

BUILDING A LADDER TO THE STARS: A COMPETITION POLICY FOR THE NEW SPACE RACE

GABRIELLE DALEY*

INTRODUCTION.....	340
I. BRIEF OVERVIEW OF INDUSTRY HISTORY: OLDSpace 1957–2002	341
A. <i>Early History and Establishment of NASA</i>	341
TABLE 1: OVERVIEW OF SPACE INDUSTRY	343
B. <i>Industry Structure and Consolidation</i>	344
II. CURRENT STRUCTURE OF INDUSTRY: ENTREPRENEURIAL SPACE: 1989 THROUGH THE PRESENT	347
A. <i>Survey of Launch Transport Startups</i>	349
1. Gilmour Space Technologies	349
2. Rocket Lab	349
3. SpaceX.....	351
4. Blue Origin	352
B. <i>Changes to Industry Structure and Competition</i>	353
TABLE 2: ESTIMATED COST OF LAUNCH SERVICES BY COMPANY...	354
III. LEGAL AND REGULATORY STRUCTURE.....	355
A. <i>Legal Structure</i>	355
B. <i>Regulatory Structure</i>	358
IV. RECOMMENDATIONS TO FOSTER COMPETITION.....	361
A. <i>Current Competition Policy in Space Industry</i>	361
TABLE 3: PARTICIPANTS IN NASA COMMERCIAL CREW PROGRAM THROUGH FEB. 25, 2016	363
B. <i>Policy Recommendations to Foster Competition</i>	365
1. Competition as a Goal.....	365
2. Merger Review.....	366
3. Competition Policy at the Agency Level.....	367
CONCLUSION	368

* J.D., University of Colorado, Class of 2018; B.A., Colorado State University, Class of 2012.

INTRODUCTION

Innovations in launch vehicle technology over the last decade are changing the structure of the space industry.¹ Since the Commercial Space Launch Act of 1984,² the U.S. space industry has moved towards a commercial rather than purely governmental sector.³ Technological developments—like reusable launch vehicles—are significantly reducing entry barriers to space by making the price of launches much more affordable.⁴

As the commercial space industry expands, there are calls for regulatory reform to reduce the transaction costs incurred when companies have to coordinate across multiple federal agencies to successfully direct a commercial launch.⁵ While a variety of regulatory reforms have been proposed and the value of competition in the commercial sector is generally lauded, concrete suggestions for establishing a competition policy for the space industry are missing. While the National Aeronautics and Space Administration (NASA) and the Department of Defense (DoD) have some regulatory policies in place that have positively impacted competition, regulators should adopt competition as an explicit goal for a national space policy. Competition in the space industry leads to savings for the provision of services to the U.S. government and serves to encourage development of the commercial sector.

This paper will proceed in four parts. Part I lays out a brief history of the American space industry from its birth in the space race age to the dominant monopoly period of the early 2000s. Part II will discuss the current disruptive era of innovation in space transport vehicles, which I will refer to as the entrepreneurial age of space.⁶ Part III will lay out the current legal framework governing the American space industry. Finally, Part IV will discuss recommendations for creating a competition policy for the

1. Banning Garrett, *How SpaceX's Recycled Rocket Launch Reflects the Growing Disruptive Technology of Space Exploration*, MEDIUM: COMPETITIVE EDGE (Mar. 31, 2017), <https://medium.com/p/how-spacexs-recycled-rocket-launch-reflects-the-growing-disruptive-technology-of-space-exploration-3cf9f08a4a88> [<https://perma.cc/TT95-TXQ4>].

2. Pub. L. No. 98-575, 98 Stat. 3055 (codified as amended at 51 U.S.C. §§ 50901–50923 (2018)).

3. *Frequently Asked Questions*, FED. AVIATION ADMIN. https://www.faa.gov/about/office_org/headquarters_offices/ast/about/faq/#cl2 [<https://perma.cc/HD2Z-TXJU>] [hereinafter FAA FAQ].

4. See *infra* Table 2.

5. See, e.g., Kaitlyn Johnson, *More than Just Fixing the Rules: Regulating for Innovation*, SPACENEWS (Apr. 27, 2017), <http://spacenews.com/more-than-just-fixing-the-rules-regulating-for-innovation/> [<https://perma.cc/8BER-BXK2>].

6. See Joerg Kreisel & Burton H. Lee, *Space Entrepreneurship – Status & Prospects*, in YEARBOOK ON SPACE POLICY 2006/2007: NEW IMPETUS FOR EUROPE 254 (Kai-Uwe Schrogl et al. eds., 2008) (discussing the developments of space entrepreneurship).

space industry to foster the continued development of the commercial space sector.

I. BRIEF OVERVIEW OF INDUSTRY HISTORY: OLDSPACE 1957–2002

The story of OldSpace⁷ is a story of decreasing competition. From the start of the space race, the space industry developed as a government mediated sector.⁸ The structure of the space industry led to increasing concentration, culminating in the establishment of the United Launch Alliance (ULA).⁹ The ULA held a government-sanctioned monopoly in the provision of launch services to the government until new companies entered to compete against it.¹⁰

A. *Early History and Establishment of NASA*

In 1957 the Soviet Union launched the first artificial satellite, Sputnik, into orbit ushering in the period known as the space race, when the United States and the Soviet Union competed for dominance in space.¹¹ In early 1958 the United States also succeeded in launching a satellite.¹² The Explorer 1 was launched under the direction of the U.S. Army Ballistic Missile Agency and the Jet Propulsion Laboratory.¹³ A few months later President Eisenhower took the first steps in moving U.S. space exploration projects from under the authority of the Advanced Research Projects Agency (ARPA), a DoD agency, to a new civilian agency.¹⁴

7. OldSpace is the term used to describe the time period from the birth of the modern space industry to the beginnings of the new, entrepreneurial space enterprises. See Joel Achenbach, *Which Way to Space?*, WASH. POST (Nov. 23, 2013), https://www.washingtonpost.com/sf/national/2013/11/23/which-way-to-space/?noredirect=on&utm_term=.d164d77dc285 [https://perma.cc/QP59-JGQ3]; cf. *id.* (discussing the development of commercial space sectors outside of governmental space projects).

8. Alan Yuhas, *The New Space Race: How Billionaires Launched the Next Era of Exploration*, GUARDIAN (Feb. 9, 2018, 11:31 AM), <https://www.theguardian.com/science/2018/feb/09/new-space-race-billionaires-elon-musk-jeff-bezos> [https://perma.cc/9JRA-RHRF].

9. Sandra Erwin, *ULA CEO Bruno: New Competitors in Military Launch Market 'Good for the Country'*, SPACENEWS (Oct. 17, 2018), <https://spacenews.com/ula-ceo-bruno-new-competitors-in-military-launch-market-good-for-the-country/> [https://perma.cc/RA5P-XGJE].

10. *Id.*

11. *Oct. 4, 1957 - Sputnik, the Dawn of the Space Age*, NASA (Oct. 4, 2017), <https://www.nasa.gov/image-feature/oct-4-1957-sputnik-the-dawn-of-the-space-age> [https://perma.cc/TA5P-P7JF].

12. *Explorer 1 Overview*, NASA, https://www.nasa.gov/mission_pages/explorer/explorer-overview.html [https://perma.cc/9ZV7-J44E] (last updated Aug. 3, 2017).

13. *Id.*

14. *Conversation with Willis Shapley*, in 8 MONOGRAPHS AEROSPACE HIST. 13, 14 (1998), <https://history.nasa.gov/40thann/legislat.pdf> [https://perma.cc/4XJS-EJR3].

On July 29, 1958, Eisenhower signed the National Aeronautics and Space Act of 1958¹⁵ into law thereby creating NASA.¹⁶ The act transformed the National Advisory Committee for Aeronautics (NACA), a civilian agency founded in 1915, into the National Aeronautics and Space Administration—NASA.¹⁷ Eisenhower's statement upon signing the act emphasized that "the combination of space exploration responsibilities with NACA's traditional aeronautical research functions is a natural evolution."¹⁸ However this "natural evolution" was not a foregone conclusion.

Earlier that same year, on March 5th 1958, the Advisory Committee on Government Organization, the President's Science advisor, and the Bureau of the Budget (BoB), recorded their final recommendation for the proposed new agency that emerged from their meeting with the President in a memorandum.¹⁹ The memorandum, while recommending the structure that would become NASA, acknowledged the alternative proposals being discussed at the time.²⁰ The first proposal was to house the authority for space exploration under the Atomic Energy Commission (AEC); the second was to consolidate the defense and non-defense activities into a new body; the third was to keep everything under the authority of the DoD.²¹ The memorandum also gives some indications as to why a civilian rather than a military—or even a hybrid—structure was selected.²² The President "felt that there is no problem of space activity (except ballistic weapons) that is not basically civilian, recognizing the application of findings may be made to serve military purpose."²³ While the final agency would coordinate with the DoD, the agency itself would remain civilian.²⁴

15. Pub. L. No. 85-568, 72 Stat. 426 (codified as amended at 51 U.S.C. § 20111 (2018)).

16. *The Early History and Development of the National Aeronautics and Space Administration (NASA)*, DWIGHT D. EISENHOWER PRESIDENTIAL LIBR., MUSEUM, & BOYHOOD HOME, https://www.eisenhower.archives.gov/research/online_documents/nasa.html [<https://perma.cc/J5G9-XEGY>].

17. President Dwight D. Eisenhower, Statement by the President Upon Signing the National Aeronautics and Space Act of 1958 (July 29, 1958), <https://www.presidency.ucsb.edu/documents/statement-the-president-upon-signing-the-national-aeronautics-and-space-act-1958> [<https://perma.cc/AJ66-P3KB>].

18. *Id.*

19. *Conversation with Willis Shapley*, *supra* note 14, at 15.

20. Memorandum from A.J. Goodpaster, Brigadier Gen., Army of the U.S., Memorandum of Conference with the President 1 (Mar. 5, 1958), https://www.eisenhower.archives.gov/research/online_documents/nasa/Binder12.pdf [<https://perma.cc/NW77-RSG3>].

21. *Id.*

22. *Id.*

23. *Id.*

24. *Id.* at 2.

The structure of the space industry can best be understood as a tripartite structure with civilian, military, and commercial components.²⁵ Since the beginning of the space race age, the commercial sector has grown relative to the other two.²⁶ Additionally space technology can be divided into two layers: space transport and space applications. Space transport means the launch vehicles that convey something into space, whereas space applications means the payloads that are actually carried into space—for example, people or satellites.²⁷ These divisions are represented in Table 1. While commercial space applications have existed since the early days of the space age, viable purely commercial space transport has only emerged recently.²⁸ The growth of the telecommunications sector of the space industry stimulated the growth of many companies during the 1990s, though many of these failed during the early 2000s.²⁹ During the last ten years, companies like SpaceX have operationalized commercial launch vehicles,³⁰ discussed in Part II.

<i>Entity</i>	<i>Type of Entity</i>	<i>Layers</i>		
<i>Civilian (NASA)</i>	<i>Governmental</i>	<i>Technology</i>	Space Transport	Space Applications
<i>Military (DoD)</i>				
<i>Commercial</i>	<i>Non-Governmental</i>			

TABLE 1: OVERVIEW OF SPACE INDUSTRY

Commercial use of space began in 1962 with the launch of AT&T's first telecommunications satellite—Telstar.³¹ Concerned that AT&T's monopoly over American telecommunications was

25. Stephen B. Johnson, *The Political Economy of Spaceflight*, in THE SOCIETAL IMPACT OF SPACEFLIGHT 141, 151–55 (Steven J. Dick & Roger D. Launius eds., 2007) [hereinafter *Political Economy of Spaceflight*].

26. *Id.* at 155.

27. *Id.* at 162.

28. *Id.* at 164.

29. *Id.*

30. Eric Berger, *We May Have Just Witnessed the Dawn of Truly Commercial Spaceflight*, ARSTECHNICA (Mar. 31, 2017, 6:55 AM), <https://arstechnica.com/science/2017/03/we-may-have-just-witnessed-the-dawn-of-truly-commercial-spaceflight/> [<https://perma.cc/C88C-VAM8>].

31. *Political Economy of Spaceflight*, *supra* note 25, at 152.

entering the space frontier, the government sought to mitigate AT&T's power by passing the Satellite Telecommunications Act of 1962, which created the Communications Satellite Corporation (COMSAT).³² COMSAT's purpose was to build and administer international satellite systems.³³ While telecommunications services can be viewed as a private enterprise in the United States, many telecommunications service providers internationally are, or were, state-owned monopolies, complicating the characterization of the telecommunications sector as a purely commercial one.³⁴

B. Industry Structure and Consolidation

Under the guidance of NASA, Americans have entered orbit, landed on the moon, and conducted countless important scientific experiments.³⁵ But even after early increases in the commercialization of launch services, the market structure remained highly concentrated.³⁶

The technology used to accomplish these feats was largely created through the government contracts procurement process.³⁷ The procurements process created a monopsony market structure with a single buyer, the United States government, soliciting bids for technology from a multitude of firms.³⁸ These firms have merged towards oligopoly.³⁹ In the first decade of the twenty-first century, government launch services in the United States became even more highly concentrated with the establishment of a joint venture between the two dominant aerospace firms.⁴⁰

In 2006, Lockheed Martin Corporation and the Boeing Company formed a joint venture, the United Launch Alliance.⁴¹ The

32. *Id.* at 168.

33. *Id.*

34. *Id.* at 169.

35. See Steve Garber & Roger Launius, *A Brief History of NASA*, NASA, <https://history.nasa.gov/factsheet.htm> [<https://perma.cc/DQ34-5NYY>] (last updated July 25, 2005).

36. See Pierre Barbaroux, *The Metamorphosis of the World Space Economy: Investigating Global Trends and National Differences Among Major Space Nations' Market Structure*, 20 J. INNOVATION ECON. & MGMT. 9, 11 (2016).

37. See *Political Economy of Spaceflight*, *supra* note 25, at 162.

38. Walter A. McDougall, *Technocracy and Statecraft in the Space Age: Toward the History of a Saltation*, 87 AM. HIST. REV. 1010, 1035 (1982).

39. *Political Economy of Spaceflight*, *supra* note 25, at 155.

40. Press Release, Fed. Trade Comm'n, FTC Intervenes in Formation of ULA Joint Venture by Boeing and Lockheed Martin, (Oct. 3, 2006) [hereinafter FTC Press Release on ULA], <https://www.ftc.gov/news-events/press-releases/2006/10/ftc-intervenes-formation-ula-joint-venture-boeing-and-lockheed> [<https://perma.cc/4AF6-HWGK>].

41. Press Release, The Boeing Co., Boeing and Lockheed Martin Complete United Launch Alliance Transaction (Dec. 1, 2006), <https://boeing.mediaroom.com/2006-12-01-Boeing-and-Lockheed-Martin-Complete-United-Launch-Alliance-Transaction> [<https://perma.cc/98H2-QC5W>]; Press Release, Lockheed Martin Corp., Lockheed Martin And Boeing Complete United Launch Alliance Transaction (Dec. 1, 2006), <https://news.lockheedmartin.com/2006-12-01-Lockheed-Martin-and-Boeing-Complete-United-Launch-Alliance-Transaction> [<https://perma.cc/92CM-AX7S>].

ULA combined the launch industry teams of Lockheed and Boeing to provide space transport services for the United States government including the DoD, NASA, and the National Reconnaissance Office.⁴² In October of 2006, the Federal Trade Commission (FTC) formally approved the joint venture subject to a consent decree.⁴³ The consent decree was essentially a government sanctioned monopoly of the provision of launch services. The approval was based on the rationale of increased national security⁴⁴ and concomitant cost savings.⁴⁵

The consent decree governed not only the ULA, but Lockheed and Boeing as well.⁴⁶ While acknowledging that the joint venture would further concentrate an already concentrated market, the FTC concluded that the national security benefits outweighed the anticompetitive harms.⁴⁷ According to the FTC, the consent decree was designed only to “addresses the ancillary competitive harms that DoD has identified as not inextricably tied to the national security benefits of ULA.”⁴⁸ The consent decree contained provisions such as a requirement to “safeguard competitively sensitive information obtained from other space vehicle and launch services providers.”⁴⁹ These provisions while ceding a dominant position in the provision of U.S. government launch services still aspired to maintain competition in the provision of commercial launch services.

Meanwhile SpaceX, at the time working on developing commercial launch services themselves, filed comments objecting to the joint venture out of concern that the FTC was underestimating the anticompetitive effects for commercial players.⁵⁰ However, the FTC rejected the alternative remedies proposed by SpaceX and dismissed the possibility that the joint venture had the potential to harm the commercial launch services market.⁵¹ The FTC laid out

42. *Company Overview of United Launch Alliance*, BLOOMBERG, <https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=27145074> [<https://perma.cc/C5T5-9SNR>].

43. Press Release, Lockheed Martin Corp., FTC Gives Clearance to United Launch Alliance (Oct. 3, 2006) [hereinafter Lockheed Martin Press Release], <https://news.lockheedmartin.com/2006-10-03-FTC-Gives-Clearance-to-United-Launch-Alliance> [<https://perma.cc/DJX9-ZM69>]; see also *A Brief Overview of the Federal Trade Commission's Investigative and Law Enforcement Authority*, FED. TRADE COMM'N (July 2008), <https://www.ftc.gov/about-ftc/what-we-do/enforcement-authority> [<https://perma.cc/LA8C-RFC9>].

44. FTC Press Release on ULA, *supra* note 40.

45. See Lockheed Martin Press Release, *supra* note 43.

46. *Id.*

47. FTC Press Release on ULA, *supra* note 40.

48. *Id.*

49. *Id.*

50. Jeremy Singer, *SpaceX, Northrop Grumman Insist on Strong Oversight of ULA*, SPACENEWS (Nov. 14, 2006, 3:12 PM), <https://spacenews.com/spacex-northrop-grumman-insist-strong-oversight-ula/> [<https://perma.cc/DXU6-7PZX>].

51. Letter from Donald S. Clark, Sec'y, Fed. Trade Comm'n, to Lawrence Williams, Vice President for Int'l & Gov't Aff., Space Expl. Tech. Corp. (May 1, 2007),

three bases for this determination.⁵² First, that the commercial launch market was competitive because it had three “well-established participants”; second, that Boeing and Lockheed were not dominant players in the commercial launch space (describing them as “nominal participants”); and finally, that Boeing and Lockheed were “not cost-competitive with the market leaders” of commercial launch services.⁵³

From 2006 through 2016 ULA enjoyed a monopoly position in the provision of launch services to the U.S. government.⁵⁴ Mr. Hicks’s wisdom that “[t]he best of all monopoly profits is a quiet life”⁵⁵ notwithstanding, the ULA has not escaped public criticism. Critics contend that the proposed benefits of the joint venture failed to materialize.⁵⁶ The ULA’s absolute monopoly on government launch services ended when SpaceX completed its first government contract, launching the National Reconnaissance Office’s NROL-76 satellite in May of 2017.⁵⁷ The award of the contract appears to be the result, in part, of a lawsuit filed by SpaceX in 2014, challenging the Air Force’s bidding process for launches.⁵⁸ The suit was settled, Air Force contracts were put up to a competitive bid, and SpaceX awarded a contract.⁵⁹

The U.S. space industry after the launch of Sputnik and until the growth of commercial launch vehicles was a relatively uncompetitive industry.⁶⁰ The U.S. government was the only driver for the demand in the launch vehicle sector and until the nascent commercial space market launched the first communications satellites, the government had the power to dictate what technology

<https://www.ftc.gov/sites/default/files/documents/cases/2007/05/0510165lettertosetc.pdf> [<https://perma.cc/456U-EFCX>].

52. *Id.*

53. *Id.*

54. See Irene Koltz, *SpaceX Breaks Boeing-Lockheed Monopoly on Military Space Launches*, REUTERS (Apr. 27, 2016, 4:30 PM), <https://www.reuters.com/article/us-space-spacex-launch/spacex-breaks-boeing-lockheed-monopoly-on-military-space-launches-idUSKCN0XO2TC> [<https://perma.cc/M8UL-DLLK>].

55. J. R. Hicks, *Annual Survey of Economic Theory: The Theory of Monopoly*, 3 *ECONOMETRICA* 1, 8 (1935).

56. See, e.g., Eric Berger, *Air Force Budget Reveals How Much SpaceX Undercuts Launch Prices*, ARSTECHNICA (June 15, 2017, 4:55 PM), <https://arstechnica.com/science/2017/06/air-force-budget-reveals-how-much-spacex-undercuts-launch-prices/> [<https://perma.cc/L4ZP-ZBS6>]; Tim Kyger, *ULA: Failure of Merger and Monopoly*, SPACENEWS (Oct. 12, 2015), <http://spacenews.com/op-ed-ula-failure-of-merger-and-monopoly/> [<https://perma.cc/PD5X-R6TZ>]; Melody Petersen, *SpaceX May Upset Firm’s Monopoly in Launching Air Force Satellites*, L.A. TIMES (Nov. 25, 2014, 5:12 PM), <http://www.latimes.com/business/la-fi-spacex-satellites-20141126-story.html> [<https://perma.cc/2NGL-47ZK>].

57. Eric Berger, *SpaceX Successfully Launches Its First Spy Satellite*, ARSTECHNICA (May 1, 2017, 4:34 AM), <https://arstechnica.com/science/2017/05/watch-live-spacex-second-attempt-to-launch-its-first-spy-satellite/> [<https://perma.cc/K39X-KY4J>].

58. *Id.*

59. *Id.*

60. See *Political Economy of Spaceflight*, *supra* note 25, at 155–56.

was made and how it was made.⁶¹ Even after early increases in commercialization of launch services the market structure remained highly concentrated.⁶²

II. CURRENT STRUCTURE OF INDUSTRY: ENTREPRENEURIAL SPACE: 1989 THROUGH THE PRESENT

According to the Federal Aviation Administration (FAA), the first commercial space launch took place in 1989 “when a Starfire sub-orbital vehicle carried aloft the Consort-1 payload from White Sands Missile Range in New Mexico.”⁶³ The FAA lays out four requirements to define a commercial launch:

- 1) The launch is licensed by the FAA,
- 2) The primary payload’s launch contract was open to international competition,
- 3) The launch was privately financed without government support, and
- 4) Commercial launch vehicles are manufactured and marketed by private companies.⁶⁴

The entrepreneurial age of space began when start-up companies attempted to enter the commercial space industry during the early 2000s.⁶⁵

The entrepreneurial age of space, or NewSpace,⁶⁶ is characterized by the rise of ventures like entrepreneur Elon Musk’s SpaceX. As innovators work to create new technologies challenging the incumbents of OldSpace, imaginations have been captured by these new entrants as Schumpeterian disruptors.⁶⁷

61. See Barbaroux, *supra* note 36, at 12–14.

62. See *id.* at 11–12.

63. FAA FAQ, *supra* note 3.

64. *Id.*

65. See Charles Fishman, *Is Jeff Bezos’ Blue Origin the Future of Space Exploration?*, SMITHSONIAN MAG. (Dec., 2016), <https://www.smithsonianmag.com/innovation/rocketeer-jeff-bezos-winner-smithsonians-technology-ingenuity-award-180961119/> [<https://perma.cc/UL9B-9T3Q>]; *About SpaceX*, SPACEEX, <http://www.spacex.com/about> [<https://perma.cc/29SL-BPL2>].

66. See *NewSpace*, SPACETEC PARTNERS, <https://www.spaceteec.com/partners/markets/newspace/> [<https://perma.cc/ST3C-3427>].

67. See, e.g., Sheraz Sadiq, *Silicon Valley Goes to Space*, KQED: SCIENCE (Nov. 18, 2013), <https://www.kqed.org/science/2013/11/18/silicon-valley-goes-to-space-2/> [<https://perma.cc/C4HM-SJXZ>] (“But the private sector isn’t simply providing lower-cost services to NASA. More fundamentally, it is disrupting the space industry by creating new technologies that make getting into space cheaper.”); Stephane Schultz, *SpaceX: La Nouvelle Odyssée de L’espace*, L’USINE DIGITALE (May 30, 2016, 10:00 AM), <https://www.usine-digitale.fr/editorial/spacex-la-nouvelle-odysee-de-l-espace.N393727> [<https://perma.cc/W5KE-RGFK>] (describing the new private space technology companies as a modern version of the Schumpeterian ‘creative destruction’); *Good and Ready: After Slow Beginnings, a Big Push in Robotics Now Seems Imminent*, ECONOMIST (Mar. 29, 2014), <https://www.economist.com/news/special-report/21599523-after-slow-beginnings-big-push-robotics-now-seems-imminent-good-and-ready> [<https://perma.cc/CMD4-ZYHN>].

However, some have expressed doubt that figures like Elon Musk and Jeff Bezos are really bringing about a ‘paradigm shift,’ or a Schumpeterian gale of creative destruction.⁶⁸ A few commentators question this narrative of disruptive innovation in the space industry and maintain that the primacy of government in space exploration will remain constant.⁶⁹ They point out that the structure of the industry remains closer to a public private partnership than a truly commercialized industry.⁷⁰

A recent study of global launches explores whether the narrative of commercialization is accurate.⁷¹ The study examined data on space launches worldwide between 2000 and 2013 and analyzed whether the payloads of these launches were commercial or non-commercial in nature.⁷² During that period, approximately 60% of U.S. launches were non-commercial and 40% were commercial.⁷³ However, “frontiers between commercial and non-commercial applications are getting blurred” as the commercial space sector develops.⁷⁴

While the analysis focused on payloads rather than launch, the study’s conclusion that commercial over non-commercial applications are increasing is important for forecasting the direction of the industry’s structure.⁷⁵ Given that the demand for launch services is largely dependent on applications,⁷⁶ it follows that increasing commercial applications will continue to drive the commercialization of space.

(“Elon Musk is shaking it up, using some of his internet-derived riches to create SpaceX, a disruptively good rocket-maker.”).

68. See, e.g., Matthew DeBord, *Wall Street Is Making the Same Mistake About Investing in Space as It Did with Self-Driving Cars*, BUS. INSIDER (Oct. 12, 2017, 11:18 AM), <http://www.businessinsider.com/wall-street-morgan-stanley-investment-spacex-2017-10> [https://perma.cc/J498-EQ9C]. For a definition of paradigm shift, see generally Patrick Q. Collins, *The “New Space Paradigm” Brings Tide of Hope for the Future*, SPACE RENAISSANCE (Aug. 18, 2012), https://spacerenaissance.space/media/NEWS/SRI_Editorial_No_1_The_New_Space_Paradigm_brings_tide_of_hope_for_the_future.pdf [https://perma.cc/A64Q-RQT8].

69. DeBord, *supra* note 68.

70. See, e.g., Eric Berger, *Trump Space Adviser: Blue Origin and SpaceX Rockets Aren’t Really Commercial*, ARSTECHNICA (Nov. 6, 2017, 3:55 PM), <https://arstechnica.com/science/2017/11/trump-space-adviser-blue-origin-and-spacex-rockets-arent-really-commercial/> [https://perma.cc/4W8P-RGPZ].

71. See Barbaroux, *supra* note 36, at 9–10.

72. *Id.* at 15.

73. *Id.* at 20–21.

74. *Id.* at 23.

75. See *id.* at 10 (noting however, that each nation studied in the report shows varying transformations).

76. See *Global Small Launch Vehicle Market 2017–2026 - Advancements in 3D Printing Technology for Developing the Components of Small Launch Vehicle*, CISION: PR NEWSWIRE (July 26, 2017, 12:30PM), <https://prn.to/2SE874w> [https://perma.cc/E78F-48EX].

A. Survey of Launch Transport Startups

The Commercial Spaceflight Federation (formerly the Personal Spaceflight Federation, “the Federation”),⁷⁷ an industry association representing U.S. commercial space companies including spaceflight developers, operators, spaceports, suppliers, and service providers, was formed in 2005.⁷⁸ The Federation’s 2016–17 annual report announced that “more than 70 commercial space companies and education institutions” have joined the association.⁷⁹ On the launch side of the industry, new companies are entering and competing with industry incumbents. This section surveys four of these companies, and their role in the entrepreneurial space age: 1) Gilmour Space technologies, 2) Rocket Lab, 3) SpaceX, and 4) Blue Origin.

1. Gilmour Space Technologies

Gilmour space technologies, an Australian based company with launch facilities in the Republic of Singapore, is developing launch vehicles to support the growing small satellite industry.⁸⁰ They have two rocket designs in production, the Ariel Sounding Rocket and Eris Orbital Launcher, projected to release in 2019 and 2020 respectively.⁸¹ These launch vehicles are designed to “focus on cost rather than performance.”⁸² Gilmour’s mission statement stands in stark contrast to ULA’s focus on reliability.⁸³ Small companies like Gilmour are entering the space launch sector and competing on other vectors—like cost—and chipping away at the dominance of OldSpace companies.

2. Rocket Lab

Rocket Lab is another start-up that is working to lower the cost barrier to entry for space applications. Specifically aimed at facilitating small-sat technologies, Rocket Lab’s Electron satellite

77. Doug Messier, *Personal Spaceflight Federation Changes Name*, PARABOLIC ARC (June 15, 2009), <http://www.parabolicarc.com/2009/06/15/personal-spaceflight-federation-website/> [https://perma.cc/9KKQ-P8VE].

78. *About Us*, COM. SPACEFLIGHT FED’N, <http://www.commercialspaceflight.org/about-us/> [https://perma.cc/RL2H-Y47Y].

79. COMMERCIAL SPACEFLIGHT FED’N, 2016–17 ANNUAL REPORT 4 (2017), <http://www.commercialspaceflight.org/wp-content/uploads/2016/05/2016-17-Annual-Report-2-min.pdf> [https://perma.cc/7TQZ-QJSY].

80. *Gilmour Space*, GILMOUR SPACE TECH., <https://www.gspacetechnology.com/> [https://perma.cc/8TYK-T6DN].

81. *Low Cost Launches for Small Payloads: Suborbital & Orbital*, GILMOUR SPACE TECH., <https://www.gspacetechnology.com/launch-vehicles> [https://perma.cc/C2HY-XH6W].

82. *Id.*

83. *About*, ULA, <http://www.ulalaunch.com/about-ula.aspx> [https://perma.cc/RJC9-M87A] (“Create value through certainty. We deliver the most dependable ride to space by combining our unrivaled legacy, tireless drive to improve and commitment to the extraordinary.”)

launch vehicle is nearing the end of its testing phase and preparing to offer commercial launches soon.⁸⁴

The launch vehicle is not the only innovation the company offers. As part of its goal to decrease entry barriers for space, the company also plans to offer “ridesharing” options.⁸⁵ Users can not only have a “dedicated” launch vehicle to put their application into space, they can also choose to ride with others to get in orbit more affordably.⁸⁶ Peter Beck, CEO and founder of Rocket Lab, sees his innovations as a way to get technology that is currently earthbound, waiting on the bottleneck of launch services, into orbit.⁸⁷ Launch is not only expensive, but given the scarcity of vehicles and complicated regulatory clearance needed for launches, (and the physical limits of orbital launch windows themselves), a company might wait years to get its technology off the ground according to Beck.⁸⁸

Another key piece of Rocket Lab’s strategy to increase access to space is the company’s ownership of its own space port. Rocket Lab proudly announces that they have established “the world’s only private orbital launch range” at its facility in Mahia, New Zealand.⁸⁹ The site is set up to comply with the FAA’s requirements for launch⁹⁰ (the FAA licenses space launches within U.S. borders and for all U.S. entities),⁹¹ and earlier this year the FAA cleared Rocket Lab’s three test flights for launch from the Mahia site.⁹²

On January 22, 2018, Rocket Lab successfully launched their second test launch of their Electron Rocket.⁹³ The Rocket not only successfully reached orbit, but also successfully launched its payload of three commercial satellites.⁹⁴ Rocket Lab has indicated

84. Loren Grush, *Rocket Lab’s Rocket Is Launching Again Soon — And This Time It’ll Carry Satellites to Space*, VERGE (Sept. 26, 2017, 10:50 AM), <https://www.theverge.com/2017/9/26/16364632/rocket-lab-electron-rocket-second-test-flight-planet-spire-satellites> [https://perma.cc/59TT-K772].

85. *Book My Launch*, ROCKET LAB, <https://www.rocketlabusa.com/book-my-launch/> [https://perma.cc/Z2G8-LLVQ].

86. *Id.*

87. Donna Dawson, *Rocket Lab All-Composite Electron Launch Vehicle*, COMPOSITESWORLD (Sept. 12, 2017), <https://www.compositesworld.com/articles/rocket-lab-all-composite-electron-launch-vehicle> [https://perma.cc/FGN6-NGMA].

88. *Id.*

89. *Launch Sites*, ROCKET LAB, <https://www.rocketlabusa.com/launch/launch-sites/> [https://perma.cc/8G7D-FGFM].

90. *Id.*

91. FAA FAQ, *supra* note 3; see also discussion *infra* Part III.B.

92. Rocket Lab USA, FAA License No. LLS 17-095A (May 15, 2017), [https://www.faa.gov/about/office_org/headquarters_offices/ast/licenses_permits/media/LLS%2017-095%20License%20Mod%20-%20Order%20A%20-%20Rev%203%20-%20Rocket%20Lab%20USA%20-%20License%20and%20Orders%20\(FINAL%202018-12-11\).pdf](https://www.faa.gov/about/office_org/headquarters_offices/ast/licenses_permits/media/LLS%2017-095%20License%20Mod%20-%20Order%20A%20-%20Rev%203%20-%20Rocket%20Lab%20USA%20-%20License%20and%20Orders%20(FINAL%202018-12-11).pdf) [https://perma.cc/6E6P-F7JS].

93. Loren Grush, *Spaceflight Startup Rocket Lab Sends Its Electron Rocket to Orbit for the First Time*, VERGE (Jan. 21, 2018, 9:07 AM), <https://www.theverge.com/2018/1/21/16915996/rocket-lab-electron-orbit-still-testing-small-satellites-success> [https://perma.cc/7WJM-94XK].

94. *Id.*

that it is now moving to begin launching the commercial contracts it already has in place with customers like NASA, as well as commercial entity Moon Express.⁹⁵ Beck emphasized the importance of the occasion commenting that “today marks the beginning of a new era in commercial access to space.”⁹⁶

3. SpaceX

Startup SpaceX is a well-known new space company providing launch services. Elon Musk, entrepreneur and founder of the company, is a celebrity figure whose dramatic pronouncements about the colonization of Mars for one, have captured the public’s imagination. The company was founded in 2002 “with the ultimate goal of enabling people to live on other planets.”⁹⁷ The company is developing reusable launch vehicles as a way to lower the cost of launches while ensuring reliability.⁹⁸ In 2017 the company made important progress towards this goal with the successful reflight of an orbital rocket.⁹⁹ The company has won several high-profile contracts from NASA and the DoD such as the provision of supplies to the international space station, and a contract for 2019 to carry astronauts to the space station.¹⁰⁰

On February 6, 2018, SpaceX conducted an important test flight of their heavy launch vehicle, the Falcon 9 Heavy.¹⁰¹ The launch, which was widely publicized, tested the viability of the heavy launch vehicle by sending a red Tesla roadster—complete with space-suited mannequin and David Bowie soundtrack—into space on a trajectory with the asteroid belt.¹⁰² Though the test was not flawless, the main engine core prematurely exhausted its propellant leading to failure to land on the drone ship,¹⁰³ commentators overall focused on the viability demonstrated by the rocket’s performance.¹⁰⁴

But the most important facet of the successful February launch is the impact on the conception of the commercial space industry’s potential for the future. Prior to the launch, commentators noted

95. *Id.*

96. *Id.*

97. *About SpaceX*, *supra* note 65.

98. *Id.*

99. *Id.*

100. *See About SpaceX*, *supra* note 65; *see also Air Force Awards AFSPC-52 Launch Services Contract to SpaceX*, L.A. A.F. BASE (June 21, 2018), <https://www.losangeles.af.mil/News/Article-Display/Article/1557227/air-force-awards-afspc-52-launch-services-contract-to-spacex/> [<https://perma.cc/2DJA-X63H>].

101. Robin Seemangal, *SpaceX Successfully Launches the Falcon Heavy—And Elon Musk’s Roadster*, WIRE (Feb. 6, 2018, 4:21 PM), <https://www.wired.com/story/spacex-successfully-launches-the-falcon-heavyand-elon-musks-roadster/> [<https://perma.cc/T2KQ-4B5Z>].

102. *Id.*

103. *Id.*

104. *See, e.g., id.*

the potential the heavy launch vehicle could have for NASA missions.¹⁰⁵ Beyond the technical potential, the launch itself caught the attention of millions.¹⁰⁶ After the launch, Musk commented: “I think it’s going to open up a sense of possibility. . . . We want a new space race. Space races are exciting.”¹⁰⁷ The potential for a new space race, between commercial, civilian, and military entities, could reshape human access to space.

4. Blue Origin

Blue Origin was founded quietly in 2000 by Amazon.com entrepreneur Jeff Bezos.¹⁰⁸ The company has focused on vehicles capable of providing human spaceflight.¹⁰⁹ While Blue Origin is still technically in the testing and development phase for its New Shepard¹¹⁰ and New Glenn¹¹¹ rockets respectively, the company has already won several notable contracts.¹¹² Unlike SpaceX’s business model of using government supply contracts to fuel the development of interplanetary vehicles for the future, Blue Origin is producing components, rocket engines, and turning its sights towards the space tourism industry.¹¹³ The company plans to provide low-cost trips to the edge of the atmosphere where space tourists can briefly experience weightlessness before coming back to earth again.¹¹⁴

105. See, e.g., Loren Grush, *A Successful SpaceX Falcon Heavy Launch Gives NASA New Options*, VERGE (Feb. 2, 2018, 9:10 AM), <https://www.theverge.com/2018/2/2/16954582/spacex-falcon-heavy-rocket-launch-impact-nasa-deep-space-travel> [<https://perma.cc/CPV7-ZPNH>].

106. Mary Beth Griggs, *SpaceX’s Falcon Heavy Launch Was (Mostly) a Success*, POPULAR SCI. (Feb. 7, 2018), <https://www.popsci.com/spacex-falcon-heavy-launch-was-joyful-success> [<https://perma.cc/MX8J-AV8F>].

107. Dave Mosher, *Elon Musk: We Want a New Space Race — Space Races are Exciting*, BUS. INSIDER (Feb. 7, 2018, 2:31 AM), <http://www.businessinsider.com/falcon-heavy-space-race-elon-musk-spacex-blue-origin-2018-2> [<https://perma.cc/S46S-WPJK>].

108. Elizabeth Howell, *Jeff Bezos: Biography of Blue Origin, Amazon Founder*, SPACE (May 1, 2018), <https://www.space.com/19341-jeff-bezos.html> [<https://perma.cc/Z2UX-PHR7>].

109. *Id.*

110. *New Shepard*, BLUE ORIGIN, <https://www.blueorigin.com/new-shepard> [<https://perma.cc/PFG3-NGER>].

111. *New Glenn*, BLUE ORIGIN, <https://www.blueorigin.com/new-glenn> [<https://perma.cc/2DAC-XYGH>].

112. Mariella Moon, *Blue Origin’s New Glenn Rocket Wins Air Force Contract*, ENGADGET (Oct. 11, 2018), <https://www.engadget.com/2018/10/11/blue-origin-new-glenn-rocket-air-force-contract/> [<https://perma.cc/45X9-LSNT>]; Will Yakowicz, *Jeff Bezos’ Blue Origin Lands NASA Contract*, INC. (June 7, 2016), <https://www.inc.com/will-yakowicz/blue-origin-lands-nasa-contract-to-launch-tech-suborbital-flight.html> [<https://perma.cc/VMU9-LXNA>].

113. Jackie Wattles, *Blue Origin CEO: We’re Taking Tourists to Space Within 18 Months*, CNN: BUS. (Oct. 5, 2017, 7:32 PM), <http://money.cnn.com/2017/10/05/technology/future/blue-origin-launch-human-space-tourism/index.html> [<https://perma.cc/A2Y7-PMB3>].

114. *Id.*

B. *Changes to Industry Structure and Competition*

Faced with this competition the ULA has been slashing its prices to try and keep its footing.¹¹⁵ As ULA has lost out on government contracts,¹¹⁶ it has also undertaken restructuring efforts.¹¹⁷

Competition in the commercial space industry is impacting both the provision of launch services to the government and the provision of launch services for commercial space applications. New companies are winning important government contracts that provide capital to these new ventures.¹¹⁸ While these companies may not be purely independent commercial entities, the government contracts facilitate the growth of the commercial sector of the space industry.¹¹⁹ In turn these companies have competed on cost and lowered entry barriers for military, civilian, and commercial applications.¹²⁰

115. See Irene Klotz, *United Launch Alliance Cuts Atlas Rocket Price Amid Competition*, REUTERS (Apr. 4, 2017, 8:10 PM), <http://reut.rs/2nVrpoq> [<https://perma.cc/6D69-CV5U>].

116. See Andrea Shalal, *U.S. to Modify Launch Capability Deal for Lockheed-Boeing Venture*, REUTERS (Mar. 25, 2015, 4:00 PM), <http://reut.rs/1EV4Zpn> [<https://perma.cc/TG4D-PJ9M>].

117. Jason Rhian, *Report: ULA to Layoff Vandenberg Staff, Potentially Change Name*, SPACEFLIGHT INSIDER (Mar. 6, 2017), <http://www.spaceflightinsider.com/organizations/ula/report-ula-to-layoff-vandenberg-staff-potentially-change-name/> [<https://perma.cc/8DAT-QTNL>].

118. See discussion *infra* Part IV.A.

119. See discussion *infra* Part IV.A.

120. See, e.g., ALEXANDER MACDONALD, EMERGING SPACE: THE EVOLVING LANDSCAPE OF 21ST CENTURY AMERICAN SPACEFLIGHT 3 (2014), <https://www.nasa.gov/sites/default/files/files/EmergingSpacePresentation20140829.pdf>

[<https://perma.cc/3G48-Q4WV>]; NEAR EARTH LLC, SUPPORTING COMMERCIAL SPACE DEVELOPMENT PART 2: SUPPORT ALTERNATIVES VERSUS NASA COMMERCIALIZATION PRIORITIES 14 (2010), <https://www.nasa.gov/sites/default/files/files/SupportingCommercialSpaceDevelopmentPart2.pdf> [<https://perma.cc/MB99-3E2K>]; Garrett, *supra* note 1.

Company	Launch vehicle	Estimated Cost of Launch (millions of dollars)	Orbit
Gilmour Space Technologies	Ariel Sounding Rocket	1.17	Up to 150 km
	Eris Orbital Launcher	12.6	LEO
Rocket Lab	Electron Satellite Launch Vehicle	5	500 km (LEO)
ULA	Atlas V	Starting at 109	LEO
SpaceX	Falcon 9	62	GTO
	Falcon 9 Heavy	90	GTO

TABLE 2: ESTIMATED COST OF LAUNCH SERVICES BY COMPANY¹²¹

121. The primary sources for the data in Table 2 can be found at: *Low Cost Launches for Small Payloads: Suborbital & Orbital*, *supra* note 81 (Gilmour Space Technologies); Dawson, *supra* note 87 (Rocket Labs); *Atlas V*, ULA, <https://www.ulalaunch.com/rockets/atlas-v> [<https://perma.cc/W565-6JY4>] (ULA); *Capabilities & Services*, SpaceX, <http://www.spacex.com/about/capabilities> [<https://perma.cc/YQ7K-XLMW>] (SpaceX).

III. LEGAL AND REGULATORY STRUCTURE

The space industry is defined not only by the high cost-barriers inherent to the enterprise of defying Earth's gravity, but also by the legal regulatory barriers at both an international and domestic level that govern space launch and applications. As the commercial space sector has developed, industry has called for changes to the regulatory structure to streamline the approval process for launches.¹²² These proposals for regulatory reforms focus on the approval process. Missing from these discussions are recommendations for an explicit competition policy to continue to foster the development of the competition that has been so beneficial to the space industry in recent years. Part III will lay out the current legal framework governing the American space industry.

A. Legal Structure

As the United States and the U.S.S.R. competed for dominance of the skies, the United Nations stepped in to state the bedrock principles of the international law of space.¹²³ The U.N began developing an international space policy and adopted the Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space, in 1963.¹²⁴ These principles were formalized in a treaty in 1967.¹²⁵ The U.N opened the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies ("Outer Space Treaty") in January 1967 for signature, and the treaty entered into force in October of that year.¹²⁶ The Russian Federation, the United Kingdom and the United States of America all signed the treaty on January 27, 1967.¹²⁷ The treaty laid out a framework for the legality of nations in space.¹²⁸

The main provisions of the treaty recognized the competition to reach space as well as aspired to cooperation. Article I provides that: "The exploration and use of outer space, including the moon

122. Johnson, *supra* note 5.

123. Vladimir Kopal, *Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies*, U.N. AUDIOVISUAL LIBR. INT'L L., 2008, http://legal.un.org/avl/pdf/ha/tos/tos_e.pdf [<https://perma.cc/3NHU-3AJM>].

124. *Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies*, U.N. OFF. FOR OUTER SPACE AFF., http://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/introouterspace_treaty.html [<https://perma.cc/E6HD-Y7TU>].

125. *Id.*

126. *Id.*

127. *Id.*

128. *Id.*

and other celestial bodies, shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development, and shall be the province of all mankind.”¹²⁹ The treaty’s aspirational language about humanity and ownership to all mankind notwithstanding, the treaty also laid out provisions holding individual nations liable for the actions of any governmental or non-governmental entities that belong to that state.¹³⁰ Article VII of the treaty effectively put the responsibility for all of a given country’s entities, whether governmental or non-governmental (military, civilian, or commercial) on the given national state,¹³¹ leading to the government mediation of all outer space activity.

Under this framework the United States government provided all launches for commercial space applications until the 1980s. In October 1984, under the Reagan administration, the Commercial Space Launch Act was signed into law with the goal of encouraging the development of “the private sector in commercial space endeavors.”¹³² President Reagan’s signing statement explicitly acknowledged the development of commercial launch vehicles as an aim of the act, and that the legislation would provide for “the need[s] of private companies interested in launching payloads to have ready access to space.”¹³³ Section 2 of the Act indicates one of the key reasons why the United States loosened its restrictions against commercial launches: “the development of commercial launch vehicles and associated services would enable the United States to retain its competitive position internationally, thereby contributing to the national interest and economic well-being of the United States.”¹³⁴

At this point in time, if a country or private entity wanted to get something into space but did not have access to a launch service of its own, they could contract with NASA to launch the application into space for them.¹³⁵ NASA would purchase the launch service technology from a private corporation, integrate the payload, and then conduct the launch.¹³⁶

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

130. *Id.* art. VII.

131. *Id.*

132. President Ronald Reagan, Statement on Signing the Commercial Space Launch Act (Oct. 30, 1984), <https://www.reaganlibrary.gov/research/speeches/103084i> [<https://perma.cc/844X-A48Y>].

133. *Id.*

134. Commercial Space Launch Act of 1984, Pub. L. No. 98-575, 98 Stat. 3055 (codified as amended at 51 U.S.C. §§ 50901–50923 (2018)).

135. See *Political Economy of Spaceflight*, *supra* note 25, at 162.

136. *Id.*

In the 1970s, NASA began developing the space shuttle and advertising it as a more economic option than commercial expendable launch vehicles of American corporations like Martin Marietta for example.¹³⁷ Europe meanwhile, had formed the European Space Agency (ESA) and was developing the Ariane launcher.¹³⁸ Both ESA and NASA priced launch services very low, threatening the survival of American aerospace companies.¹³⁹ Concerned at the effect that these low prices would have on industry, the Reagan administration stepped in and passed the Commercial Space Launch Act to encourage the development of commercial launchers under the authority of the Department of Transportation.¹⁴⁰

The space shuttle's threat to commercial launches failed to materialize due in large part to action by the Reagan administration following the 1986 Challenger accident.¹⁴¹ After the explosion of the space shuttle due to the failure of a booster engine,¹⁴² the Reagan administration banned NASA from any commercial launches.¹⁴³ The entrance of the burgeoning capitalist economies of Russia and China into the launch services market, following the collapse of the U.S.S.R., put increasing pressure on the U.S. industry.¹⁴⁴ Concerned with the potential damage that these foreign launch services could do to the U.S., but still wanting to foster these developing economies, the U.S. signed agreements with Russia, the Ukraine, and China, to set prices for commercial satellite launches.¹⁴⁵

In 2004, the Commercial Space Launch Amendments Act¹⁴⁶ recognized that satellites were not the only commercial space applications and amended the language of the Commercial Space Launch Act to regulate commercial flights of humans—space tourism.¹⁴⁷ The Act provided for minimal safety regulations to encourage the development of the fledgling industry.¹⁴⁸

In 2015 the deregulatory tenor of commercial space continued with the passage of the U.S. Commercial Space Launch

137. *Id.* at 162–63.

138. *Id.*

139. *Id.* at 163.

140. *Id.*

141. *Id.*

142. *Remembering Space Shuttle Challenger*, NASA, https://www.nasa.gov/multimedia/imagegallery/image_gallery_2437.html [<https://perma.cc/9SMN-GJG6>] (last updated Feb. 5, 2019).

143. *See Political Economy of Spaceflight*, *supra* note 25, at 163.

144. *See id.* at 163–64.

145. *Id.* at 164.

146. Commercial Space Launch Amendments Act of 2004, Pub. L. No 108-492, 118 Stat. 3974 (codified as amended in scattered sections of 49 and 51 U.S.C.).

147. *Commercialization of Space: Commercial Space Launch Amendments Act of 2004*, 17 HARV. J.L. & TECH. 619, 619–20 (2004).

148. *Id.* at 628.

Competitiveness Act.¹⁴⁹ The Act has several key provisions designed to foster the growth of commercial space.¹⁵⁰ First, the Act gives possessory rights to discoveries of nonliving space resources such as minerals and water.¹⁵¹ Second, the Act continues to place caps on the liability of commercial space operations (an important aid to companies looking for insurance to operate).¹⁵² Finally, the Act provides an eight year reprieve from increased regulatory oversight.¹⁵³

B. Regulatory Structure

Despite the deregulatory direction of U.S. commercial space legislation since the 1980s, commercial space launches are still governed by a complex regulatory structure. This next section will provide a brief overview of the relevant regulatory bodies and discuss current proposals for regulatory reform.

Primary authority for the approval of all commercial space transport is overseen by the Federal Aviation Administration's Office of Commercial Space Transportation.¹⁵⁴ Originally, authority for overseeing commercial space launches was placed with the Secretary of Transportation, who oversees the Office of Commercial Space Transportation (AST).¹⁵⁵ In 1995 AST was transferred to the FAA.¹⁵⁶ FAA/AST licenses all commercial launches and reentries in the United States and by United States Citizens.¹⁵⁷

Unlike private launches, government launches, are overseen by the DoD and NASA, not the FAA.¹⁵⁸ However, it is important to note that commercial launch companies putting governmental applications into space may be subject to FAA/AST licensure requirements. For example, the SpaceX launch of a satellite for the National Reconnaissance Office within the DoD in May of 2017 was licensed by the FAA/AST.¹⁵⁹ Other agencies also have a role in

149. Pub. L. No. 114-90, 129 Stat. 704 (codified in scattered sections of 51 U.S.C.).

150. See Nick Stockton, *Congress Says Yes to Space Mining, No to Rocket Regulations*, WIRED (Nov. 8, 2015, 10:00 AM), <https://www.wired.com/2015/11/congress-says-yes-to-space-mining-no-to-rocket-regulations/> [<https://perma.cc/UC3K-KPTS>].

151. Space Resource Exploration and Utilization Act of 2015, Pub. L. No. 114-90 §§ 401–03, 129 Stat 704, 720–22 (codified as amended at 51 U.S.C. §§ 51301–51303).

152. See U.S. Commercial Space Launch Competitiveness Act § 103.

153. *Id.* § 111.

154. *About the Office*, FED. AVIATION ADMIN., https://www.faa.gov/about/office_org/headquarters_offices/ast/about/ [<https://perma.cc/WK2W-PXCX>].

155. Organization and Delegation of Powers and Duties, Office of the Secretary, 50 Fed. Reg. 7782 (Feb. 26, 1985); *id.*

156. *About the Office*, *supra* note 154.

157. *Fact Sheet – Commercial Space Transportation Activities*, FED. AVIATION ADMIN., https://www.faa.gov/news/fact_sheets/news_story.cfm?newsId=19074 [<https://perma.cc/P6XG-CVYC>].

158. *Id.*

159. See *Launch Details*, FED. AVIATION ADMIN., https://www.faa.gov/about/office_org/headquarters_offices/ast/launch_data/launch_details/?launchId=2079 [<https://perma.cc/TDM8-GKH6>]; see also *Completed Missions*, SPACEX, <https://www>

authorizing space launches and applications.¹⁶⁰ Any commercial space application dependent on spectrum would require approval by the Federal Communications Commission.¹⁶¹

The FAA/AST criteria for issuing permits is focused on public and national security concerns. According to the agency, a license will issue if the requested launch “will not jeopardize public health and safety, property, U.S. national security or foreign policy interests, or international obligations of the United States.”¹⁶² These criteria demonstrate that while commercial space policy is developing, it continues to be characterized by national concerns and international obligations.

In October of 2017, the Government Accountability Office (GAO) published a report exploring attitudes on relocating the FAA/AST to its previous position under the Office of the Secretary of Transportation.¹⁶³ This report came in the midst of ongoing conversations about the desirability of regulatory reform to facilitate the ease of commercial launches.¹⁶⁴

The GAO report found that stakeholders had differing opinions as to whether the proposal could “help accelerate the pace of commercial space regulatory reform”¹⁶⁵ Generally commercial space industry stakeholders favored the move, while most agency personnel did not.¹⁶⁶ Various stakeholders also noted that the agency could be moved under the broad authority of the Department of Transportation, rather than under the Secretary of Transportation.¹⁶⁷ This move would recognize that space, like highways and rail, is its own unique form of transport, rather than a subcategory of air travel.¹⁶⁸

The same month that the GAO report was released, President Trump reconvened the National Space Council.¹⁶⁹ The Trump administration appears to be prioritizing a lunar manned mission,

.spacex.com/missions [https://perma.cc/RCK6-Y3XK] (dating the launch of the National Reconnaissance Office (NROL-76) Satellite as May 1, 2017).

160. See Johnson, *supra* note 5.

161. See *id.*

162. *Office of Commercial Space Transportation: Licenses, Permits & Approvals*, FED. AVIATION ADMIN., https://www.faa.gov/about/office_org/headquarters_offices/ast/licenses_permits/ [https://perma.cc/4DXP-W7RJ].

163. U.S. GOV'T ACCOUNTABILITY OFF., FEDERAL AVIATION ADMINISTRATION: STAKEHOLDERS' PERSPECTIVES ON POTENTIALLY MOVING THE OFFICE OF COMMERCIAL SPACE TRANSPORTATION (2017).

164. See *generally id.*

165. *Id.*

166. *Id.* at 7.

167. *Id.* at 6.

168. See *id.* at 13.

169. Press Release, White House Office of the Press Sec'y, Vice President Mike Pence Announces First Meeting of The National Space Council (Sept. 26, 2017), <https://www.whitehouse.gov/the-press-office/2017/09/26/vice-president-mike-pence-announces-first-meeting-national-space-council> [https://perma.cc/KQG8-UB32].

and private industry may play a role in this executive goal.¹⁷⁰ SpaceX and Blue Origins representatives present at the meeting called for “streamlining the bureaucratic process of licensing launches.”¹⁷¹ These comments are characteristic of calls for reform of the way that the U.S. handles space policy.¹⁷²

The National Space Council met for the second time on February 21, 2018.¹⁷³ At this meeting, entitled: “Moon, Mars, and Worlds Beyond: Winning the Next Frontier,” the Council presented its recommendations for President Trump.¹⁷⁴ The Council agreed on four recommendations:

The Secretary of Transportation should work to transform the launch and re-entry licensing regime; . . .

The Secretary of Commerce should consolidate its space commerce responsibilities, other than launch and reentry, in the Office of the Secretary of Commerce; . . .

The National Telecommunication and Information Administration should coordinate with the Federal Communications Commission to ensure the protection and stewardship of radio frequency spectrum necessary for commercial space activities; [and] . . .

The Executive Secretary of the National Space Council, in coordination with members of the National Space Council, should initiate a policy review of the current export licensing regulations affecting commercial space activity.¹⁷⁵

Expectedly, most of these recommendations relate to the licensing and regulatory streamlining the industry has been concerned with.

In December of 2017, the Aerospace Corporation’s Center for Space Policy and Strategy released a whitepaper describing “how the United States may develop national space policy to address the

170. Kenneth Chang, *Space Council Chooses the Moon as Trump Administration Priority*, N.Y. TIMES (Oct. 5, 2017), <https://nyti.ms/2yLjQ7Q> [<https://perma.cc/BUV5-6Z56>].

171. *Id.*

172. See, e.g., Christian Zur, *How Last Century Bureaucracy Is Hurting U.S. Space Sovereignty*, U.S. CHAMBER COM.: ABOVE FOLD (July 5, 2017, 4:00 PM), <https://www.uschamber.com/series/above-the-fold/how-last-century-bureaucracy-hurting-us-space-sovereignty> [<https://perma.cc/8UNS-4WEM>].

173. Bob Granath, *Vice President Pence Hosts National Space Council at NASA’s Kennedy Space Center*, NASA (Feb. 21, 2018), <https://www.nasa.gov/feature/vice-president-pence-hosts-national-space-council-at-nasas-kennedy-space-center> [<https://perma.cc/UD4U-3LVW>].

174. *Id.*

175. Press Release, White House Office of the Vice President, Moon, Mars, and Worlds Beyond: Winning the Next Frontier (Feb. 21, 2018) [hereinafter White House Press Release], https://www.nasa.gov/sites/default/files/atoms/files/moon_mars_worlds_beyond.pdf [<https://perma.cc/SCW5-2BFP>].

dynamic space environment. . . .”¹⁷⁶ The report makes policy recommendations such as embracing new technologies and seeking reform of international agreements.¹⁷⁷ Notable in this and other descriptions of space policy, the role of competition in increasing the viability of the commercial space sector is acknowledged, but recommendations for ensuring competition in the future are absent.¹⁷⁸

IV. RECOMMENDATIONS TO FOSTER COMPETITION

Although a variety of regulatory reforms have been proposed and the value of competition in the commercial sector is generally lauded, concrete suggestions for establishing a competition policy for the space industry are missing. NASA and the DoD have some regulatory policies in place that have positively impacted competition;¹⁷⁹ however, regulators should adopt competition as an explicit goal in space policy. Competition in the space industry both leads to reduced costs and serves to encourage innovation.¹⁸⁰

A. *Current Competition Policy in Space Industry*

The U.S. space industry has adopted some measures to facilitate competition across all three sectors of the space industry: civilian, military, and commercial. These measures are discussed briefly below.

In the civilian context, NASA’s commercial crew program has facilitated competition for the provision of space transport, providing important capital to the commercial space sector over the last decade.¹⁸¹ The commercial crew program was instituted to facilitate the development of efficient and cost-effective space

176. JAMES A. VEDDA & PETER L. HAYS, MAJOR POLICY ISSUES IN EVOLVING GLOBAL SPACE OPERATIONS 1 (2017), https://aerospace.org/sites/default/files/2018-05/Space_Policy_FINAL_interactive_0.pdf [<https://perma.cc/CW7X-2Y7L>].

177. *Id.* The five recommendations are:

1) the United States should lead by example; 2) roles need to be clarified among the government, commercial, and international sectors of activity; 3) emerging technologies should be embraced, not obstructed, even if their proliferation carries some risk; 4) classification of space operations could be reduced to facilitate international and cross-sector collaboration; and 5) reform of international agreements should be approached with caution and patience to ensure that important provisions and understandings are not lost. *Id.*

178. *See, e.g.*, ROBERT ZIMMERMAN, CAPITALISM IN SPACE: PRIVATE ENTERPRISE AND COMPETITION RESHAPE THE GLOBAL AEROSPACE LAUNCH INDUSTRY 6 (2017), <https://s3.amazonaws.com/files.cnas.org/documents/CNAS-Report-CapitalismInSpace-Final.pdf?mtime=20170216144336> [<https://perma.cc/Q6FL-DAFV>].

179. *See id.*

180. *See* Joshua Hampson, The Future of Space Commercialization 30 (Jan. 25, 2017) (unpublished manuscript) (on file with author).

181. *See Commercial Crew Program - The Essentials*, NASA, <https://www.nasa.gov/content/commercial-crew-program-the-essentials/> [<https://perma.cc/R6P3-G77F>]; *see also infra* Table 3.

transport for the international space station and low earth orbit.¹⁸² The program awards money to private companies to fund the development of human space flight.¹⁸³ NASA has imposed certain safety and operational requirements for the award of funds such as number of crew members that the craft must be able to carry, and a requirement to assure crew safety during launch for example.¹⁸⁴ Under a combination of space act agreements and contracts, NASA has been a substantial funder of commercial space companies, as reflected in Table 3.¹⁸⁵ The stated goal of the program is to not only enhance competitive options for the provision of services for the government, but also to further the development of the commercial space sector in and of itself.¹⁸⁶

This type of program, encouraging the civilian sector to infuse the commercial sector with necessary capital has benefitted both the civilian sector and encouraged development of commercial spaceflight. Innovative public private partnerships like this program can enhance competitiveness across all sectors of the space industry.

Another mechanism that facilitates competition are agency acquisition regulations, which among numerous other requirements, impose competitive buying policies on NASA and DoD procurement practices. The agencies have both internal and external requirements that have competitive impact. The Federal Acquisition Regulation (FAR) governs acquisitions by all government agencies made with funds appropriated by Congress.¹⁸⁷ The regulation contains a plethora of requirements governing federal agency acquisitions.¹⁸⁸ NASA and the DoD have their own supplemental regulations in addition to FAR's requirements.¹⁸⁹

182. *Commercial Crew Program – The Essentials*, *supra* note 181.

183. See NAT'L AERONAUTICS & SPACE ADMIN., COMMERCIAL CREW PROGRAM 2 (2014), <https://www.nasa.gov/sites/default/files/files/CCP-Apr-14.pdf> [<https://perma.cc/9E3T-T8LY>].

184. *Id.* at 1.

185. *Commercial Crew Program – The Essentials*, *supra* note 181.

186. *Id.*

187. See 48 C.F.R. ch. 1 (2019).

188. See *id.*; *Federal Acquisition Regulation (FAR)*, ACQUISITION.GOV, <https://www.acquisition.gov/browsefar> [<https://perma.cc/N668-MBC7>].

189. See, e.g., NAT'L AERONAUTICS & SPACE ADMIN., NASA FAR SUPPLEMENT (2015) [hereinafter NASA FAR SUPPLEMENT], <https://www.hq.nasa.gov/office/procurement/regs/NFS.pdf> [<https://perma.cc/V2HT-A5JZ>]; DEP'T OF DEF., DEFENSE FEDERAL ACQUISITION REGULATION SUPPLEMENT (2019) [hereinafter DOD FAR SUPPLEMENT].

<i>Company Name</i>	<i>Funding Vehicle</i>	<i>Amount Awarded</i>
Alliant Techsystems	Participated in CCDev2	Unfunded Partnership
Blue Origin	Participated in CCDev1 and CCDev2	\$25.6 Million
Boeing	Participated in CCDev1, CCDev2, CCiCap, CPC, and CCtCap	\$4.82 Billion
Excalibur Almaz Inc.	Participated in CCDev2	Unfunded Partnership
Paragon Space Development Corp.	Participated in CCDev1	\$1.4 Million
Sierra Nevada Corp.	Participated in CCDev1, CCDev2, CCiCap, and CPC	\$363.1 Million
SpaceX	Participated in CCDev2, CCiCap, CPC, and CCtCap	\$3.144 Billion
ULA	Participated in CCDev1 and CCDev2	\$6.7 Million

TABLE 3: PARTICIPANTS IN NASA COMMERCIAL CREW PROGRAM THROUGH FEB. 25, 2016¹⁹⁰

Part 1806 of NASA's FAR supplement contains the mandate for competition in acquisition policy.¹⁹¹ This policy outlines the competition requirements for NASA acquisitions.¹⁹² The competition requirements include procedures to ensure that multiple viable competitors for supply remain in the field.¹⁹³ One of the key problems of government procurement is that the award of one contract can increase the likelihood of the award of future contracts because of the learning opportunity as well as infusion of capital.¹⁹⁴ The procedures contained in part 1806 instructs the agency to consider this,¹⁹⁵ and ensure that there will be multiple options in the market for NASA to choose from.

190. *Id.*

191. NASA FAR SUPPLEMENT, *supra* note 189, at § 1806.

192. *Id.*

193. *Id.*

194. *See* Hampson, *supra* note 180, at 30.

195. NASA FAR SUPPLEMENT, *supra* note 189, at § 1806.

In addition to the section specifically on competition, FAR imposes a requirement to report when competition is being harmed.¹⁹⁶ Section 1803.303 outlines procedures for reporting suspected violations of the antitrust laws to the U.S. Attorney General and NASA itself.¹⁹⁷ If a NASA procurement officer receives a bid that leads her to believe that the offer was a result of collusion, the officer must report the suspected violation to NASA's General Counsel.¹⁹⁸ If the General Counsel agrees that a violation may have occurred, she must submit a report to the Attorney General.¹⁹⁹

Part 1806 also contains exceptions where NASA may prioritize other values over competition in awarding contracts.²⁰⁰ Subpart 1806.3 carves out exceptions where international agreements or the public interest may take precedence over competitive values.²⁰¹ This provision demonstrates the tension between competitive values and current national policy.

The DoD has similar requirements in their supplement to FAR requirements.²⁰² Despite this, DoD sanctioned the joint venture between Lockheed and Boeing, to form the ULA and provide DoD with launch, in the name of reliability.²⁰³ In that case the provision of space launches to the military was allowed to go down to one entity, a government sanctioned monopoly for this service. To contrast a competitive procurement practice to a sanctioned monopoly: NASA now has two to three companies' commercial launch vehicles to choose from when awarding contracts,²⁰⁴ whereas, until SpaceX's launch in 2017, DoD was dependent on the ULA facing criticism and high costs.²⁰⁵

While the competition requirements of the FAR regulations provide important opportunities for facilitating the development of the commercial sector, the countervailing policies in these regulations allow competition to be subordinated to concerns about national security or the public interest. While national security, must continue to play a vital role in all space undertakings, a complete understanding of competition takes into account the role that competition itself has to play in facilitating these other policies. Therefore, any decision to preference another policy over competition, should be carefully weighed. FAR regulations should

196. *Id.* § 1803.303.

197. *Id.*

198. *Id.* § 1803.303(b)(ii).

199. *Id.*

200. *Id.* § 1806.3.

201. *Id.*

202. DOD FAR SUPPLEMENT, *supra* note 189, at §§ 203, 206; *see also* MARK A. LORELL ET AL., GOING GLOBAL?: U.S. GOVERNMENT POLICY AND THE DEFENSE AEROSPACE INDUSTRY 86 (2003).

203. *See* discussion *supra* Part I.B.

204. ZIMMERMAN, *supra* note 178, at 15.

205. *See* Berger, *supra* note 56.

be drafted to ensure that any exceptions to the competition requirements are construed narrowly.

B. Policy Recommendations to Foster Competition

As the commercial sector of the space industry continues to grow, competition is lauded as playing a positive role in its development. However, recommendations for ensuring competition in the future are absent. Having recognized the value of competition for this sector, we should continue to foster it. Outlined below are suggestions for instating a competition policy for the space industry.

1. Competition as a Goal

The first and most aspirational of these policy recommendations is to recognize the inherent value of competition as an industry goal and to shape policy accordingly.²⁰⁶ National space policy is shaped by various goals like ensuring national security and safety, and fostering economic growth. As the language of the FTC's ruling in the ULA case makes clear,²⁰⁷ if competition in the space industry is not seen as having inherent value in and of itself, these competing claims will win out to the detriment of the space industry as a whole. This will require a change of mindset that takes in the broader context of space, and recognizes that competition for military and civilian contracts, and well as in the purely commercial sector, can have benefits across the industry as a whole.²⁰⁸

In 2010 President Obama issued a National Space Policy Directive ("the Policy") to establish and guide all governmental activities with relation to space.²⁰⁹ The Policy contains five overarching principles.²¹⁰ The second principle addresses the commercial space sector:

A robust and competitive commercial space sector is vital to continued progress in space. The United States is committed to encouraging and facilitating the growth of a U.S. commercial space sector that supports U.S. needs, is globally competitive, and advances U.S. leadership in the generation of new markets and innovation-driven entrepreneurship.²¹¹

206. See TODD HARRISON ET AL., IMPLICATIONS OF ULTRA-LOW-COST ACCESS TO SPACE 26–27 (2017), https://csis-prod.s3.amazonaws.com/s3fs-public/publication/170316_Harrison_UltraLowCostAccess_Web.pdf [<https://perma.cc/N7DM-LNJQ>].

207. FTC Press Release on ULA, *supra* note 40.

208. See MACDONALD, *supra* note 120, at 3, 7–8.

209. See EXEC. OFFICE OF THE PRESIDENT, NATIONAL SPACE POLICY OF THE UNITED STATES OF AMERICA (June 28, 2010), https://obamawhitehouse.archives.gov/sites/default/files/national_space_policy_6-28-10.pdf [<https://perma.cc/73KX-FHV4>].

210. See *id.* at 3.

211. *Id.*

This kind of aspirational message acknowledging the importance of competition for the commercial space sector to prosper is the kind of message that needs to continue to be a core part of our discussions of space policy. The recommendation can be even more explicit than the one above, where competitiveness could be read to pertain only to competition the global stage, rather than the competition of commercial players with each other.²¹² As the current Presidential administration considers the development of their national space policy, and various regulator, and agencies grapple with the burgeoning NewSpace race, they should ensure that competition remains a central ideal of their policies.

2. Merger Review

Merger review is an important legal area where civilian and military agencies can play a role in fostering competition in the industry.²¹³ The Federal Trade Commission (FTC) and Department of Justice (DOJ) in the course of merger review should seek comment from NASA and DoD on mergers that have the potential to decrease competition in services they purchase. These agencies should encourage the FTC or DOJ not to approve mergers that harm competition. A recent whitepaper on national space policy from the Aerospace Corporation's Center for Space Policy and Strategy noted that "future consolidation or contraction of domestic industry could put the U.S. government back into a monopoly provider situation, increasing risks. . . ."²¹⁴ A merger policy informed by the heightened risks of consolidation in the space industry can stop this kind of consolidation *ex ante*, preventing harmful industry concentration from taking hold.

An example of the kind of merger that regulators should take a hard look at is the pending merge between space launch company Orbital ATK and Northrop Grumman, a security and aerospace firm. At the end of November 2017, Orbital ATK's shareholders voted to approve a merger with Northrop Grumman.²¹⁵ Orbital ATK has expanded its aircraft, defense, and rocket component business to enter the commercial launch service sector and now offers "small- and medium-class space launch vehicles for civil,

212. Although one goal of the Policy is to "[e]nergize competitive domestic industries to participate in global markets and advance the development of: satellite manufacturing; satellite-based services; space launch; terrestrial applications; and increased entrepreneurship," competition policy could still be more explicitly embraced. *See id.* at 4.

213. HARRISON ET AL., *supra* note 206, at 26–27.

214. VEDDA & HAYS, *supra* note 176, at 12.

215. Jeff Clabaugh, *Orbital ATK Shareholders Approve \$9B Northrop Grumman Merger*, WTOP (Nov. 29, 2017, 1:22 PM), <https://wtop.com/business-finance/2017/11/orbital-atk-shareholders-approve-9b-northrop-grumman-merger/> [<https://perma.cc/D4HN-8YR9>].

military, and commercial missions.”²¹⁶ Northrop Grumman is an aerospace and defense contractor.²¹⁷

Industry analysts speculate that the proposed merger would create a “more vertically integrated company [that] would leave the military with fewer choices in certain sectors of the market.”²¹⁸ Analysts are unsure what regulators in the Trump administration would make of the merge.²¹⁹ In December of 2017 the FTC issued a second request for information in the merger review process, a sign that the agency is undertaking an extensive review of the competitive issues.²²⁰ As of March of 2018, the FTC in consultation with the DoD is still in the process of reviewing the merger.²²¹

Regulators have an important role to play in preventing undesirable industry consolidation while permitting mergers that are not anticompetitive to come to fruition. Should the FTC find that the proposed consolidation of these two companies would harm competition in the growing space industry, a consent decree should not be entered allowing the merger to proceed and the merger should not be approved. Instead the agency should deny the transaction completely, the better to allow innovation and competition on the merits.

3. Competition Policy at the Agency Level

Finally, any regulatory reform of the commercial space sector should include the institution of a competition policy at the agency level. Agency polices can either promote competition or protect powerful cartels as was the case at the FAA before economic deregulation in the 1970s.²²² Agencies can play a role in overseeing mergers in the industry as well as monitoring the health of

216. *Innovation Systems - Sector Divisions*, NORTHROP GRUMMAN, <http://www.northropgrumman.com/AboutUs/BusinessSectors/InnovationSystems/Pages/Innovation-Systems-Sector-Divisions.aspx> [https://perma.cc/NQJ5-2WXN].

217. *See Aerospace Systems*, NORTHROP GRUMMAN, <http://www.northropgrumman.com/AboutUs/BusinessSectors/AerospaceSystems/Pages/default.aspx> [https://perma.cc/C9QS-D2TL].

218. Sandra Erwin, *Analysts See Red Flags in Northrop’s Acquisition of Orbital ATK*, SPACENEWS (Sept. 18, 2017), <http://spacenews.com/analysts-see-red-flags-in-northrops-acquisition-of-orbital/> [https://perma.cc/F33M-Z5D5].

219. *See id.*

220. Jeff Clabaugh, *Federal Regulators Want More Information About Northrop Grumman, Orbital ATK Merger*, WTOP (Dec. 7, 2018, 10:52 AM), <https://wtop.com/business-finance/2017/12/ftc-wants-information-northrop-grumman-orbital-merger/> [https://perma.cc/3U5Q-9MYX].

221. Sandra Erwin, *Northrop Grumman Moves Ahead with New ICBM Design, Impact of Orbital Merger Still Unclear*, SPACENEWS (Feb. 27, 2018), <http://spacenews.com/northrop-grumman-moves-ahead-with-new-icbm-design-impact-of-orbital-merger-still-unclear/> [https://perma.cc/GT3Q-4JRW] (last updated Mar. 1, 2018).

222. MICHAEL WISE, BACKGROUND REPORT ON THE ROLE OF COMPETITION POLICY IN REGULATORY REFORM 23 (1998), <https://www.ftc.gov/sites/default/files/attachments/us-submissions-oecd-and-other-international-competition-fora/US%201999%20Peer%20Review.pdf> [https://perma.cc/25X6-F9JL].

competition in the sector.²²³ By enshrining the value of competition in the agency responsible for overseeing commercial space, we affirm the value of competition in the space industry as well as aspire to thoughtful pro-competitive agency policies.

As discussions emerge around the revision of the regulatory structures responsible for overseeing commercial space flight, the extent to which the regulator can ensure the competitiveness of the industry should be considered. If the National Space Council's proposal to consolidate space commerce responsibilities, not including launch and reentry, in the Office of the Secretary of Commerce is adopted²²⁴ there are opportunities to make thoughtful pro-competitive choices in establishing these regulatory revisions.

The Space Council's second recommendation includes a sub-recommendation to create an Under Secretary of Space Commerce "responsible for all commercial space regulatory functions."²²⁵ If the position of Under Secretary of Space Commerce is established, that official should promptly adopt a regulatory mandate to ensure the continued effective competitiveness of the commercial space industry. As regulatory processes are streamlined, administrative entities should work to ensure that competition is encouraged to flourish throughout the space industry.

CONCLUSION

Elon Musk has said he wants to put humans on Mars by 2024.²²⁶ Blue Origin says it will send the space tourists to the edge of the atmosphere in 2019.²²⁷ If these entrepreneurs—who have already achieved so much—can aspire to such great heights, surely we can aspire to create a competitive market structure to facilitate their reach for the stars.

²²³. See *id.* at 12–13.

²²⁴. See White House Press Release, *supra* note 175.

²²⁵. *Id.*

²²⁶. Nadia Drake, *Elon Musk: In Seven Years, SpaceX Could Land Humans on Mars*, NAT'L GEOGRAPHIC (Sept. 29, 2017), <https://news.nationalgeographic.com/2017/09/elon-musk-spacex-mars-moon-bfr-rockets-space-science/> [<https://perma.cc/DP9E-56RL>].

²²⁷. See Wattles, *supra* note 113.