20595 [https://perma.cc/3WG4-NYTH] (noting that the FAA accepted the application and proceeded with review for a Payload Review and Determination on the MX-1E spacecraft on April 21, 2016).

[165] *See, e.g.*, Jeff Foust, *Proposed Legislation Would Close Commercial Space Regulatory Gap*, SPACENEWS (Sept. 15, 2016), http://spacenews.com/proposed-legislation-would-close-commercial-space-regulatory-gap/ [https://perma.cc/YN4B-DHZK] ("A longer, more sophisticated mission, [State Dept. Lawyer Brian] Israel suggested, might be harder to approve currently without the ability to set conditions on a payload review. 'Our lack of ability to say 'yes, but' to prescribe conditions necessary for compliance with the treaty would put U.S. in a bind,' he said.").

age authority in response to Bigelow Aerospace's payload review request concerning the creation of zones of non-interference for its space habitats. The FAA, in consultation with the State Department, Department of Defense, NASA, NOAA, and other agencies, declared that it will use its current launch licensing authority as best as it can to protect space facilities, hardware, and personnel by ensuring zones of non-interference with commercial operations. However, the zones of non-interference will only apply vis-à-vis others being licensed by FAA, mostly U.S. corporations. While these decisions are a sign that FAA recognizes the importance of protecting and stimulating private sector investments in new space activities,[166] the limits the FAA placed on leveraging existing payload review authority are a strong indication that such leveraging will not fill the gap entirely.

Finally, some argue that there is no "gap" that needs to be filled because the FCC licenses spectrum for use by a spacecraft undertaking on-orbit activities and many of the spacecrafts going to space are capable of sensing Earth and therefore need a NOAA license too. Thus, according to this argument, the U.S. is authorizing and supervising its commercial actors' on-orbit or in-space activities already. The problem here is that the FCC and NOAA lack authority to take into account compliance with all OST obligations in issuing licenses. For example, can NOAA and the FCC take into account planetary protection issues flowing from OST Art. IX's harmful contamination (planetary protection) obligation when licensing a spacecraft under their respective laws and regulations? With respect to NOAA, the answer is no it may not. 51 U.S.C. § 60121(a)(2) provides the following:

> LIMITATION WITH RESPECT TO SYSTEM USED FOR OTHER PURPOSES.—
>
> In the case of a private space system that is used for remote sensing and other purposes, the authority of the Secretary under this subchapter shall be limited only to the remote sensing operations of such space system.

[166] *See* Matthew Schaefer, *Assessing the U.S. House of Representatives' SPACE Act of 2015 (H.R. 2262) and the related U.S. Senate Bill (S. 1297), Part IV – Providing for or Allocating On-Orbit (or In-Space) Jurisdiction*, LAW OF SCHAEFER (Aug. 19, 2015), www.lawofschaefer.com/ [https://perma.cc/4U2S-MUNV] (arguing that the legislative history of amendments to the Commercial Space Launch Act indicates that Congress did not intend to allocate licensing authority to the FAA for in-space or on-orbit activities).

The FCC also lacks authority to ensure compliance with all OST obligations. The FCC has taken into account foreign policy interests as part of its broader public interest analysis when assessing whether a U.S. satellite can utilize a foreign ground station or a foreign-registered satellite can provide service in the United States.[167] However, absent unusual facts, the FCC has not taken into account foreign policy interests in deciding on U.S. satellite spectrum applications; it would be breaking from tradition and practice to do so.[168] Moreover, the FCC jurisdiction is based on radio communications,[169] thus any foreign policy considerations they can take into account should likely be limited to foreign policy implications connected with the use of the radio spectrum, not, for example, the violation of unrelated OST obligations, such as harmful contamination (planetary protection) obligations.

4.2. National Security Risk and Regulatory Uncertainty Risk

Every-day, non-illicit space activities have national security implications. For example, debris created by pure accident can risk making orbits unusable,[170] and accidental interference with satellites or space operations may raise concerns given the difficulty in

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[167] *See, e.g.*, FCC, *Disco II Application* ("In the *DISCO II Order*, the Commission set forth the public interest analysis applicable in evaluating applications to use non-U.S. licensed space stations to provide satellite service in the United States. In conducting this analysis, we consider the effect on competition in the United States, spectrum availability, eligibility requirements and operating (*e.g.*, technical) requirements. In addition, we consider issues of national security, law enforcement, foreign policy and trade policy, when those issues are brought to our attention by the Executive Branch with regard to a particular application. After consideration of these issues, we find that the public interest would be served by a grant of USAsia Telecom[']s application.").

[168] *See* FCC, PETITION OF THE INTERNATIONAL TELECOMMUNICATIONS SATELLITE ORGANIZATION UNDER SECTION 316 OF THE COMMUNICATIONS ACT, AS AMENDED, DA 07-4715, Nov. 23, 2007.

[169] *See* 47 U.S.C. §§ 151–52 (2012) (establishing the FCC to regulate communications by wire and radio).

[170] *See* Tomasz Nowakowski, *Space Debris Expert Warns about Dangers of Orbital Junk*, PHYS.ORG, Jan. 12, 2015, https://phys.org/news/2015-01-space-debris-expert-dangers-orbital.html [https://perma.cc/U4KA-8G9Y] (stressing importance of international cooperation over the problem of floating space junk and the multiple dangerous effects space junk may have on orbiting operational spacecraft).

establishing intent and attribution in space.[171] Getting to space involves technology similar to an intercontinental ballistic missile. The U.S. military operates its own satellites but also increasingly leases transponders on commercial satellites.[172] These satellites are used for "nuclear command and control apparatus, military and intelligence surveillance, and national security communications and coordination."[173] No nation is more militarily reliant on space assets than the United States.[174] Interference with those assets is, and will remain, a national security concern.[175] It is implausible for the U.S. government to give carte blanche approval to activities in outer space without at least minimal national security review. Indeed, the Executive Branch would face strong temptations to lev-

171 *See* Paula A. DeSutter, Assistant Secretary for Verification, Compliance, and Implementation, Remarks to the George C. Marshall Institute Roundtable at the National Press Club (as prepared) ,March 4, 2008, https://2001-2009.state.gov/t/vci/rls/rm/101711.htm [https://perma.cc/N6EM-3SK5] ("Clearly, the fact that a space object has been destroyed, or has sustained damage or injury, or that its parameters have been altered is detectable with high confidence by the satellite owner and, in some instances, by the National Technical Means (NTM) of other states. The attribution of such an action to another state may be possible with high confidence in the case of a direct intercept or of a collision with an object known to belong to that other state. However, identification (as an attack) may not be possible if the other state denies that its action was deliberate. Further, identification (as an attack) and/or attribution (to a state) may not be possible in other instances—e.g., if there were no observable intercept or collision, as in the case of a remote, covert telemetric attack on the software of the object's operating system or if the damage were caused by 'space debris.' Attribution also could be a challenge with certain types of launches, e.g., from locations at sea.").

172 *See* Timothy M. Bonds & Isaac R. Porche III, *Satellites for Rent*, U.S. NEWS & WORLD REPORT (Nov. 7, 2013), https://www.usnews.com/opinion/blogs/world-report/2013/11/07/limiting-the-pentagons-reliance-on-commercial-satellites. [https://perma.cc/H5CX-ASWK] (describing different models of satellites utilized by the U.S. government, and proposing other leasing strategies that could increase and diversify supply).

173 *See* JOSHUA HAMPSON, THE FUTURE OF SPACE COMMERCIALIZATION, NISKANEN CENTER (Jan. 25, 2017), https://niskanencenter.org/wp-content/uploads/2017/01/TheFutureofSpaceCommercializationFinal.pdf [https://perma.cc/S5LB-899E].

174 *See* Omar Lamrani, *What the U.S. Military Fears Most: A Massive Space War*, THE NAT'L INT. (May 18, 2016), http://nationalinterest.org/blog/the-buzz/what-the-us-military-fears-most-massive-space-war-16248 [https://perma.cc/5NYT-CA36] ("For the United States, being the leader in military space technologies provides immense advantages. At the same time, its outsized reliance on those technologies entails risks. The current unequal dependence on space, the United States fears, could give adversaries incentive to attack its infrastructure in orbit.").

175 *Id.*

erage its existing payload review authority to prevent any on-orbit activities that threaten national security.[176] Industry acknowledges this dynamic. Businesses focused on new activities do not want a dysfunctional process that delays deployment of new technologies or decisions based on outdated benefit-cost analysis, even with regards to national security interests. They do, however, understand that a pure permissionless innovation model is simply impracticable in the outer space domain. Indeed, at its October 2016 meeting, COMSTAC made the following finding and recommendation:

> The COMSTAC finds that the current lack of an explicit, defined process for commercial space activities that are not currently explicitly supervised by a U.S. Government Agency has resulted in a lack of stability, predictability, transparency, and efficiency, which has and will continue to hinder the development of domestic commercial space operations.
>
> RECOMMENDATION:
>
> COMSTAC recommends that, in meetings and discussions with policymakers, regardless of the ultimate approach taken to meet the nation's international treaty obligations, the U.S. Government should take expeditious action to enable a safe, predictable, and conducive environment for the growth of commercial space operations and activities . . . .[177]

Fortunately, U.S. national security interests connected with many of the expected new activities—such as on-orbit and lunar habitats and research labs, and asteroid and space resource min-

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[176] See, e.g. *Regulating Space: Innovation, Liberty, and International Obligations hearing before the Committee on Science and Technology, Subcommittee on Science*, 115th Cong. (March 8, 2017) (statement of Doug Loverro, Former Deputy Assistant Secretary of Defense for Space Policy) http://docs.house.gov/meetings/SY/SY16/20170308/105659/HHRG-115-SY16-Wstate-LoverroD-20170308.pdf [https://perma.cc/YE2Y-B48B] (presenting an example of collaboration between private sector and Executive Branch to eliminate a program's national security risks).

[177] COMSTAC proposed OFR's, (Oct. 26, 2016) (on file with author); (adoption confirmed by and available at Marcia Smith, *Bridenstine: This is Our Sputnik Moment & The Moon Will Ensure U.S. Preeminence in Space*, SPACEPOLICYONLINE.COM (November 3, 2016 12:43 am ET), http://www.spacepolicyonline.com/news/bridenstine-this-is-our-sputnik-moment-the-moon-will-ensure-u-s-preeminence-in-space [https://perma.cc/GX47-HR57]).

ing—align with its commercial interests. U.S. national security is generally enhanced if U.S. commercial companies are leaders in these industries rather than second-movers. On-orbit satellite servicing or active debris remediation technologies—because the technology can be adapted for satellite weaponry—is a closer call. But even here if the technology is to come to market, it is far better for U.S. national security if it is the U.S. industry to lead the development of the technology rather than foreign countries. If Congress does not enact a transparent and stable process, then the Executive Branch will always face temptations to leverage existing authorities and commercial space businesses will be left wondering if activities will be blocked or limited by the government at the last minute or after significant investment in time and money. Thus, in addition to limiting the international obligation risk, a "light touch" authorization and supervision process can diminish both national security risk for the government as well as regulatory uncertainty risk for the commercial space industry.

5. EXECUTIVE BRANCH AND CONGRESSIONAL PROPOSALS TO CURE THE ON-ORBIT REGULATORY GAP

The benefits of Congress filling the on-orbit regulatory gap are numerous. First, it will ensure that the United States can meet its international obligations under Article VI of the OST. Meeting our international obligations will lessen opposition and diplomatic complaints among some countries to controversial activities such as asteroid mining. Correspondingly, it will prevent actions by foreign governments against foreign partners cooperating with, or foreign customers purchasing from, U.S. commercial space businesses engaged in on-orbit activities. Second, it will also ensure that U.S. national security concerns will be addressed in a more certain and predictable manner. Third, it can provide regulatory certainty to space industry investors. However, doing so does not require Congress to abandon pursuit of permissionless innovation thinking. Congress, in filling the gap, should also seek to maximize permissionless innovation thinking within the on-orbit regulatory framework it creates, as well as help advance a permissionless innovation esprit de corps in the inter-agency process considering applications.

Three proposals to cure the gap have been advanced in the past two years: (i) the Obama Administration's Mission Authorization proposal of April 4, 2016 (delineated in a report required by Section 108 of the U.S. Commercial Space Launch Act of 2015), (ii) Representative Bridenstine's American Space Renaissance Act bill's proposal for an enhanced payload review process for *after deployment* activities of payloads, and (iii) the 2017 House Science Committee's American Space Commerce Free Enterprise Act bill calling for a certification process. The three proposals are examined below along with options for improving the permissionless innovation quotient in each, or alternatively, in the case of the third proposal, ensuring its proposed certification process sufficiently addresses international obligation and national security risk factors that can undermine the benefits of permissionless innovation.

5.1. The Executive Branch's Proposed Mission Authorization Framework of April 4, 2016

In November 2015, President Obama signed into law the U.S. Commercial Space Launch Competitiveness Act of 2015. The law in Section 108 contains a reporting requirement for the Executive Branch (Director of OSTP) to address the on-orbit authority issue, namely to undertake the following:

> (1) assess current, and proposed near-term, commercial non-governmental activities conducted in space;
>
> (2) identify appropriate authorization and supervision authorities for the activities described in paragraph (1);
>
> (3) recommend an authorization and supervision approach that would prioritize safety, utilize existing authorities, minimize burdens to the industry, promote the U.S. commercial space sector, and meet the United States obligations under international treaties . . . .[178]

Section 108 adopted the Senate bill's language over that of the House bill. The House bill would have only required an examination of on-orbit authority in the context of space resource and as-

[178] U.S. Commercial Space Launch Competitiveness Act, Pub. L. No. 114-90.

teroid resource extraction activities.[179] As noted above, asteroid mining is only one of many future on-orbit activities. The Senate bill focused, as did the final law, on current and "near-term" new activities[180] without defining what "near-term" means (i.e., three years? Five years? Ten years? Or more?).

Most space companies and investors want certainty as to the on-orbit licensing processes sooner rather than later. However, a few may wish for a delay to prevent any risk of adoption of an inappropriate or overly complex framework, created without benefit of first seeing the activities that come to market. Skeptics of immediate legislative fixes indicate that there is always a possibility of continuing to modestly stretch current authorities for some activities that creep up earlier than expected. Government agencies, particularly the U.S. State Department, wish to have a framework in place sooner rather than later in order to minimize any diplomatic complaints, particularly over activities such as asteroid mining. The U.S. framework could possibly serve as a model for other nations while also ensuring compliance with U.S. international obligations. There are hints of this tension in Section 108's requiring a report by the Executive Branch and seemingly wanting to push the process along sooner but with the focus placed on current and "near-term" activities, suggesting some sympathy to treading more slowly as activities occur.

The report required by Section 108 of the U.S. Commercial Space Launch Competitiveness Act was released by White House/OSTP on April 4, 2016.[181] The report does not draw a bright line for what constitutes "near-term" activities, but does mention activities that might occur within one year as well as activities that might "not begin for a decade or more."[182] The three categories of activities addressed in the report are: (i) private missions beyond Earth Orbit (e.g., commercial missions to the Moon or Mars and commercial lunar habitat), (ii) new on-orbit activities (e.g., on-orbit satellite servicing, including repair and refueling, and commercial orbital habitats), and (iii) space resource utilization (e.g., extracting/mining resources from asteroids or the Moon).[183] The report states that the U.S. government has imple-

179 H.R. Res. 2262, § 402 114th Cong. (2015).

180 S. Res. 1297, § 7 114th Cong. (2015).

181 Holdren, *supra* note 19.

182 *Id.*

183 *Id.*

mented its OST Article VI obligations to "authorize" and "continually supervise" through licensing conditions with separate frameworks for launch/reentry, remote sensing, and communications adding that these existing frameworks do not "provide clear avenues through which the U.S. government can fulfill its Art. VI obligations in relation to the newly contemplated commercial space activities."[184]

The report highlighted the desire, by many companies, for a "clear and predictable oversight process that ensures access to space and imposes minimal burdens on the industry."[185] Accordingly, the report made a suggestion for such an oversight process, called the "Mission Authorization" proposal.

Modeled on the payload review process of the FAA, the April 4, 2016 OSTP report recommends a new "Mission Authorization" framework and states a belief that legislation creating such a framework "would encourage investment in [new space] activities . . . ."[186] The Mission Authorization proposal is similar to the FAA's payload review process in that the FAA would coordinate an inter-agency process on a case-by-case basis. The proposal does not authorize any agency to adopt substantive, generally applicable regulations.[187] The Mission Authorization proposal defines "mission" to involve "the operation of a space object, with or without human occupants, in outer space, including the Moon and other celestial bodies,"[188] but explicitly excludes those activities requiring an FCC or NOAA license.

One further benefit of establishing the Mission Authorization proposal, according to the report, is that the current payload review process only applies to payloads launched from the United States, whereas the Mission Authorization proposal would apply to U.S. nationals regardless of launch location. As such, it would eliminate any potential disincentive for U.S. nationals to launch from foreign countries.[189] Another benefit is that it would open the door to "yes, but . . . " answers in response to requests for authorization as, according to some government officials, the current pay-

184 *Id.* at 3.

185 *Id.* at 4.

186 *Id.*

187 *Id.*

188 *Id.* app. at 6-7.

189 *Id.* at 4–5.

load review process does not allow for any conditions.[190] Under the proposal, conditions can be placed on mission authorizations if "deem[ed] necessary for compliance with United States international obligations, preservation of the foreign policy interests and national security of the United States, and protection of United States government uses of outer space."[191]

5.2. Rep. Bridenstine's American Space Renaissance Act Bill's (H.R. 4945) Enhanced Payload Review

In April 2016, Representative Bridenstine from Oklahoma released H.R. 4945, or the "American Space Renaissance Act," without formally introducing it.[192] The bill states the sense of Congress that existing law is sufficient authority for the U.S. to meet its international obligations under the OST.[193] However, it proceeds to call on the DOT (specifically, a newly created Assistant Secretary for Commercial Space Transportation) to issue regulations "as are necessary to provide for enhanced review and determination process for payloads and associated activities *after deployment*," pursuant to a launch license.[194] The bill also calls for enhanced coordination and participation of DOT with other agencies, specifically including the Department of State, Department of Defense, Department of Commerce, NASA, and the Office of the Director of National Intelligence.[195]

Section 309 of the Bridenstine bill appears to be responsive to at least some of Chairman Babin's concerns regarding the Mission Authorization proposal, specifically Chairman Babin's concern that the on-orbit approval process will face the same pitfalls as the

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[190] *See, e.g.*, Jeff Foust, Proposed Legislation Would Close Commercial Space Regulatory Gap, SPACENEWS (Sept. 15, 2016), http://spacenews.com/proposed-legislation-would-close-commercial-space-regulatory-gap/ [https://perma.cc/9VXY-QNP7]).("A longer, more sophisticated mission, [State Dept. lawyer Brian] Israel suggested, might be harder to approve currently without the ability to set considerations on a payload review. 'Our lack of ability to say 'yes, but. . .' to prescribe conditions necessary for compliance with the treaty would put the U.S. in a bind,' he said.").

[191] Holdren Letter, *supra* note 19, app. at 6-7.

[192] H.R. Res. 4945, 114th Cong. (2016).

[193] *Id.* § 309(a)(1).

[194] *Id.* § 309(a)(2).

[195] *Id.* § 309(a)(2)(B).

NOAA process for remote sensing, including lengthy delays. Thus, under Rep. Bridenstine's bill, determinations are required within sixty days of submission, by the payload owner or operator, of information sufficient to make an enhanced review and determination. If sixty days pass without a determination, approval is deemed to have occurred.[196] Conditions may be imposed to ensure consistency with U.S. treaty obligations, protection of U.S. national security, prevention of harmful interference with already approved activities, and protection of historic artifacts.[197] If DOT denies a license due to a payload and its associated activities, it must provide the owner or operator with a clearly articulate rationale so that they can attempt to remedy any defect.[198]

5.3. House Science Committee's American Space Commerce Free Enterprise Act Bill (H.R. 2809) of June 2017

The House Science Committee approved and reported out of committee H.R. 2809 on June 8, 2017.[199] The bill seeks to establish a certification regime for new on-orbit space activities. The Secretary of Commerce, rather than the FAA, is empowered by the bill to issue certificates to applicants that meet the requirements outlined in the bill.[200] In essence, applicants have to describe the proposed operations of their space object (where and when it will operate) and attest that they are not carrying any WMD or testing weapons on celestial bodies (that is, not violating OST Art. IV).[201] The Secretary of Commerce "shall as he determines necessary" consult with other agencies on the application.[202] Thus, an interagency discussion is

196 *Id.* § 309(a)(2)(C)(i).

197 *Id.* § 309(a)(2)(C)(ii).

198 *Id.* § 309(a)(2)(C)(iii).

199 *See* American Space Commerce Free Enterprise Act Bill, H.R. 2809, 115th Cong. (2017) *supra* note 80 (amending Title 51 of the United States Code to provide for the authorization and supervision of nongovernmental space activities).

200 *See id* at § 3 (focusing on authorization and supervision of issuing certificates to operate space objects).

201 *Id.*

202 COMMITTEE ON SCIENCE, SPACE & TECHNOLOGY, AMENDMENT TO H.R. 2809 OFFERED BY MR. SMITH OF TEXAS, https://science.house.gov/sites/republicans.science.house.gov/files/documents

not absolutely required, although even weaker language utilizing the word "may" was in the bill originally and strengthened to "shall" after an amendment at the bill's mark-up by the committee.[203] If the Secretary of Commerce exceeds the time deadline for decision, the certification is considered approved without condition.[204] The Secretary of Commerce can condition or deny an application for a certification if the Secretary cannot verify information in the application or if the Secretary determines with clear and convincing evidence that the activity would violate an international obligation of the United States under the OST.[205] However, as noted earlier, in making that determination, the Secretary is supposed to interpret the OST in a minimally burdensome way, but without any acknowledgement of Vienna Convention treaty interpretation rules, nor the State Department's traditional role in administering treaty interpretation of the OST.[206] Indeed, under the statute, only the Secretary of Commerce is allowed to make findings regarding OST obligations in the case of U.S. commercial actors' new space activities.[207] There is no specific mention of any other criteria the Secretary can take into account in conditioning or denying a certification—no specific national security criteria exists.[208] There is a provision in the statute addressing a situation in which a certification holder's space operations pose a threat to the physical safety of an American government asset.[209] However, in such a situation, the Secretary is only entitled to hold a consultation between the affected parties and report the results to Congress, but the Secretary is not empowered to impose conditions on operations as a result of the consultation.[210]

/SMITTX_012_xml.pdf [https://perma.cc/MLE5-W8GG] (adopted at Committee Mark-Up by voice vote).

203 *Id.*

204 American Space Commerce Free Enterprise Act of 2017, H.R. 2809, 115th Cong. (2017) *supra* note 80 at §3.

205 *Id*.

206 *Id.*

207 *Id*. at § 5.

208 *Id*. at § 3.

209 *Id.* at § 5.

210 *Id.*

6. When Congress Acts to Cure the On-Orbit Regulatory Gap, How Can It Maximize Permissionless Innovation Thinking and Permissionless Innovation *Esprit de Corps* within the Interagency Process, While Ensuring International Obligation Risk and National Security Risk are Sufficiently Minimized?

Worries exist that the interagency process created by a Mission Authorization Framework or an Enhanced Payload Review Process will lead to lengthy delays in approval or authorization or lead to overly burdensome regulation. This does not appear to be the intent of those proposing or supporting cures to the on-orbit regulatory gap, and so the question arises what provisions can be injected as "friendly amendments" to limit an overly-restrictive or burdensome process on the commercial space industry. Additionally, the question arises as to what suggestions for change to these approaches should be avoided. However, the Certification Process laid out by the American Space Commerce Free Enterprise Act bill raises the opposite concern: whether its desire for permissionless innovation thinking goes too far, thereby creating international obligation risk as well as national security risk issues that undermine the ultimate benefits of permissionless innovation.

6.1. Features That Should be Adopted in any Proposal to Cure the Regulatory Gap for New On-Orbit Space Activities

6.1.1. Creating a Default Presumption in Favor of Approval.

Key to permissionless innovation thinking is the establishment of a policy default of approval of the development and deployment of new technologies. In an attempt to ensure that decisions are reached in a timely fashion and create a default rule in favor of approval, Rep. Bridenstine's bill attempts to use a "deemed authorized" provision. That is, if no decision on an on-orbit activity application is given within set number of days, then the applicant's activities are "deemed authorized."[211] The American Space Com-

[211] H.R. Res. 4945, *supra* note 186, § 309(a)(2)(C)(i).

merce Free Enterprise Act bill also contains a similar provision.[212] The problem with a "deemed authorized" provision, while it is consistent with the default of approval in permissionless innovation thinking, is that it may simply lead to a "no" answer if no decision has been reached within the time window provided. That answer will be given to avoid having the activity be deemed authorized. In other words, a "deemed authorized" provision can backfire and essentially lead to a default of no permission. Instead, any law granting Executive Branch authority should simply declare a presumption in favor of approval.

Indeed, Congress could even go further and create a "foreseeable harm" requirement. The requirement would mandate the agency to find "foreseeable harm" to one of the listed interests/factors the agency is to consider in authorization decisions. Such a requirement can act to avoid precautionary principle thinking seeping into the process. Congress recently employed a foreseeable harm requirement in the context of improvements to FOIA to buttress presumptions in favor of release of information, so it is a tool with which Congress is familiar.[213] The American Space Commerce Free Enterprise Act bill employs a "clear and convincing" evidence standard for international obligation violations that can also assist a presumption in favor of allowing activities.[214] However, use of this evidentiary standard raises the risk of a litigation-centric approach, and there is no absolute certainty that it is the standard that would be employed internationally for violations.[215] Moreover, the evidentiary standard does not work as well for a national security criterion, but of course, such a criterion is absent in the bill, as we will see below.

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[212] American Space Commerce Free Enterprise Act of 2017, *supra* note 80, at §3.

[213] *See* FOIA IMPROVEMENT ACT OF 2015, S. REP. 114-4, (2015) (reviewing the FOIA Improvement Act's of 2015 background, purpose, history, and regulatory impact evaluation, and recommending passage of the bill).

[214] American Space Commerce Free Enterprise Act of 2017, H.R. 2809, 115th Cong. (2017) *supra* note 80, at §3.

[215] For example, the International Court of Justice has not made clear what standard of proof they would employ for a state responsibility issue, although there is some support for the clear and convincing evidence standard. *See, e.g.*, Marco Roscini, *Evidentiary Issues in International Disputes Related to State Responsibility for Cyber Operations*, 50 TEXAS INT'L L.J. 234, 248-51 (2015) (examining possible methods and standards of proof in the context of international cyber operations).

6.1.2. Limiting Factors that Can be Considered by the Executive Branch but Not So Much as to Create International Obligation Risk, National Security Risk or Interference with Operations Risk.

The Mission Authorization Framework proposed by the Obama administration bans the issuance of substantive regulations. Instead, there is an *ex ante* interagency process established that will consider four factors: (i) compliance with international obligations, (ii) U.S. national security interests, (iii) U.S. foreign policy interests, and (iv) protection of U.S. government uses of outer space.

Rep. Bridenstine's bill contains a similar set of factors to consider but with some differences. Bridenstine's four factors include, like the Obama Administration's Mission Authorization framework, compliance with international obligations and U.S. national security interests. However, Bridenstine's four factors do not include foreign policy interests, nor protection of U.S. government uses of outer space. Dropping these two probably helps favor permissionless innovation thinking. Dropping foreign policy interests as a factor limits discretion to disapprove new space activities. Foreign policy interests are a broader potential limit than compliance with international obligations and national security interests, both of which might be considered to encompass a subset of all foreign policy interests. Eliminating protection of U.S. government uses of outer space as a criterion is consistent with Congressional calls to utilize commercial services to the maximum extent,[216] and in any event, the national security factor already adequately protects national security assets and activities.

Rep. Bridenstine's approach has the following additional factors included: the activity must "not result in harmful interference with approved and operating payloads and associated activities," and must "not harm historic artifacts."[217] The first additional factor is necessary to protect U.S. commercial first movers from interference from U.S. commercial second-movers. Compliance with international obligations only deals with interference between U.S. companies and foreign entities. The second additional factor is fairly narrow—likely referring to Tranquility Base, the location on

[216] 51 U.S.C. § 50901 (2012).

[217] H.R. Res. 4945, *supra* note 186, § 309(a)(2)(C)(ii).

the Moon where Neil Armstong's footprints still reside, as do other similar artifacts, and would only implicate activities on the Moon in any event.[218] Rep. Bridenstine's list of factors, being a bit narrower, appears to be more friendly to permissionless innovation than those in the Mission Authorization Framework.

The American Space Commerce Free Enterprise Act bill basically limits its criteria to international obligations, with numerous limitations on how those international obligations can be interpreted and a high standard (clear and convincing) for proving their violation.[219] It almost appears that, except for those OST Art. IV obligations related to WMD and weapons testing, the bill is making it difficult to consider other minimally burdensome OST obligations laid out in the checklist earlier in this article. Yet, arguably somewhat inconsistently, the marked-up bill calls on the President to protect U.S. entities from harmful interference, protect ownership interests of U.S. entities' space objects, and ensure that U.S. entities operations are given due regard.[220] In other words, it calls on the President to protect OST Art. VIII and IX rights of U.S. entities without requiring the President to ensure that threats to these rights are proven by clear and convincing evidence. The bill, as worded, thus creates a risk that foreign countries may view the U.S. as not respecting their OST rights to the same degree the U.S. is expecting its OST rights to be respected, and consequently raises the prospect of foreign retaliation.

The bill also does not contain any general national security criteria, and only allows for a consultation and report to Congress on such consultation, should the commercial activity threaten the physical safety of a U.S. government space asset. The bill thus might have narrowed the criteria for approval too much. It creates a risk of the U.S. government potentially stepping in to block an ac-

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[218] *See, e.g.*, Michael Milstein, *NASA Looks to Protect Historic Sites on the Moon*, SMITHSONIAN (June 2008), http://www.smithsonianmag.com/science-nature/nasa-looks-to-protect-historic-sites-on-the-moon-47186092 [https://perma.cc/3E4A-XZR6] (discussing NASA's guidelines to protect historic lunar landmarks and high importance of international norms governing lunar archaeology); *see also* Alice Gorman, *Look, But Don't Touch: U.S. Law and the Protection of Lunar Heritage*, SPACE.COM (Dec. 6, 2013, http://www.space.com/23860-look-but-dont-touch-us-law-and-the-protection-of-lunar-heritage.html [https://perma.cc/79M9-EQMC] (stressing urgency of adequate Moon heritage protection).

[219] American Space Commerce Free Enterprise Act of 2017, H.R. 2809, 115th Cong. (2017) *supra* note 80, at §§ 3, 5.

[220] *Id*.

tivity and overstretching authorities in case of a rare but significant national security issue being raised. The risks of foreign retaliation or last-minute blockages by the federal government potentially undermine the purported benefits of a (too) pure permissionless innovation regime.

Furthermore, the bill does not include interference with the activities of an already approved U.S. commercial space object as a criterion. There is some concern that some entities might attempt to use non-interference rights to "space squat" and block potential competitors from certain areas or regions. Indeed, the bill declares that the Secretary of Commerce "may not deny an application for a certification. . .in order to protect an existing certification holder from competition."[221] This is good policy in isolation, but any solution to the regulatory gap must also account for true cases of interference with pre-existing U.S. commercial operations.

6.1.3. Enhancing the Default Presumption by Explicitly Declaring U.S. Leadership in Specific New Activities is in the National Security Interest of the United States.

At first glance, national security concerns could potentially be the greater obstacle to a favorable decision, compared to international obligation concerns. This is due to the limited nature of OST obligations that might apply to commercial activities. However, many of the new space activities most likely to occur in the near future will probably cause less of a national security concern than appears in the remote sensing context. As a general matter, it is in the U.S.'s national security interests to have U.S. companies be the first to engage in asteroid or lunar mining, and to establish private research labs or hotels in-orbit or on the Moon. Thus, the interagency process should be designed to act promptly on such applications. The new activities of on-orbit satellite servicing or debris removal may contain more competing national security arguments. It stems from the fact that if operations go wrong, they may endanger national security assets by creating additional debris or move debris into a more populated orbit. On balance, since some of the technology is akin to satellite weaponry, it is still in the U.S. interest if such activities are born by and engaged in by U.S. com-

[221] *Id.*

mercial entities first. Congress could declare that U.S. leadership in these activities by U.S. commercial companies is in the national security interest. This will prevent national security criteria for approval from being utilized to limit commercial operations, except in very rare and essential cases, such as when the commercial operation might harmfully interfere with an existing critical U.S. government space asset. The American Space Commerce Free Enterprise Act bill contains such a declaration,[222] and thus it should not fail to contain any national security criteria, or at least contain a bit more robust authority to protect federal government space assets from harmful interference, for a rare instance in which the new activities raise such concerns.

6.1.4. Granting Lead Interagency Status to an Agency Directed to Promote Industry

Both the Executive Branch's proposed Mission Authorization Framework and Rep. Bridenstine's proposed bill would entrust the FAA (or in the case of the Bridenstine bill, a newly created position of an Assistant Secretary for Commercial Space within the DOT) with leading the interagency process for reviewing missions and payloads, as well as issuing final decisions on applications. Since the FAA has authority to "encourage, facilitate and promote" the commercial space industry, placing the FAA in the interagency lead may help establish a permissionless innovation *esprit de corps* within the interagency process. In contrast, NOAA—the lead agency for remote sensing decisions—is not charged with promoting the industry. Having an agency with promotion authority lead the interagency process can help ensure that the benefits (including national security benefits) of an activity are fully considered. It can also help ensure consideration of the potential foreign competition that might seek to benefit from less stringent authorization processes abroad. Additionally, "if an agency that has experience in licensing is given the lead authority this will help reduce transac-

[222] *See* American Space Commerce Free Enterprise Act of 2017, H.R. 2809, 115th Cong. (2017) *supra* note 80, at § 2(5) ("The private exploration and use of outer space by nongovernmental entities will further the national security, foreign policy, and economic interests of the United States.").

tion costs and avoid possible duplication in processes."[223] Thus, the FAA is likely the best candidate to be the lead agency because it has both promotion authority and experience in licensing and inter-agency coordination in commercial space matters. The problem with the American Space Commerce Free Enterprise Act bill's attempt to place authority over new in–orbit space activities in the Department of Commerce and not absolutely requiring an interagency process, is several–fold. If such authority is given to another agency, duplication may result, as FAA–AST will still conduct a payload review, separately or as part of a launch license. Given the State Department's lead role in treaty interpretation and international consultations on space matters, and DOD's knowledge of critical national security space assets, it is important that on-orbit licensing remain an interagency process. Hence, "[s]imply adding an on-orbit component to the existing payload review, along with the other suggestions made in these eight principles, may be the least costly and least disruptive solution to solving the on-orbit authorization gap."[224]

6.1.5. Establish Deadlines with Executive Branch Notification and Reporting Requirements to Congress.

In order to put some teeth, or at least pressure, behind statutory deadlines, and prevent years-long delays of the kind that occurred in NOAA remote sensing licensing processes, Congress can place significant notification and reporting requirements on the Executive Branch in any delegation of on-orbit authority to the Executive Branch. For example, Congress could require immediate notification to the House Science and Senate Commerce Space Subcommittees when the deadline for a decision has passed. It can also require semi-annual reports on mission authorization (or enhanced payload review) applications and decisions, as well as on any foreign on-orbit activities and foreign licensing procedures. Such notification and reporting requirements may place subtle pressure on the Executive Branch to ensure timely decisions are

[223] *Reopening the American Frontier: Exploring How the Outer Space Treaty Will Impact before the Subcomm, on Space, Science and Competitiveness of the S. Comm. on Commerce, Sci. and Transp.*, 115th Cong. (2017) (Statement of Matthew P. Schaefer, American Branch of International Law Assoc. Space Law Committee).

[224] *Id.* at 14.

made, while also ensuring that they are keeping track of any foreign competitive pressures.

6.1.6. Establish an Ombuds as well as Possible Appeal Avenues to the President or Vice–President in Cases of Denial.

Congress might even consider creating an ombuds[225] with a top security clearance that is able to intervene in cases in which decisions are delayed, or rationales for decisions are not fully explained or cannot be explained due to lack of proper security clearances by applicant company officials. On numerous occasions executive ombuds, that take complaints regarding agency action, have been created by means of Congressional statutes. In fact, there are so many ombuds that a Coalition of Federal Ombuds has been created.[226] Congress can also add the option of an appeal to a higher authority, such as the Vice President-led Space Council, recently re-created under the Trump Administration,[227] or the President, in situations where the ombuds working with the interagency process and the company have not reached a satisfactory resolution.

6.1.7. Limit Chances for Regulatory Arbitrage and "Flags of Convenience" to Help Ensure Innovation Occurs in the United States.

The space business is global and, in establishing any regulatory regime, the U.S. must be sensitive to avoid regulating in a manner that encourages the outflow of innovative space businesses to other spacefaring countries. International Traffic in Arms (ITAR) regula-

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225 *See* Coalition of Federal Ombudsman, (Aug. 27, 2012), http://federalombuds.ed.gov/federalombuds/index.html (last visited Feb. 24, 2017) [https://perma.cc/7WAC-NBA6] (explaining the purpose and resources provided by the Coalition of Federal Ombudsman, which facilitates ombuds serving United States government agencies).

226 *See id.* (detailing the goals and services offered by the Coalition of Federal Ombuds to assist ombuds).

227 *See* Exec. Order No. 13803, 82 Fed. Reg. 31429 (June 30, 2017)*; see also* Leonard David, *Playing the Space Trump Card: Relaunching a National Space Council*, SPACE (Dec. 29, 2016), https://www.space.com/35163-trump-administration-national-space-council.html [https://perma.cc/G733-9LJG] (examining potential usefulness of President Trump's idea of re-launching the National Space Council).

tions, even after substantial reform in the past several years, help prevent outsourcing to some degree. However, given the importance of the space industry to national security and national economic interests of the United States, policy-makers still must be sensitive to this concern.[228] In recognition of other countries' actions, as well as space industries benefitting from similar frameworks at least as favorable as the U.S. one, Congress just recently showed its concern for possible regulatory arbitrage among those seeking to access space. In 2015, it passed a long-term (ten-year) extension of the promise of government indemnification for third party damages, above the amount of insurance required to be purchased by launch licensees to place U.S. industry on roughly equal footing with foreign launch companies that benefit from third-party liability caps enacted by their governments.[229] Thus, when filling the on-orbit regulatory gap, Congress might now require the interagency process led by the FAA to consider in its decision–making the global nature of the industry, and the goal of not placing U.S. commercial space entities at a competitive disadvantage when compared to the regulatory frameworks and authorization processes adopted by foreign countries. The Congressional committee reports on any legislation can detail the very limited nature of the obligations in the OST that might apply to commercial space activities, laying out the checklist developed earlier in this article.[230] The law itself might also direct the President to ensure, through negotiation and consultation, that foreign countries are also meeting the same minimum standards—e.g., not creating "flags of convenience"[231] to attract the space industry. Congress might even consider ensuring that foreign subsidiaries of U.S. companies (even those relying on foreign launch vehicles) receive U.S. authorization for their activities. This latter provision would mean that Congress would choose the Mission Authorization Framework ap-

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228 Schaefer, *supra* note 45, at 225–27.

229 *Id*. at 232–233.

230 *Id.* at 36.

231 *See generally* Frans G. von der Dunk, *Towards Flags of Convenience in Space?*, (Univ. of Neb.) (2012), http://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1075&context=spacelaw [https://perma.cc/5PFK-6AYF] (noting that, in the space context, "from the mere fact that national laws and licensing regimes are different it can not automatically be concluded that there is a risk in practice for 'flags of convenience' in outer space to become a real problem, so as to require or justify substantial efforts to deal with it for example at the UN level.").

proach to this issue rather than following Rep. Bridenstine's Enhanced Payload Review, as the payload reviews only occur for payloads using U.S. launch vehicles.

6.1.8. Have the U.S. Government Both Encourage and Give Substantial Deference to Industry Standards.

House Science Committee Space Subcommittee Chairman, Rep. Babin, recently proposed turning to "standards-setting bodies" and "self-regulating organizations" as alternatives to an authorize and supervise framework.[232] However, these approaches cannot be alternatives to an authorize and supervise framework while also maintaining consistency with OST Art. VI. That is because Art. VI requires the government to be the one authorizing and supervising. Yet, the spirit of Chairman Babin's proposal is achievable, since there is no prohibition on the U.S. government deferring to industry-set standards, and standards of self-regulating organizations, in determining whether to authorize an activity. For example, COSPAR has planetary protection standards. For a number of reasons, these standards, created and followed in a science-inspired coalition of governments and scientists, do not create a floor for what constitutes harmful contamination under the OST.[233] The U.S. government recognizes that COSPAR standards do not constitute "subsequent practice establishing the agreement of the parties" under the Vienna Convention on the Law of Treaties interpretation rules. Therefore, the U.S. government need not follow these standards in authorizing on-orbit activities.[234] Instead, the U.S. government has the flexibility to set its own planetary protection standards in a commercial environment, or to follow industry-set standards. Congress recently has promoted industry standards over safety matters by requiring periodic reports from the FAA in consultation with industry on such matters every thirty months.[235] Congress could similarly push the FAA to promote industry standards on matters related to ensuring compliance with OST obligations by private parties—specifically non-interference and

232 Babin, *supra* note 2 at 5.

233 *Supra* notes 159–62 and accompanying text.

234 *Id.*

235 Public Law No. 114–90, *supra* note 178.

harmful contamination (planetary protection) standards. Indeed, the American Space Commerce Free Enterprise Act bill calls for the establishment of a private sector advisory committee to examine, among others, harmful interference and harmful contamination issues.[236] Of course, there could be some hurdles to industry establishing standards, such as concerns about releasing proprietary information to potential competitors, but nevertheless there should be mechanisms and processes that allow for standards that are greatly informed by industry such that the standards are friendly to commercial activity.

6.2. Two Approaches that Should Be Avoided

Other suggestions have been made by current and former government officials to limit the extent of Executive authority over on-orbit activities. However, the drawbacks of these suggestions outweigh their benefits and should be avoided in any legislative solution.

6.2.1. Listing Specific Activities that Require Authorization or Giving Blanket Statutory Authorizations to Certain Activities.

A former DOT/FAA official suggested listing specific activities that require authorization.[237] The former official argues that specific listing is necessary so as not to run afoul of the U.S. Constitution's non-delegation doctrine or the Due Process Clause.[238] However, the Constitutional arguments made in favor of listing specific activities are inaccurate. First, the non-delegation doctrine is a

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[236] *See* American Space Commerce Free Enterprise Act of 2017, H.R. 2809, 115th Cong. (2017) *supra* note 80 at § 3.

[237] *See* Montgomery, *supra* note 124 (discussing the United States compliance with the Article VI of the Outer Space Treaty); *see also* Montgomery, *supra* note 105 (discussing application of the Article VI of the Outer Space Treaty to the private sector).

[238] *See* Laura Montgomery, *Comments to the FAA on an Enhanced Payload Review*, GROUND BASED SPACE MATTERS (Sept. 16, 2016), http://groundbasedspacematters.com/index.php/2016/09/16/comments-to-the-faa-on-an-enhanced-payload-review/#more-115 [https://perma.cc/QY9Y-3QVT] (arguing "the proposed enhanced payload review fails to provide commercial actors adequate notice as to what activity must obtain authorization").

very weak one, that only requires Congress to provide an "intelligible principle" to guide the Executive Branch or to exercise the essentials of the legislative function.[239] Delegating to the Executive Branch authority over activities that essentially require being placed aboard the equivalent of an intercontinental ballistic missile to engage in, and subjecting those activities to review based on a limited set of factors—including national security and international obligation compliance—seems to be narrower than many previously upheld delegations. For example, U.S. courts upheld the price control delegations granted to President Nixon in the 1970's that potentially applied to the entire economy.[240]

Moreover, the Supreme Court jurisprudence in the famous *Curtiss-Wright* case confirms that Congress can paint with a very broad brush when delegating power in the foreign affairs and national security realms.[241] The Supreme Court has not invalidated a delegation in over eight decades.[242] If Congress chooses to require authorization for on-orbit activities generally, rather than a specific list of activities, it will be upheld in any court challenge. Proponents of listing specific activities that require authorization also argue that failure to do so is like Congress delegating power to the Executive Branch to authorize every activity in the State of Connecticut.[243] The analogy collapses immediately based on federalism concerns present in one and not in the other. The Connecticut hypothetical would have the federal government regulating in areas of traditional state competence. Federal regulation of on-orbit activities does not intrude on traditional areas of state regulation. The closer, although still imperfect, analogy is if Congress delegated authority to the Executive Branch to restrict travel of U.S. citi-

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239 *See, e.g.*, J.W. Hampton Jr. & Co. v. United States, 276 U.S. 394, 409 (1928).

240 *See, e.g.*, Amalgamated Meat Cutters & Butcher Workmen of North Am., AFL-CIO v. Connally, 337 F.Supp. 737 (D.D.C. 1971) (approving delegation to the President under a statute that provided the President is authorized to issue such orders and regulations as he may deem appropriate to stabilize prices, rents, wages, and salaries at a level not less than those prevailing on May 25, 1970).

241 *See* United States v. Curtiss-Wright Export Corp., 299 U.S. 304 (1936).

242 *See* Stephen Wermiel, *SCOTUS for Law Students: Non-Delegation Doctrine Returns after Long Hiatus*, SCOTUS BLOG (Dec. 4, 2014), http://www.scotusblog.com/2014/12/scotus-for-law-students-non-delegation-doctrine-returns-after-long-hiatus [https://perma.cc/4QC9-8ARL] (discussing non-delegation doctrine being recently revisited).

243 *See* Laura Montgomery, *supra* note 105 (discussing application of the Article VI of the Outer Space Treaty to the private sector).

zens to, and their activities upon arrival in, other non-sovereignty zones, such as the high seas or Antarctica. The federal government could impose such restrictions on travel to ensure compliance with international obligations or to protect U.S. national security.

Due process arguments for failure to list specific activities, and thus, to provide proper notice to those potentially regulated, will also fail. Those boarding or placing objects on board rockets intended for LEO or beyond have adequate notice that they need authorization involving a limited set of criteria under any of the proposed solutions to fill the regulatory gap. Policy reasons also caution against specifically listing activities requiring authorization. The Administration's report proposing a Mission Authorization Framework discussed the most likely activities to occur within the near future—mining, on-orbit or lunar labs, facilities or hotels, and on-orbit satellite servicing—and one could, in theory, simply limit the framework to those activities. But doing so would come with costs. It is often hard to predict which new technologies will come to market first. There is always the unexpected idea that proceeds to market quicker than anticipated. Any activity not on the list is disadvantaged, relative to listed activities, because it would be subject to the exact same cloudy situation facing all on–orbit activities currently—one in which the Executive Branch may seek to leverage its payload authority to prevent the activity, or alternatively may not, because it lacks authority. In either case, the non-listed activity's investors are in a difficult situation—if blocked, they may be left with only a litigation option, and even if not blocked, they may suffer ramifications due to questions over whether the U.S. complied with its OST Art. VI obligations.

Remember that, in terms of international obligation compliance, much of what must be considered in an authorization and supervision process are Art. IX's non-interference and anti-contamination obligations.[244] Take a company that is considering a lunar brewing facility—an idea not so far-fetched, it turns out.[245] There is no way to say in advance whether the lunar brewing facility's chosen location will interfere with the operations of another

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[244] *Id.* at 34-5.

[245] *See* Henry Bodkin, *Scientist Brewing Up Plan to Make Beer on the Moon*, THE TELEGRAPH (Jan. 22, 2017), http://www.telegraph.co.uk/science/2017/01/22/scientists-brewing-plan-make-beer-moon [https://perma.cc/7V8X-YY7Q] (discussing a plan to find out whether beer can be brewed on the Moon).

entity—it all depends on the location chosen and the plans of the business. It is for this reason that Chairman Babin's idea for "blanket statutory authorizations for classes of activities"[246] will also be hard to implement. Many, if not all, space activities could be performed in a manner consistent or inconsistent with the OST—all depending on the facts. For example, Congress has already made clear that asteroid and space resource mining is an approved activity—so much so that Congress has essentially granted property rights in extracted resources garnered from those activities. But there is still a need for those activities to go through the "light touch" authorization and supervision process to determine whether the chosen location of those activities harmfully interferes with foreign space activities, or whether the rover and operations will harmfully contaminate a celestial body. Of course, there may be some "Earthly," mundane activities taking place within research labs or space hotels (i.e., in-facility activities) that may cause no concern, such as teeth brushing. Congress could direct the authorizing agency to create a list of "in-facility" activities that are in essence pre-approved, recognizing that disposal of certain items (such as toothbrushes) may still require review. Congress might also seek to exclude these types of activities via definitions. For example, the American Space Commerce Free Enterprise Act bill excluded from its definition of space object "an article on board a space object that is only intended for use inside a space object."[247]

6.2.2. Relying on the Common Law of Torts or a Newly Created Federal Statutory Cause of Action for Unreasonable Interference.

Using existing tort law,[248] or even a newly created federal statutory cause of action, as a replacement for an authorization and supervision framework administered by the Executive Branch that looks at U.S. international obligations—especially non-interference obligations—creates several problems. First, authorization indicates that "official permission" is obtained, and the context of that authorization suggests the U.S. must assure conformity with non-

246 *See* Babin, *supra* note 2.

247 American Space Commerce Free Enterprise Act of 2017, H.R. 2809, 115th Cong. (2017) *supra* note 80 at § 80101(11)(C)(i).

248 *See id.* at 5 (listing tort law as a possible solution to be considered).

interference obligations in Art. IX of the OST. Tort law solutions do not meet the ordinary meaning of the word "authorize," but rather attempt to remedy an actual case of harmful interference after the fact. Further, tort law solutions in domestic courts, for actions occurring in outer space, face several potential problems, including difficulties in basing cases on trespass given the lack of surface or sub-surface property rights, as well as difficulties in fact collection in the outer space arena. Given the global nature of the aerospace industry, other procedural barriers will limit the effectiveness of relying on litigation to meet Art. IX obligations, such as obtaining personal jurisdiction over foreign defendants, or enforcing U.S. court judgments abroad, among others.[249]

The original July 2014 Asteroids Act bill (H.R. 5063) did seek to create a non-interference right and a federal court action to enforce the right. Specifically, it provided the following:

> (b) FREEDOM FROM HARMFUL INTERFERENCE
>
> As between any entities over which the United States can exercise jurisdiction, any assertion of superior right to execute specific commercial asteroid resource utilization activities in outer space shall prevail if it is found to be first in time, derived upon a reasonable basis, and in accordance with all existing international obligations of the United States.
>
> RELIEF FROM HARMFUL INTERFERENCE
>
> A United States commercial asteroid resource utilization entity may bring an action for appropriate legal or equitable relief, or both, under this chapter for any action, by another private entity, compromising the right to conduct its operations free of harmful interference.[250]

However, this federally-created non-interference action was dropped from the final version of the U.S. Commercial Space Launch Competitiveness Act of 2015.[251] Having federal courts create rules for what constitutes unreasonable and harmful interference is not preferred to solutions negotiated between government

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[249] *See* Schaefer, *supra* note 45, at 256–62 (discussing the potential for litigation by SFPs in foreign court).

[250] Asteroids Act, H.R. 5063, 113th Cong. § 51302 (2014).

[251] Pub. L. No. 114-90, *supra* note 178.

and industry, or between the U.S. government and foreign governments, given the diplomatic and political sensitivities. Enforcement of any such judgments in foreign jurisdictions may also face numerous hurdles,[252] as well as if U.S. courts engage in a U.S. centric-view of how to balance the competing principles of "free access to all areas of celestial bodies" and the ban on surface or sub-surface rights in Art. I and II of the OST on the one hand, with the "due regard" and avoid "harmful interference" obligations of Article IX on the other hand. It is better to leave judgments on granular matters to the Executive Branch that can consult with and negotiate with U.S. industry and foreign governments, free of standards of proof and the evidentiary rules of a courtroom. Further, other countries might open their courts to similar actions against U.S. entities, leading to parallel litigation and competing judgments. Lastly, the Asteroids Act's harmful interference action would only have applied to foreign entities over which U.S. courts could exercise personal jurisdiction,[253] whereas the Executive Branch negotiations and leverage can also be brought to bear with respect to actors over which U.S. courts lack personal jurisdiction.

7. CONCLUSION

Permissionless innovation is rarely pure or unadulterated, but rather, it is contextual. The space domain context necessitates ex ante, case-by-case approval processes, if the U.S. is to comply with its international obligations and ensure protection of national security. The current regulatory gap concerning new on-orbit activities by commercial space entities appears to come close to a (nearly) pure or unadulterated form that on its surface appears to avoid all need for ex ante, or any other, review. Indeed, advocates of the nearly pure form of permissionless innovation seek to ensure this status quo by even ignoring the long-established, agreed-upon rules of treaty interpretation that bind the U.S. government to argue that the U.S. does not need to authorize and supervise new on-orbit activities to ensure compliance by commercial entities with

[252] *See generally* Asteroids Act, *supra* note 250 (limiting the jurisdiction under the act to "between any entities over which the United States can exercise jurisdiction.").

[253] *See id.* at § 51303.

OST obligations. But ironically, this nearly pure form of permissionless innovation fails to achieve the benefits of permissionless innovation for the innovators.

If the regulatory gap continues, the Executive Branch will continue to face a Hobbesian choice: allow on-orbit activities without review, and thus violate U.S. international obligations under the Outer Space Treaty and risk failing to take account of national security concerns, or, alternatively, seek to leverage existing payload review authority in a manner that is likely not true to Congressional intent to review and possibly block such activities where they conflict with the OST or national security interests. Commercial space businesses are in an equally poor situation: risking foreign government retaliation in a variety of forms for engaging in activity that does not comply with the OST, or being faced with the prospect of costly and time-consuming litigation against the U.S. government, a substantial customer of commercial space services, arguing that the Executive Branch exceeded its delegated powers. Investment in new on-orbit activities will be chilled as a result of this regulatory uncertainty.

Fortunately, Congress can enact a "light touch" regulatory solution that fills the gap—providing compliance with international obligations, protection of national security, and regulatory certainty for U.S. space businesses—and at the same time ensures that permissionless innovation thinking and *esprit de corps* controls the interagency approval process. Congress can do so by adjusting the three existing proposals to fill the gap—the Mission Authorization framework proposed by the Obama White House's OSTP, the Enhanced Payload Review process proposed by Rep. Bridenstine in the Space Renaissance Act bill, and the Certification Process proposed by the House Science Committee's American Space Commerce Free Enterprise Act—to comport fully with the eight core features recommended in this article. These core features include: creating a default presumption in favor of approval, but without a deemed authorized provision; limiting (but not too narrowly) the factors that can be considered by the Executive Branch; enhancing the default presumption by explicitly declaring that U.S. leadership in specific new activities being contemplated is in the national security interest; granting lead interagency status to an agency directed to promote industry and experienced in licensing and administering an interagency process; establishing deadlines with notification and reporting requirements to Congress; establishing an ombuds and/or appeal avenues to the President or Vice-

President-led Space Council in cases of denial of approval; limiting chances for regulatory arbitrage and possible "flags of convenience," to help ensure innovation occurs in United States; and having the U.S. government encourage and give substantial deference to industry standards. An ex ante licensing process with features that ensure a default in favor of approval, along with timely, transparent, and appealable decisions, with deference to industry standards, fits comfortably within a permissionless innovation line of thinking.

However, two suggested amendments to the existing proposed approaches should be avoided: first, listing specific activities that require authorization or giving blanket statutory authorizations to certain activities, and, second, relying on the common law of torts or a newly created federal statutory cause of action to prevent harmful interference. The first is not mandated by Constitutional requirements and actually preserves the cloudy situation for non-listed activities. The latter places decisions in non-expert hands without the benefit of negotiation by the Executive Branch with foreign countries and with the industry over what should constitute harmful interference.