The Space Law Review

Editor
Joanne Wheeler MBE

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THE SPACE LAW REVIEW

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PREFACE

I am honoured to introduce the first edition of *The Space Law Review*.

It seems appropriate to be writing this introduction in 2019, the 50th anniversary of the first human landing on the Moon on 20 July 1969 as part of NASA's Apollo 11 lunar mission. This anniversary has further raised awareness of the value of space activities, whether from a scientific perspective, in a commercial context or simply to inspire the next generations.

I am hugely appreciative of the time and dedication of the lawyers who have contributed to this first edition, and more importantly for embracing space law as a practice area. The importance of *The Space Law Review* will grow each year as the value of space activities increases, further applications of satellite technology are brought into use and the commercial revenues from the industry are recognised. Lawyers will be required to understand the international treaties, how they are enforced and applied in national law and apply such laws, regulations and policies, potentially creatively, to new technologies and business models.

The economic benefits from the space sector are beginning to be recognised by states. The global space economy is expected to be worth £40 billion by 2030. The productivity of the space sector tends to be much larger than national averages.

New and innovative technologies increasingly derive from private commercial activities rather than the more traditional government-funded missions. States are responsible for national activities in outer space and therefore seek to supervise and authorise such activities through national legislation and licensing mechanisms.

New technology such as CubeSats, constellations of thousands of satellites, in-orbit servicing, high-resolution Earth observation data and new small-launcher technology are testing regulatory and insurance frameworks, and offer challenges to regulators that must work very closely with industry, using ideally anticipatory and outcome-focused regulation, to govern such activities. We are seeing new insurance models and financial security concepts being considered by regulators in the granting of launch and operations licences.

Efficient national regulation, which enables innovation effectively, is an increasingly important source of competitive advantage globally. We are witnessing more regulatory forum shopping than ever before in the space industry.

Regulators are required to achieve a balance between:

a managing government risk and liability, compliance with international obligations, safety, security and the sustainable use of and access to space; and

b encouraging commercialisation, innovation and growth, the benefits to society of new technology and attractiveness to foreign investment.

What is being recognised is that effective national regulation is an enabler to new and innovative satellite technology and the ability to raise finance.

On a personal note, this industry has been my passion for over 27 years. In that time, it has evolved from government-led telecommunications cooperatives to a competitive commercial innovative market, with applications that I would not have imagined in my lifetime. We are now seeing a paradigm shift in technology and opportunities in an industry that is growing with drive and determination; lawyers and regulators need to fully engage with the industry to keep up with it. It is a fascinating industry to engage with.

I thank my professor of space law, the lawyers and clients who supported me over the years, and most of all the contributors again, and hope that readers enjoy this edition and recognise the unique value that the international space industry can bring us on Earth.

Joanne Wheeler MBE
Alden Legal Limited
London
November 2019

Chapter 11

UNITED STATES

Milton 'Skip' Smith[1]

I INTRODUCTION TO THE NATIONAL LEGAL, REGULATORY AND POLICY FRAMEWORK

The United States has the most robust and detailed national space law and regulatory regime addressing space activities of any nation. Many nations have modelled their laws on those of the United States.

The United States is a party to the four principal UN space treaties: the Outer Space Treaty; the Agreement on the Rescue and Return of Astronauts; the Liability Convention; and the Convention on Registration of Objects Launched into Outer Space. The United States is not a signatory or party to the Moon Agreement. The term 'treaty', as a matter of United States constitutional law, means an international agreement made by the President with the advice and consent of the Senate. In general, a treaty has a status that is equal to a federal statute, superior to a state law and inferior to the Constitution.

Some, but not all, of the space treaties have been the subject of policy, legislation and regulation. For example, pursuant to Article 6 of the Outer Space Treaty,[2] nations bear 'international responsibility for national activities in space' whether these activities are carried on by governmental or non-governmental entities.[3] Moreover, the activities of non-governmental entities in outer space require 'authorization and continuing supervision'.[4] To fulfil these obligations, the United States has established detailed statutory and regulatory regimes addressing safety, financial responsibility, licensing and other matters.

In the United States, there are numerous governmental actors that address space activities from a regulatory and policy aspect. The National Aeronautics and Space Administration (NASA) focuses on civil space activities, the Department of Defense (DOD) controls government and military space activities, and a number of other federal agencies regulate commercial activities. These agencies include: the Federal Aviation Administration (FAA), which licenses launch, re-entry, spaceport and related activities; the Federal Communications Commission (FCC), which licenses communication frequencies and operating characteristics; the National Atmospheric and Oceanic Administration (NOAA), which licenses remote sensing activities; the Department of State (DOS), which coordinates international interactions, including export control of certain products that are particularly sensitive or could have military uses; and the Department of Commerce (DOC), which

1 Milton 'Skip' Smith is a member of Sherman & Howard LLC. This chapter is adapted and changed from a work originally published in *Colorado Lawyer*, Vol. 47, May 2018.

2 Outer Space Treaty, Jan. 27, 1967, 18 UST. 2410, 610 U.N.T.S. 205, www.state.gov/t/isn/5181.htm.

3 id., at Article 6.

4 id.

generally handles export control of space products in the commercial realm. The DOS Directorate of Defense Trade Controls interprets and handles the export control of space products in the defence arena and enforces the International Traffic in Arms Regulations. Presently, no agency regulates on-orbit activities.

II REGULATION IN PRACTICE

This section provides a review of key aspects of the US legal regime applicable to commercial space activities with a focus on (1) commercial space launch, (2) satellite remote sensing of the Earth, (3) satellite communications, (4) NASA activities and (5) space mining. Most of these areas involve US space policy, statutory provisions and extensive administrative regulations. The regulatory regimes have generally worked well and fostered the development of commercial space activities in the United States.

One significant development in US space law was the re-codification of space laws in 2010. Public Law 111-314 enacted a restatement of existing law relating to national and commercial space programmes as a new title of the United States Code. The enactment of Title 51 transferred statutes dealing with space programmes from various United States Code titles and put them in one place.[5] Most of the laws relevant to commercial use of space are now located at Title 51.

i Commercial space launch activities

Commercial space launch capabilities are important to the United States for many reasons. The 2010 National Space Policy reflects this importance; one of its six goals is to '[e]nergize competitive domestic industries to participate in global markets and advance the development of: . . . space launch[.]'[6] The 2013 National Space Transportation Policy established five goals, including to '[p]romote and maintain a dynamic, healthy, and efficient domestic space transportation industrial base; [and] [e]ncourage and facilitate the US commercial space transportation industry to increase industry robustness and cost effectiveness[.]'[7] The 2013 Policy also directs agencies to '[p]urchase and use US commercial space transportation capabilities and services and facilitate multiple US commercial providers of space transportation services across a range of launch vehicle classes, to the maximum extent practicable'.[8] The United States has done so in many ways, including NASA's use of Space Act Agreements, discussed in subsection iv. Because commercial space launch capabilities are so important, there is a very detailed statutory and regulatory regime applicable to such activities.

The Commercial Space Launch Act (CSLA)[9] was enacted in 1984 to incentivise the commercial space launch industry. The CSLA and its implementing regulations govern commercial space launch activity. The CSLA empowers the Secretary of Transportation, delegated to the FAA Office of Commercial Space Transportation, to (1) authorise and

5 Detailed information about Pub. L. No. 111-314 is available in the accompanying House Report 111-325.

6 Office of Space Commerce, National Space Policy at 4 (2010), https://obamawhitehouse. archives.gov/sites/default/files/national_space_ policy_6-28-10.pdf.

7 Office of Space Commerce, National Space Policy at 2 (2013), https://obamawhitehouse. archives.gov/sites/default/files/microsites/ostp/national_space_transportation_policy_11212013. pdf.

8 id., at 4.

9 Commercial Space Launch Act of 1984, as amended (CSLA) and re-codified in 51 USC Ch. 509 §§ 50901 to 50923.

regulate launch and re-entry activities of licensees consistent with public health and safety, the environment, national security and US foreign policy; (2) impose and enforce insurance and financial responsibility requirements on licensees; (3) encourage, facilitate and promote commercial space launches and re-entries by the private sector; and (4) investigate and penalise violations of the CSLA.[10]

The CSLA requires a licence for:

a a person to launch a launch vehicle, operate a launch or re-entry site, or re-enter a re-entry vehicle (launch–re-entry activities) inside the United States;

b a US citizen to conduct launch–re-entry activities outside the United States; and

c a US citizen to conduct launch–re-entry activities outside the United States in certain situations involving a foreign government.[11]

The CSLA implementing regulations in Title 14 of the Code of Federal Regulations (CFR)[12] establish procedures to obtain a:

a launch licence (Part 415);

b licence to operate a launch site (Part 420);

c licence for launch and re-entry of a reusable launch vehicle (Part 431);

d licence to operate a re-entry site (Part 433); and

e licence for re-entry of a vehicle other than a reusable launch vehicle (Part 435).

Part 413 of the regulations establishes licence application procedures.[13] The procedures include guidance on who must obtain a licence or permit, pre-application consultation with the FAA, confidentiality and licence or permit renewal.

Part 440 of the CSLA regulations addresses financial responsibility.[14] The FAA determines 'the maximum probable loss (MPL) from covered claims by a third party for bodily injury or property damage, and the United States, its agencies, and its contractors and subcontractors for covered property damage or loss, resulting from a permitted or licensed activity'.[15] The MPL is an important concept because the MPL determination 'forms the basis for financial responsibility requirements issued in a license or permit order'.[16] The licensee or permittee must obtain third-party liability insurance or demonstrate financial responsibility in amounts sufficient to compensate for the MPL.[17] The third-party MPL amounts are established for each licence by the FAA up to a maximum of US$500 million or '[t]he maximum liability insurance available on the world market at a reasonable cost'.[18] Similar provisions apply to claims by the United States, its agencies, and its contractors and subcontractors, with their MPL capped at US$100 million or '[t]he maximum liability insurance available on the world market at a reasonable cost'.[19]

10 See generally Commercial Space Transportation, www.faa.gov/regulations_ policies/faa_regulations/commercial_space.

11 51 USC § 50904(a).

12 14 CFR Chapter III, Parts 400 to 460.

13 14 CFR §§ 413.1 to 413.23.

14 14 CFR §§ 440.1 to 440.19.

15 14 CFR § 440.7(a).

16 id.

17 14 CFR § 440.9(a) and (b).

18 14 CFR § 440.9(c)(1) and (2).

19 14 CFR § 440.9(d) and (e).

Each licensee must also comply with detailed and complex reciprocal waiver of claims requirements.[20] This includes signing a cross-waiver of liability with their customers and the US government.[21] Through these reciprocal waivers each party (1) agrees to be responsible for property damage or loss it sustains, and for personal injury to, death of, or property damage or loss sustained by its own employees, resulting from an activity carried out under the licence; and (2) waives claims it may have against the other parties to the agreement.[22] Furthermore, the licensee and its contractors, subcontractors and customers, as well as the contractors and subcontractors of the customers, are also to extend the requirements of the waiver and release of claims, and the assumption of responsibility, to their contractors and subcontractors.[23] Proper implementation and flow-down of these waivers is critical. Failure to do so can lead to indemnity obligations[24] and other significant consequences, such as exposing parties to potential liability.

With limited exceptions, the government is authorised, subject to congressional appropriations, to pay successful third-party claims against the licensee, a contractor, subcontractor or customer of the licensee, or a contractor or subcontractor of the licensee's customer, in excess of the amount of the licensee's third-party liability insurance up to US$1.5 billion.[25] In such an event, the President, on the recommendation of the Secretary of Transportation, must submit a compensation plan to Congress recommending the amount of claims to be paid.[26]

In addition to determinations of financial responsibility, the FAA, with assistance from other government agencies, will conduct policy, safety, payload, and environmental 'reviews' for a proposed activity.[27]

In a policy review, the FAA 'reviews a license application to determine whether it presents any issues affecting US national security or foreign policy interests, or international obligations of the United States'.[28] This may involve interagency coordination with the DOD, the DOS and other federal agencies. The processing of these reviews at the FAA, and at the NOAA, has come under attack from industry owing to long delays, sometimes exceeding one year.[29]

Safety reviews vary depending on the specific type of activity. The FAA conducts them to determine whether an applicant is capable of launching a launch vehicle and its payload

20 14 CFR § 440.17.

21 Forms for such cross-waivers are found in the FAA regulations. See 14 CFR § 440 Appendices B through E.

22 14 CFR § 440.17. See also 51 USC § 50914(b) (1).

23 51 USC § 50914(b)(2); 14 CFR § 440.17.

24 14 CFR § 440.17(c)(2)(i).

25 51 USC § 50915(a); 14 CFR § 440.19(d). The CSLA requires that the US$1.5 billion maximum amount that the United States will pay in excess of the licensee's third-party liability insurance be adjusted to reflect inflation. 14 CFR § 440.19(a)(1)(B). The Commercial Space Launch Competitiveness Act of 2015 extended this indemnification of launch providers for extraordinary catastrophic third-party losses through 2025. 51 USC § 50915(f).

26 51 USC § 50915(d).

27 14 CFR Part 415.

28 14 CFR § 415.23(a). See also § 431.23(a).

29 See, e.g., http://spacenews.com/house-panel-criticizes-commercial-remote-sensing-licensing.

without endangering public health and safety and the safety of property.[30] These reviews generally include analysis of compliance with acceptable flight risk criteria, flight readiness and communication plans, and accident investigation plans and procedures.[31]

The FAA reviews a proposed payload 'to determine whether a license applicant or payload owner or operator has obtained all required licenses, authorization, and permits . . . to determine whether its launch would jeopardize public health and safety, safety of property, US national security or foreign policy interests, or international obligations of the United States'.[32] The FAA does not review payloads regulated by the FCC or the NOAA, or those owned or operated by the US government.[33] The FAA's environmental review evaluates the environmental impacts associated with a proposed launch or re-entry.[34] The applicant must provide sufficient information for the FAA to evaluate compliance with the National Environmental Policy Act[35] and other statutes.

The FAA regulations require a launch licence applicant to describe how it will satisfy the FAA's requirements for avoiding the creation of space debris.[36] Among other things, the application must demonstrate efforts to prevent collisions between components of the launch vehicle and the satellite being launched. As described in subsection iii, other government agencies, including the FCC and the NOAA, also require debris mitigation plans.

Part 460 of the FAA regulations details requirements for approval of human space flights. These requirements include requirements for the crew, government astronauts, and 'space flight participants', defined as 'an individual, who is not crew, carried aboard a launch vehicle or reentry vehicle'.[37] The CSLA and FAA regulations require crew members and space flight participants to be advised of the risks associated with space travel and to sign waivers releasing the US government and the licensee from any claims arising from injury or property damage associated with their participation in space activities.[38] The CSLA protects private spaceflights from additional regulatory oversight by allowing the industry until 1 October 2023 to develop before government regulators will have a substantial role absent a death, serious injury or an event that could have led to a death or serious injury.[39]

It is important to note that while the CSLA and FAA regulations apply to the launch and re-entry of space objects, there is no regulation of on-orbit operations by the FAA or any agency. Although there have been proposals to assign responsibility for on-orbit transportation to the FAA or another agency, this regulatory gap remains.

30 14 CFR Part 415, Subpart C (Safety Review and Approval for Launch From a Federal Launch Range) and Subpart F (Safety Review and Approval for Launch of an Expendable Launch Vehicle From a Non-Federal Launch Site).

31 id.

32 14 CFR § 415.51.

33 14 CFR § 415.53.

34 14 CFR §§ 415.201 to 415.203, 431.91 to 431.93.

35 National Environmental Policy Act, 42 USC § 4321.

36 14 CFR § 417.129.

37 14 CFR § 401.5.

38 14 CFR §§ 460.9, 460.19, and 460.49.

39 51 USC § 50905(c)(9).

ii Remote sensing of the Earth from space

Remote sensing of the Earth from space[40] presents significant national security issues. The United States has developed a legal regime based on policies, laws and regulations to accommodate national security concerns and allow the promotion of commercial remote sensing activities. Since 2003, US remote sensing policy has favoured commercialisation.[41] Pursuant to the 2003 US Commercial Remote Sensing Policy, the US government will:

a rely to the maximum practical extent on US commercial remote sensing space capabilities for filling imagery and geo-spatial needs for military, intelligence, foreign policy, homeland security, and civil users;

b focus government remote sensing space systems on meeting needs that cannot be effectively, affordably and reliably satisfied by commercial providers because of economic factors, civil mission needs, national security concerns or foreign policy concerns;

c develop a long-term, sustainable relationship between the government and the commercial remote sensing space industry;

d provide a timely and responsive regulatory environment for licensing the operations and exports of commercial remote sensing space systems; and

e enable US industry to compete successfully as a provider of remote sensing space capabilities for foreign governments and foreign commercial users, while ensuring appropriate measures are implemented to protect national security and foreign policy.[42]

Remote sensing in the United States (other than national security operations) started with the government-built and operated Landsat series of satellites. Although the government still operates Landsat satellites and provides its images for free, remote sensing has developed into a strong commercial industry.

The Land Remote Sensing Policy Act (LRSPA)[43] and its implementing regulations[44] govern commercial remote sensing operations. The LRSPA's purposes include stimulating the development of the commercial market for unenhanced data; furthering the long-term goal of commercialisation of land remote sensing, which will enhance international trade; and promoting widespread access to unenhanced data on a non-discriminatory basis. The LRSPA therefore encourages accessibility to remote sensing data and encourages commercial and scientific cooperation between nations.[45]

The LRSPA authorises the Secretary of Commerce to license private commercial remote sensing satellite systems and provide unenhanced data produced by private remote sensing systems and government systems to foreign governments and other users pursuant

40 Regulations define 'remote sensing space system' as 'any device, instrument, or combination thereof, the space-borne platform upon which it is carried, and any related facilities capable of actively or passively sensing the Earth's surface, including bodies of water, from space by making use of the electromagnetic waves emitted, reflected, or diffracted by the sensed objects'. See 15 CFR § 960.3 (2017).

41 Office of Space Commerce, Commercial Remote Sensing Policy at 4 (2003), www.nesdis.noaa.gov/CRSRA/files/Commercial%20Remote%20Sensing%20Policy%202003.pdf.

42 id., at 2. The 2010 National Space Policy also has provisions related to remote sensing.

43 Land Remote Sensing Policy Act, as amended, 15 USC §§ 5601 to 5672 (Pub. L. No. 102-55 (1992)), as amended in 1998 (Pub. L. No. 105-303); now 51 USC §§ 60101 et seq.

44 15 CFR Part 960.

45 id.

to commercial terms and conditions.[46] Operations under these licences must be carried out in a manner to preserve US national security and to observe international obligations of the United States.[47] The Secretary of Commerce has delegated his authority to the NOAA. Operating requirements of licensees include (1) furnishing complete orbit and data collection characteristics of the remote sensing system, and immediately providing notification of any deviation, and (2) upon termination of operations under the licence, making disposition of any satellites in space in a manner satisfactory to the President.[48]

The NOAA regulations governing licensing of private remote sensing satellite systems are in 15 CFR Part 960. These detailed regulations set forth licensing requirements, prohibitions and enforcement procedures.

The NOAA regulations apply broadly to any 'person', including individuals regardless of citizenship, business entities and private remote sensing systems having substantial connections with the United States.[49] Appendix 1 to Part 960[50] provides filing instructions and information to be included in the licence application, which includes: information on the company; launch segment information, such as the launch vehicle, site and schedule; the space segment, including sensor type, spatial and spectral resolution, fields of view for each sensor, and anticipated system lifetime; ground segment, including data collection and processing capabilities, command and mission data frequencies, and methods to be used to ensure integrity of operations; and other information, including plans for providing access to or distributing unenhanced data, information regarding commercial data distribution and pricing, and a plan for post-mission disposition of the satellite. These end-of-life plans are now standard within the industry.

In addition, the licensee must notify and seek approval from the Secretary of Commerce regarding any significant or substantial agreement the licensee intends to enter into with a foreign nation, entity or consortium involving foreign nations or entities, not later than 60 days prior to concluding the agreement.[51] The term 'significant or substantial foreign agreement' is defined as an agreement providing for one or more of the following:

a administrative control, which may include distributorship arrangements involving the routine receipt of high volumes of unenhanced data from a licensee's system;

b participation in operations of the system, including direct access to the system's unenhanced data; or

c an equity interest in the licensee held by a foreign nation or person (or both) if this interest equals or exceeds, or will equal or exceed, 20 per cent of total outstanding shares or entitles the foreign person to a position on the licensee's board of directors.[52]

46 51 USC § 60121(a) and (e). The LRSPA makes it unlawful for any person who is subject to the jurisdiction or control of the United States to operate a private remote sensing space system without a licence issued by the Secretary. 51 USC § 60122(a).

47 51 USC § 60122(b)(1).

48 51 USC § 60122(b)(4) and (5). In the final rule implementing the LRSPA regulations, NOAA stated it will review post-mission plans on a case-by-case basis. See Licensing of Private Land Remote-Sensing Space Systems, Final Rule, 71 Fed. Reg. 24474, 24479 (Apr. 25, 2006).

49 15 CFR § 960.3.

50 15 CFR § 960 at Appendix 1.

51 15 CFR § 960.8. See also 51 USC § 60122(b)(6).

52 15 CFR § 960.3.

In conjunction with the DOD, the DOS and other relevant agencies, the DOC reviews the proposed agreement in light of national security interests, foreign policy and the government's international obligations. As noted in subsection i, private industry has been critical of the time required to complete these reviews. The LRSPA regulations outline certain requirements such an agreement must meet for approval.[53]

Consistent with the United Nations' Principles Relating to Remote Sensing of the Earth from Outer Space,[54] the LRSPA requires a licensee to make available to the government of any country (including the United States) 'unenhanced data' regarding the territory under the jurisdiction of that government as soon as the data are available and on reasonable cost terms and conditions.[55] Unenhanced data, however, will not be provided if the release is contrary to national security concerns, foreign policy or international obligations, or is otherwise prohibited by law.[56] Unenhanced data is defined, in part, as 'remote sensing signals or imagery products that are unprocessed or subject only to data preprocessing'.[57] In addition to the provision of this data to foreign governments, a licensee (and the US government) must provide unenhanced data designated by the Secretary of Commerce to all users without preference or special arrangement regarding delivery, pricing or technical considerations. Unenhanced data, however, may be provided on condition that the data are used solely for non-commercial purposes.[58]

A licensee must also maintain operational control of the remote sensing space system from a location within the United States at all times and allow US government representatives to access its facilities for licence monitoring and compliance inspections.[59]

iii Satellite communications

Communication satellites are used in every country and are the most pervasive commercial use of outer space. Satellite communication systems have extensive international regulation through the International Telecommunication Union (ITU)[60] as well as national regulations that are consistent with the ITU regulations. In the United States, the Communications Act of 1934, as amended[61] (the Communications Act), combined and organised federal regulation of telephone, telegraph and radio communications. The Communications Act has been amended by many acts of Congress since 1934, most extensively by the Telecommunications Act of 1996.[62]

The Communications Act created the FCC to oversee and regulate radio communication activities by non-federal government entities, and the FCC applies this

53 15 CFR § 960.8(b).

54 The Principles Relating to Remote Sensing of the Earth from Space, G.A. Res. 41/65 (Dec. 3, 1986), www.unoosa.org/pdf/gares/ARES_41_65E.pdf.

55 51 USC § 60122(b)(2).

56 15 CFR § 960.11(b)(10).

57 15 CFR § 960.3.

58 51 USC §§ 60122(b)(3) and 60141(b).

59 15 CFR § 960.11(b)(2) and (3).

60 The ITU is the specialised agency of the United Nations for communications and information technologies. The ITU allocates global radio spectrum and satellite orbits and develops technical standards to ensure that networks and technologies seamlessly interconnect. About ITU, www.itu.int/en/about/Pages/default.aspx.

61 Communications Act of 1934, as amended, 47 USC §§ 151 et seq. (Pub. L. No. 416 (1934)).

62 See 110 Stat. 56, Pub. L. No. 104-104 (1996).

authority to space activities.[63] The FCC's primary function concerning radio communication is to issue licences and develop rules to further the use of radio in the public interest.[64] The FCC issues licences based on a demonstration that the proposed operations will serve the public interest, convenience and necessity. The FCC may also adopt rules to carry out the Communications Act, or the provisions of 'any international radio or wire communications treaty or convention, or regulations annexed thereto, including any treaty or convention insofar as it relates to the use of radio, to which the United States is . . . a party'.[65]

Part 25 of the FCC's rules provides procedures, technical standards and other requirements for the licensing and operation of facilities used for satellite communications, including ground stations and satellites.[66] These rules provide technical requirements and enable coordination of satellite systems and spectrum in the United States and internationally to avoid harmful radio-frequency interference. The FCC regulations also address reporting requirements for satellite operators.[67] The FCC participates in the processes directed by the ITU as the US national administration to the ITU.

FCC regulations address communication satellites operating in the Geostationary Satellite Orbit, where the majority of communication satellites are located, as well as non-geostationary satellites. Geostationary satellites stay in a fixed location relative to the Earth's orbit and can be serviced by stationary antennas. Most geostationary satellites' orbital position and access to spectrum (spectrum filings) are regulated through a 'first-come, first-served' regulatory regime by the ITU and the FCC, which processes licensing applications in the order they are filed with the Radiocommunications Bureau of the ITU.[68] If an application is acceptable for filing, the FCC, on behalf of the applicant, will make a filing for rights with the ITU, enter into the ITU frequency coordination process and ultimately seek to have the satellite system entered into the ITU's Master International Frequency Register (MIFR). Entry in the MIFR as a conforming assignment provides international recognition and protection against harmful interference from subsequent applicants.[69]

The FCC also regulates non-geostationary satellite (NGSO) systems.[70] These satellites do not stay in a filed location relative to their Earth stations. Thus, the Earth stations must track the satellites across the horizon. The FCC first determines whether the NGSO

63 The FCC's authority does not extend to satellite systems owned and operated by US government agencies. 47 USC § 305. The National Telecommunications and Information Administration (NTIA), DOC, has the exclusive authority to manage radio spectrum use by US government agencies and to make frequency assignments to radio stations and classes of radio stations belonging to and operated by the United States. See National Telecommunications and Information Administration Organization Act of 1992, as amended (codified at 47 USC §§ 901 et seq.).

64 47 USC §§ 301, 303. In general, the FCC has jurisdiction only with respect to satellites that communicate with stations in the United States. Thus US citizens are free to operate communications satellites, if licensed by a foreign administration, without FCC authorisation as long as no US landing rights are involved.

65 47 USC § 303(r).

66 See 47 CFR Part 25, Satellite Communications.

67 47 CFR §43.62.

68 47 CFR § 25.158. Some geostationary satellites operate with frequencies and orbital locations that are planned and do not follow the 'first-come, first-served' regulatory regime. See generally, https://www.itu.int/en/ITU-R/space/snl/Documents/ITU-Space_reg.pdf.

69 See generally www.itu.int/en/ITU-R/terrestrial/broadcast/Pages/MIFR.aspx.

70 47 CFR § 25.157.

application is a 'lead application' or a 'competing application'. Public notice is provided, and the FCC ultimately grants applications that meet the standards.[71] The FCC has procedures for situations where there is insufficient spectrum available for all qualified applicants.[72]

The FCC has adopted rules concerning orbital debris mitigation by satellite systems.[73] In adopting these rules, the FCC stated it would help preserve continued affordable access to space, continued provision of reliable space-based services, and continued safety of persons and property in space and on the Earth's surface.[74] The FCC's rules require a satellite operator to submit an orbital debris mitigation plan to the FCC addressing:

a the amount of debris released in a planned manner during normal operations, and the probability of the space station becoming a source of debris by collisions with small debris or meteoroids that could cause loss of control and prevent post-mission disposal;
b accidental explosions during and after completion of mission operations;
c the probability of the space station becoming a source of debris by collisions with large debris or other operational space stations; and
d the quantity of fuel that will be reserved for post-mission disposal manoeuvres.[75]

Submission of orbital debris plans is becoming standard practice for launch operations and satellite operators.

Over many decades the ITU and FCC regulations have enabled thousands of communication satellites to effectively provide service for direct television broadcasts, mobile satellite services, telephone communications and other uses without harmful radio frequency interference.

iv NASA space activities

One year after the Soviet Union launched Sputnik, the National Aeronautics and Space Act of 1958 (the Space Act)[76] authorised the creation of NASA. Congress declared that 'it is the policy of the United States that activities in space should be devoted to peaceful purposes for the benefit of all humankind.'[77] Congress also declared 'the general welfare of the United States requires that the Administration seek and encourage, to the maximum extent possible, the fullest commercial use of space.'[78]

The Space Act identified numerous objectives for NASA, including:

a expansion of human knowledge of the Earth and the phenomena in the atmosphere and space;
b improvement of the usefulness, performance, speed, safety and efficiency of aeronautical and space vehicles;
c establishment of studies of the benefits from and problems involved in the use of space for peaceful and scientific purposes;

71 47 CFR § 25.156.
72 47 CFR § 25.157(d) to (e).
73 47 CFR § 25-114(d)(14).
74 Mitigation of Orbital Debris, Final Rule, IB Docket 02-54, FCC 04-130, 69 Fed. Reg. 54581 (Sept. 9, 2004) (Mitigation Final Rule).
75 47 CFR § 25-114(d)(14).
76 National Aeronautics and Space Act of 1958, as amended, 42 USC §§ 2451 to 2484 (Pub. L. No. 85-568 (1958)); re-codified in 51 USC §§ 20102 to 20164.
77 51 USC § 20102(a).
78 51 USC § 20102(c).

d preservation of US leadership in space science and technology; and
e cooperation with other nations.[79]

International cooperation is exemplified by the International Space Station (ISS).[80] The ISS has a complex legal structure based on an intergovernmental agreement signed by the government partners, four memoranda of understanding between NASA and other cooperating space agencies and numerous bilateral implementing arrangements between space agencies that allow them to get things done. The ISS has been a tremendous success and is now facing issues of what to do next. Privatisation is one option.

The Space Act enables NASA to acquire, construct, improve, operate and maintain laboratories, research facilities, and aeronautical and space vehicles, and other real and personal property, or any interest therein.[81] Additionally, NASA has authority to enter into 'other transactions',[82] commonly referred to as Space Act Agreements. These Space Act Agreements may be reimbursable, non-reimbursable or funded agreements.[83] NASA used funded Space Act Agreements for the Commercial Orbital Transportation System (COTS) and the Commercial Crew Program. The Agreements facilitated the combination of public and private financing, escaped the burdens of the Federal Acquisition Regulations and promoted speed and innovation to secure new capabilities. They also helped SpaceX and Orbital ATK develop commercial space launch vehicles and helped Sierra Nevada Corporation Space Systems company develop the Dream Chaser spacecraft, which has now received a NASA contract to provide cargo delivery, return and disposal services for the ISS.

The Space Act also contains provisions to meet US responsibilities under Article VII of the Outer Space Treaty[84] and the Convention on International Liability for Damage Caused by Space Objects[85] regarding the absolute liability to pay compensation for damage on the Earth's surface caused by a US space object. The Space Act authorises NASA to provide liability insurance for any 'user'[86] of a 'space vehicle'[87] to compensate all or a portion of claims by third parties for death, bodily injury, or loss of or damage to property resulting from activities conducted in connection with the launch, operation or recovery of the space vehicle.[88] Additionally, NASA may indemnify a space vehicle user against claims by third parties for death, bodily injury, or loss of or damage to property resulting from activities

79 51 USC § 20102(d).
80 ISS, NASA, www. nasa.gov/mission_pages/station/cooperation/ index.html.
81 51 USC § 20113(c).
82 51 USC § 20113(e).
83 NASA's Space Act Agreement authority is implemented in NASA Policy Directive (NPD) 1050.1l. Additionally, NASA's 'Space Act Agreements Guide' provides instructions and guidance for developing Space Act Agreements. See NASA Advisory Implementing Instruction (NAII) 1050-1c, https://nodis3.gsfc.nasa.gov/NPD_attachments/NAII_1050_1C.pdf.
84 Outer Space Treaty, see footnote 2.
85 Convention on International Liability for Damage Caused by Space Objects, Mar. 29, 1972, 24 UST. 2389, 961 U.N.T.S. 187, www. unoosa.org/ oosa/en/ourwork/spacelaw/ treaties/liability-convention.html.
86 A 'user' of a space vehicle is defined as 'anyone who enters into an agreement with [NASA] for use of all or a portion of a space vehicle, who owns or provides property to be flown on a space vehicle, or who employs a person to be flown on a space vehicle'. 51 USC § 20138(a)(3).
87 A 'space vehicle' is defined as 'an object intended for launch, launched, or assembled in outer space, including the space shuttle and other components of a space transportation system, together with related equipment, devices, components, and parts'. 51 USC § 20138(a)(1).
88 51 USC § 20138(b).

carried on in connection with the launch, operations, or recovery of the space vehicle to the extent that such claims are not compensated by the user's liability insurance. Indemnification may not extend to the user's actual negligence or willful misconduct.[89]

v Space mining

In 2015, the United States adopted the Commercial Space Launch Competitiveness Act (the Act).[90] The Act, among other things, adopts provisions relating to mining operations on celestial bodies including the Moon and asteroids.[91] Pursuant to this Act, the President, through federal agencies, shall 'facilitate commercial exploration for and commercial recovery of space resources by United States citizens'.[92] Furthermore, '[a] United States citizen engaged in commercial recovery of an asteroid or space resource . . . shall be entitled to any asteroid resource or space resource obtained, including to possess, own, transport, use, and sell . . . , in accordance with applicable law, including the international obligations of the United States.'[93] The Act unequivocally allows US citizens to 'engage in commercial exploration for and commercial recovery of space resources . . . in accordance with the international obligations of the United States and subject to authorization and continuing supervision by the Federal Government'.[94]

The Act further asserts the 'sense of Congress that by the enactment of this Act, the United States does not thereby assert sovereignty or sovereign or exclusive rights or jurisdiction over, or the ownership of, any celestial body'.[95] Notwithstanding this 'sense of Congress', some scholars contend that recognising the ownership of space resources is itself an act of sovereignty and the Act violates the non-appropriation clause of the Outer Space Treaty.[96] However, that provision must be read in conjunction with the freedom of use principle of the Outer Space Treaty.[97] While this scholarly debate may continue, there has been very little official objection to the legislation from countries within the United Nations or otherwise. In fact, in 2017 Luxembourg enacted legislation very similar to the Commercial Space Launch Competitiveness Act.[98]

Space mining is expected to become viable in the near future. How near is debatable. However, it is telling that the Colorado School of Mines recently established the world's first graduate programme in space resources, which offers masters and PhD degrees in this emerging field.[99] Given the differing opinions on the legality of space mining, perhaps engineers will need to be accompanied by lawyers when they go into space to mine resources.

89 51 USC § 20138(c).

90 Pub. L. 114-90, 129 Stat. 704 (2015).

91 51 USC Ch. 513, Space Resource Commercial Exploration and Utilization.

92 51 USC § 51302(a)(1).

93 51 USC § 51303.

94 51 USC § 51302(a)(3). The 'authorization and continuing supervision' requirement fulfils US obligations under the Outer Space Treaty. See Outer Space Treaty, footnote 2 at Article VI.

95 Pub. L. No. 114-90 § 403, 129 Stat. at 722.

96 See, e.g., Hobe and de Man, 'National Appropriation of Outer Space and State Jurisdiction to Regulate the Exploitation, Exploration and Utilization of Space Resources', *German Journal of Air and Space Law* 460–75 (2017).

97 Outer Space Treaty, footnote 2 at Article 1.

98 Silver, 'Luxembourg passes first EU space mining law. One can possess the Spice,' *The Register* (July 14, 2017), www.theregister.co.uk/2017/07/14/luxembourg_passes_space_mining_law.

99 Space Resources Program, Colorado School of Mines, http://space.mines.edu.

III DISTINCTIVE CHARACTERISTICS OF THE NATIONAL FRAMEWORK

As reflected in Section II, one major, distinctive characteristic of the US national framework is the extensive nature of policies, statutes and regulations applicable to commercial space activities. Another distinctive characteristic has been the success the United States has had in developing its commercial space industry. Much of that success is owed to the use of public–private partnerships (P3s). While P3s are associated with a large collection of projects – large to small, complex to simple, high-tech to low-tech – there are some common elements. They have been used fairly extensively and effectively for funding space activities, and are attracting even more attention as sources of public financing grow scarce. It is inevitable that P3s will play a larger role in future space activities.

Examples of P3s for space activities in the United States include NASA's use of funded Space Act Agreements,[100] discussed in Section II.iv for COTS. SpaceX and Orbital Sciences were awarded COTS Space Act Agreements and, because both companies successfully demonstrated medium-class launch vehicles and cargo capsules, they were subsequently awarded follow-on commercial resupply services contracts in 2008. NASA required SpaceX and Orbital Sciences to share in the cost of the COTS research, development and demonstration, and provided incentives to timely perform. The Space Act Agreements terms and conditions established reasonable cost and risk-sharing, which enabled performance.[101] NASA also used Space Act Agreements for its Commercial Crew Program in which it partnered with commercial companies to provide reliable and cost-effective human space transportation to and from the ISS and low-Earth orbit. This multi-phased programme has involved Space Act Agreements between NASA and numerous US companies including Boeing, SpaceX, Sierra Nevada Corporation, Blue Origin and ULA. Funding for the development programmes has been through NASA and the commercial companies. Following demonstrations of capabilities, contracts have been awarded to several companies for certification of commercially built and operated crew transportation systems.[102]

The US Defense Advanced Research and Projects Agency and the US Air Force have used their Other Transaction Authority (OTA)[103] for programmes similar to Space Act Agreements. OTAs are legally binding agreements that may be used to involve industry and academia in a broad range of research and prototype projects including the option to extend the programme to production.

100 See generally, Alternative Agreements for Research and Development with NASA, Briefing Papers, second series, Issue 18-4, March 2018.

101 See generally, Commercial Orbital Transportation Services: a New Era in Spaceflight, https://www.nasa.gov/sites/default/files/files/SP-2014-617.pdf.

102 See Commercial Crew Program – The Essentials, https://www.nasa.gov/content/commercial-crew-program-the-essentials/#.U_ung_ldUn3.

103 10 USC. § 237l (b) grants the DOD authority to enter into transactions for prototype projects using OTAs, which are legal instruments other than a contract, grant or cooperative agreement. OTAs allow defence and other federal agencies to negotiate terms and conditions specific to their project. OTAs are often used for P3 arrangements and offer flexibility to help agencies attract commercial partners. Such flexibility is not found in standard US government contracts.

IV CURRENT DEVELOPMENTS

Given the tremendous growth in commercial space activities, there are initiatives to streamline some of the extensive regulations and expedite the processing of licence applications by agencies. US space law is likely to mature as the commercialisation of space activities progresses.

At the very end of 2018, legislation aimed at reforming commercial space regulations and extending the life of the ISS failed to win approval in the US House of Representatives (the House). The Space Frontier Act S.3277 won approval in the Senate, but failed in the House. This legislation would have directed reforms in the areas of commercial space launch and remote sensing regulations. Among other things, this bill would have shortened the deadline for the government to render a decision on remote-sensing applications and would have authorised NASA to start a low-Earth orbit commercialisation programme. It is likely that elements of the bill will be considered in the 2019 Congress.

The United States is considering how to regulate activities in outer space, such as satellite serving and commercial lunar missions. No agency currently has formal oversight of these activities to provide the authorisation and continuing supervision required by Article 6 of the Outer Space Treaty. Consideration has been given to providing that oversight responsibility to the Office of Space Commerce within the DOC. Another issue being considered is how to develop industry consensus for standards when approving the safety of space flight participants on commercial spacecraft, including suborbital spacecraft. The FAA is currently restricted from enacting such formal government standards until no earlier than 2023.

Recent changes to the National Space Policy will also impact the direction of space activities in the United States. In December 2017, President Trump signed Space Policy Directive 1, which changed national space policy to provide for a US-led, integrated programme with private sector partners (a P3 arrangement) for a human return to the Moon, followed by missions to Mars and beyond. In May 2018, President Trump signed Space Policy Directive 2, which instructs the Secretary of Transportation and the FAA to devise a new regulatory regime for launch and re-entry activities, and to consider requiring just a single licence for all such commercial operations. It also orders the Commerce Secretary to review regulations on commercial remote-sensing, with the goal of creating a 'one-stop shop' within the Commerce Department for private spaceflight regulation. In June 2018, President Trump signed Space Policy Directive 3, which will guide critical and sorely needed progress on space traffic management. It provides guidelines and direction to ensure that the United States is a leader in providing a safe and secure environment as commercial and civil space traffic increases. This Directive seeks to reduce the mounting threat of orbital debris in the interest of all nations. The Department of Commerce is tasked to lead these efforts, but NASA is also given responsibilities to update the US Orbital Debris Mitigation Standard Practices and establish new guidelines for both satellite design and operation.

Pursuant to Space Policy Directive 2, the Department of Commerce issued an Advanced Notice of Proposed Rulemaking to reform commercial sensing regulations. The Department is actively engaged in rule-making. The FAA also is engaged in rule-making that will reform launch licensing processes. As a result of these efforts, 2019 could see significant changes in the regulation and licensing of remote sensing satellites and commercial space launches.

V OUTLOOK AND CONCLUSIONS

This brief summary of some of the most significant US space laws and regulations offers a glimpse into the complex legal regime governing the use and exploration of outer space in the United States. There are many other US laws that relate to governmental and commercial space activities.

Although international space law flourished in the 1960s and 1970s and has changed relatively little since then, US space law is an evolving and exciting field. The development of a robust commercial space industry will likely continue as the agencies involved in space activities become less of a 'doer' and more of a 'facilitator'. The use of P3s is likely to increase, as is the role of international participation in space activities in which the United States engages.

Companies and agencies are also increasingly likely to evaluate on-orbit services, and rendezvous and proximity operations; the Consortium for Execution of Rendezvous and Servicing Operations, funded by the Defense Advanced Research Projects Agency, is an industry-led initiative to establish technical and safety standards for these on-orbit activities, which could have many benefits including extending the life of satellites and mitigating the creation of space debris.

Appendix 1

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Milton 'Skip' Smith is the chair of Sherman & Howard's space law practice group and has over 30 years of experience in aerospace, defence and government contracts. Skip represents most segments of the aerospace industry, from large companies to start-ups, and from manufacturers to launch service providers. He handles both transactional matters, such as drafting launch services agreements, as well as litigation and arbitration of aerospace disputes. Skip has negotiated deals and litigated disputes with dollar values into the hundreds of millions. He is on the board of directors of the International Institute of Space Law and is a past chair of the Colorado Space Business Roundtable. Skip has also taught space law at several law schools and he held significant positions during his Air Force career, including Director of Space Law at Space Command and Chief of Space Law for the Air Force. Skip also served in Geneva as the legal adviser of the 50-person US Delegation at the ITU Conference on the Geostationary Satellite Orbit. Skip is an Air Force Academy graduate, and he received his law degree from George Washington University and a doctorate in space law from the Institute of Air and Space Law, McGill University.

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