

**Before the  
FEDERAL COMMUNICATIONS COMMISSION  
Washington, DC 20554**

In the Matter of	)	
	)	
Allocation of Spectrum for Non-Federal Space Launch Operations	)	ET Docket No. 13-115
	)	
Amendment of Part 2 of the Commission’s Rules for Federal Earth Stations Communicating with Non-Federal Fixed Satellite Service Space Stations	)	RM -- 11341
	)	

**REPLY COMMENTS OF TECHFREEDOM**

TechFreedom hereby files these Reply Comments in the above-referenced proceeding in response to the Commission’s Further Notice of Proposed Rulemaking (FNRPM).<sup>1</sup> In these Reply Comments, we address the key issues facing the commercial space sector.

**1. About TechFreedom**

TechFreedom is a non-profit think tank dedicated to promoting the progress of technology that improves the human condition. We seek to advance public policy that makes experimentation, entrepreneurship, and investment possible, and thus unleashes the ultimate resource: human ingenuity. TechFreedom and undersigned counsel have a long history advocating for innovative uses of outer space.<sup>2</sup>

---

<sup>1</sup> See *Allocation of Spectrum for Non-Federal Space Launch Operations*, ET Docket No. 13-115, Report and Order and Further Notice of Proposed Rulemaking, FCC 21-44 (Apr. 22, 2021) [hereinafter “*Non-Federal Launch Report and Order*”]. By Order, DA 21-788 (July 7, 2021), the Commission extended the comment date until August 11, 2021, and the reply comment date until September 10, 2021. These reply comments are timely filed.

<sup>2</sup> See, e.g., *Reopening the American Frontier: Exploring How the Outer Space Treaty Will Impact American Commerce and Settlement in Space: Before the Senate Committee on Commerce, Science, & Transportation Subcommittee on Space, Science, and Competitiveness, 115th Cong. (2017)* (written testimony of James E. Dunstan & Berin Szoka), available at

## 2. A Maturing U.S. Launch Industry Needs a Mature Licensing Regime

This proceeding began eight years ago, in 2013, with the adoption of a Notice of Proposed Rulemaking in the above-captioned proceeding.<sup>3</sup> In the intervening eight years, what we have witnessed is nothing short of a revolution in space launches, and with it, the recapturing of a dominant position by U.S. launch providers in a market that for several decades slowly had migrated to foreign launch providers because of misguided federal policies.<sup>4</sup> In 2013, when this proceeding began, the Federal Aviation Agency (FAA) licensed only eight commercial launches.<sup>5</sup> In 2020, the FAA licensed 39 launches, and as of the writing of these reply comments, there have been 41 launches to date for 2021, many of these carrying

---

<https://www.commerce.senate.gov/services/files/A9AD88B2-9636-4291-A5B0-38BC0FF6DA90>, video of hearing available at <https://www.commerce.senate.gov/2017/5/reopening-the-american-frontierexploringhow-the-outer-space-treaty-will-impact-american-commerce-and-settlement-in-space>; *Artemis Accords: One Small Step for NASA, Not So Giant a Leap for Space Law*, TechFreedom (May 15, 2020), <https://techfreedom.org/artemis-accords-one-small-step-for-nasa-not-so-giant-a-leap-for-space-law/>; *Revived National Space Council Could Mean Space Policy Rethink*, TechFreedom (July 7, 2017), <https://techfreedom.org/revivednational-spacecouncil-mean-space-policy-rethink/>.

<sup>3</sup> *Amendment of Part 2 of the Commission's Rules for Federal Earth Stations Communicating with Non-Federal Fixed Satellite Service Space Stations*, ET Docket No. 13-115, Notice of Proposed Rulemaking and Notice of Inquiry, 28 FCC Rcd 6698 (2013) [hereinafter Space NPRM].

<sup>4</sup> See G. Abbey and N. Lane, "United States Space Policy: Challenges and Opportunities Gone Astray", American Academy of Arts and Sciences, 2009, available at <https://www.amacad.org/sites/default/files/publication/downloads/spaceUS.pdf> (discussing the 2005 amendments to the International Traffic in Arms Regulation (ITAR) severely limiting the ability of U.S. to exchange data on space technologies which severely curtailed U.S. exports of satellites as well as limiting the ability of U.S.-based launch providers to carry foreign satellites to space). Fortunately, this policy was changed in 2014 to move most satellite technologies off of the munitions list and back to the Export Administration Regulations. See Amendment to the International Traffic in Arms Regulations: Revision of U.S. Munitions List Category XV, 79 Fed. Reg. 27, 180 (May 13, 2014) (interim final rule); Revisions to the Export Administration Regulations (EAR): Control of Spacecraft Systems and Related Items the President Determines No Longer Warrant Control Under the United States Munitions List (USML), 79 Fed. Reg. 27, 417 (May 13, 2014) (interim final rule with request for comments).

<sup>5</sup> See *Commercial Space Data: Licensed Launches*, FEDERAL AVIATION ADMINISTRATION (Apr. 21, 2021), [https://www.faa.gov/data\\_research/commercial\\_space\\_data/](https://www.faa.gov/data_research/commercial_space_data/) (last modified Apr. 21, 2021, 10:53 AM).

multiple payloads to space. The cadence of commercial launches has increased drastically since 2013 and, barring a major accident or the adoption of bad federal policies, that pace will continue to rise. These launches are occurring not only from federal ranges, such as the

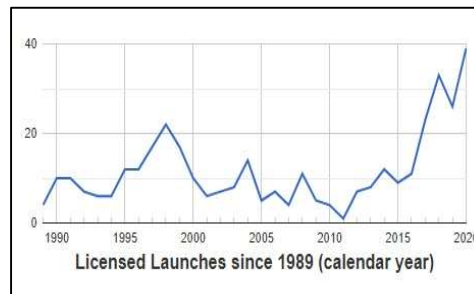


Figure 1 Source: FAA

Kennedy Space Center and Vandenburg AFB, but from FAA-licensed spaceports such as Spaceport America and the Mid-Atlantic Regional Spaceport (MARS), and even from private launch complexes owned and operated by companies such as SpaceX and Blue Origin.

The increased pace of launches has helped fuel a concomitant rapid decrease in the cost of launching objects into space, as predicted by the Air University 2017 “Fast Space” study.<sup>6</sup> This, in turn, has jumpstarted entirely new businesses in space, everything from cubesats conducting commercial remote sensing operations,<sup>7</sup> to satellite servicing,<sup>8</sup> to suborbital<sup>9</sup> and orbital “space tourism.”<sup>10</sup> The Space Foundation recently calculated the world space economy

---

<sup>6</sup> Maxwell AFB, AL, “Fast Space: Levering Ultra Low-Cost Access for 21<sup>st</sup> Century Challenges,” Air University (Jan. 13, 2017), available at: [https://www.airuniversity.af.edu/Portals/10/Research/Space-Horizons/documents/Fast%20Space\\_Public\\_2017.pdf](https://www.airuniversity.af.edu/Portals/10/Research/Space-Horizons/documents/Fast%20Space_Public_2017.pdf).

<sup>7</sup> See Stephen G. Anderson, *CubeSats: the Smallest Big Thing in Remote Sensing Sciences*, INTERNATIONAL SOCIETY FOR OPTICS AND PHOTONICS (July 1, 2019), available at <https://spie.org/news/spie-professional-magazine-archive/2019-july/cubesats?SSO=1>; Anderson, *CubeSats: the Smallest Big Thing in Remote Sensing Sciences*, INTERNATIONAL SOCIETY FOR OPTICS AND PHOTONICS (July 1, 2019), available at <https://spie.org/news/spie-professional-magazine-archive/2019-july/cubesats?SSO=1>.

<sup>8</sup> See Mandy Mayfield, *Industry Offering On-Orbit Satellite Servicing*, NATIONAL DEFENSE (Jan. 29, 2021), available at <https://www.nationaldefensemagazine.org/articles/2021/1/29/industry-offering-on-orbit-satellite-servicing>.

<sup>9</sup> See Jeff Foust, *Will suborbital space tourism take a suborbital trajectory?*, SPACENEWS (Aug. 17, 2021), available at <https://spacenews.com/will-suborbital-space-tourism-take-a-suborbital-trajectory/>.

<sup>10</sup> The “Inspiration4” commercial crew is set to launch to orbit on September 15, 2021. See Amy Thompson, *SpaceX’s private Inspiration4 mission is ‘go’ for launch on Sept. 15*, SPACE.COM (Sept. 3, 2021),

at \$447 billion, up 55 percent over the past decade.<sup>11</sup> This impact can be seen everywhere, from the thousands of new jobs created by the “NewSpace” industry,<sup>12</sup> to machinists now taking special courses in aerospace fabrication techniques required by the space economy.<sup>13</sup>

The FCC is faced with a communications landscape in space similar to the terrestrial landscape just after World War II, when surplus communications and radar gear migrated into the commercial market, and commercial frequency allocations were necessary to bring the “swords into plowshares” benefits of these war-created technologies to the public at large.<sup>14</sup> Unlike during that period, however, where the FCC merely had to expand its Part 2 Table of Allocations to include higher frequencies, today the FCC can’t just “manufacture” new spectrum, but must instead carefully balance the need for commercial space spectrum and

---

<https://www.space.com/spacex-inspiration4-flight-readiness-review>. Russia is reportedly racing to film the first movie in space, ahead of a proposed project involving Tom Cruise. See Matthew Bodner, *Russia, racing to beat Tom Cruise and NASA to first movie shot in space, picks its cast*, NBC NEWS (May 14, 2021, 11:51 AM), available at <https://www.nbcnews.com/science/space/russia-racing-beat-tom-cruise-nasa-first-movie-shot-space-n1267341>.

<sup>11</sup> See Space Foundation, *Global Space Economy Rose to \$447B in 2020, Continuing Five-Year Growth*, SPACE REF (July 15, 2021), available at <http://spaceref.com/news/viewpr.html?pid=57786>. Much of that growth has come from the commercial sector, with government spending falling 1.2% in 2020.

<sup>12</sup> The origin of the term “NewSpace” is a mystery to all but the few who have toiled in the field of space advocacy over the past few decades. In short, it is rooted in the mantra that “space is a place, not a program,” and that the future of space development will not be anchored by large government “top down” programs, but the blooming of thousands of space businesses in a “bottom up” ecosystem where the best ideas and implementations are rewarded, while those that don’t work, or can’t attract business capital, are destined to fail. For a good explanation of “NewSpace,” see Gourav, *Let’s talk about NewSpace*, SATSEARCH (June 28, 2021), <https://blog.satsearch.co/2019-02-26-lets-talk-about-newspace>.

<sup>13</sup> See TITANS OF CNC AEROSPACE ACADEMY, <https://aerospaceacademy.com> (last visited Sept. 8, 2021) (offering online programs in CAD/CAM/CNC, automation, and additive manufacturing for aerospace uses).

<sup>14</sup> See, generally, Andrew G. Haley, *International Cooperation in Rocketry and Astronautics*, 25 J. of Jet Propulsion 627, 632 (Nov. 1955) (discussion of the needs for the ITU and the FCC to allocate higher frequencies bands. For example, it was not until 1947 that the ITU’s table of allocations went above 200 MHz).

licensing against both federal users as well as other terrestrial users, ever-hungry for additional spectrum for 5G and other uses.<sup>15</sup>

During the pendency of this proceeding, commercial launch companies were required to seek Special Temporary Authority (STA) for their launch operations. As launch dates changed (a common occurrence because of weather or technical difficulties), these STAs often had to be refiled or amended. The FCC's first Report and Order in this proceeding was a vital first step in updating the FCC's approach to commercial space launch.<sup>16</sup> A quickly maturing commercial launch industry needs assured access to frequencies and firm processing rules and timelines. TechFreedom supports the efforts of the Commission in this regard and supports virtually all of the proposals set forth in the FNPRM.

### **3. The FCC Must Protect the Current Space Allocations and Look to Allocate More Spectrum, Where Possible, for Space Uses**

The current National Space Policy reflects the push to encourage commercial space efforts.<sup>17</sup> The Department of Commerce's National Oceanic and Atmospheric Administration (NOAA) has had a similar commercial space policy for more than five years.<sup>18</sup>

---

<sup>15</sup> See, *infra* Section 3 for a discussion of the critical need for the FCC to protect space spectrum against encroachment by terrestrial users. We are also cognizant of the vital role the FCC plays in protecting the space environment from orbital debris and support the FCC's review of all license applications to ensure compliance with its orbital debris mitigation rules set forth in 47 CFR § 25.114(d)(14). For a fuller discussion of the orbital debris problem, see James E. Dunstan, "*Space Trash: Lessons Learned (and Ignored) from Space Law and Government*," 39 J. OF SPACE L. 23 (2013).

<sup>16</sup> *Non-Federal Launch Report and Order*, *supra* note 1 (allocating the 2200-2290 MHz band for space operations on a secondary basis and permitting non-federal use in specific portions of this band for purposes of space launch operations to help meet the increasing demands for space exploration and development).

<sup>17</sup> National Space Policy of the United States of America, Dec. 9, 2020, available at <https://trumpwhitehouse.archives.gov/wp-content/uploads/2020/12/National-Space-Policy.pdf>.

<sup>18</sup> See NAO 217-109: NOAA Commercial Space Policy, Issued Jan. 8, 2016, available at <https://www.noaa.gov/organization/administration/nao-217-109-noaa-commercial-space-policy> ("Rapid change in the commercial space services arena over the past several years is now yielding new

A robust, innovative, and competitive commercial space sector is the source of continued progress and sustained United States leadership in space. The United States remains committed to encouraging and facilitating the continued growth of a domestic commercial space sector that is globally competitive, supports national interests, and advances United States leadership in the generation of new markets and innovation-driven entrepreneurship.<sup>19</sup>

The Department of Commerce’s National Oceanic and Atmospheric Administration (NOAA) has had a similar commercial space policy for more than five years.<sup>20</sup> If the rise of commercial space, and specifically “NewSpace” tells us anything, it is that as commercial space operations (not just launches) expand, the need for spectrum will also increase. This is contrary, in many ways, to the government’s approach to space frequencies over the past several decades, where terrestrial demands for spectrum have often led the FCC to reallocate spectrum *away* from space uses to feed the terrestrial beast.<sup>21</sup> The trend continues today,

---

technical and business approaches not only to building, launching, and operating satellites but also to selling private satellite capabilities as services. NOAA is interested in exploring these new business models to understand how they might complement the current public and international data supply arrangements. The changing landscape is ripe with new opportunities and NOAA looks forward to learning more alongside the commercial sector in a policy process that will iterate along with the dynamic landscape. This document lays out the guidelines and policies by which NOAA will engage with these new prospects, most significantly that we must manage change in ways that ensure there is no degradation of weather and warning services to the Nation.”).

<sup>19</sup> *Id.* at 3.

<sup>20</sup> See NAO 217-109: NOAA Commercial Space Policy, Issued January 8, 2016, available at <https://www.noaa.gov/organization/administration/nao-217-109-noaa-commercial-space-policy> (“Rapid change in the commercial space services arena over the past several years is now yielding new technical and business approaches not only to building, launching, and operating satellites but also to selling private satellite capabilities as services. NOAA is interested in exploring these new business models to understand how they might complement the current public and international data supply arrangements. The changing landscape is ripe with new opportunities and NOAA looks forward to learning more alongside the commercial sector in a policy process that will iterate along with the dynamic landscape. This document lays out the guidelines and policies by which NOAA will engage with these new prospects, most significantly that we must manage change in ways that ensure there is no degradation of weather and warning services to the Nation.”).

<sup>21</sup> See James E. Dunstan, “Earth to Space: I can’t Hear You – Selling Off Our Future to the Highest Bidder,” Space Manufacturing 11, *The Challenge of Space: Past & Future*, Proceedings of the Thirteenth SSI/Princeton Conference on Space Manufacturing, 1997, at 247-253; reprint available at

evidenced by the attempt of some parties to reallocate the 12 GHz band for terrestrial mobile uses.<sup>22</sup> TechFreedom has demonstrated why this particular reallocation represents bad policy, and how hamstringing the American satellite industry with such a reallocation may well drive American businesses overseas to seek a more conducive regulatory environment, at precisely the same moment where the American commercial launch industry is recapturing a dominant position in the world launch market after the multi-decade long ITAR debacle.<sup>23</sup> A failure to protect vital spectrum for space operations, we risk ceding all of outer space to our adversaries, especially China.<sup>24</sup>

Similar care must be taken more generally with the FCC's approach to space frequencies. Efforts by terrestrial users to take away frequencies must be thwarted and efforts by entrenched federal users to keep space frequencies for themselves, including a failure to coordinate commercial usage in good faith, will slow or stall the continued rapid growth of the U.S. commercial space sector. Commercial space companies must contend with a federal government that viciously guards the frequencies it uses from expanded commercial uses."<sup>25</sup>

---

<https://techfreedom.org/wp-content/uploads/2020/10/SSI-1997-Earth-to-Space-I-cant-Hear-You.pdf>.

<sup>22</sup> See *Expanding Flexible Use of the 12.2-12.7 GHz Band*, WT Docket No. 20-443, Notice of Proposed Rulemaking, 36 FCC Rcd 606 (2021).

<sup>23</sup> See Comments of TechFreedom in Docket 20-443, filed May 7, 2021, available at <http://techfreedom.org/wp-content/uploads/2021/05/TF-Comments-12-GHz-NPRM-4-7-21.pdf>.

<sup>24</sup> See Reply Comments of TechFreedom in Docket 20-443, filed July 7, 2021, available at <https://techfreedom.org/wp-content/uploads/2021/07/TechFreedom-Reply-Comments-7-7-21.pdf>.

<sup>25</sup> NTIA's comments are a prime example of the government's parochial approach to frequency management. As noted above, while the commercial space sector has been booming, government spending on space has been on a steady decline over the past decade, with much of that spending going into huge programs such as the Space Launch System on which we've already spent over \$20 billion and the James Webb Space Telescope on which we've spent nearly \$10 billion all with minimal frequency use. See Eric Berger, *NASA has begun a study of the SLS rocket's affordability*, ARSTECHNICA (Mar. 15, 2021, 6:27 PM), available at <https://arstechnica.com/science/2021/03/nasa-has-begun-a->



NTIA’s “let them eat cake” response is predictable, NTIA “urge[s] the Commission and non-federal users to focus on identifying alternatives to these federal bands. NTIA is prepared to assist with that effort.”<sup>26</sup> So long as federal users throw up obstructions to working with commercial space companies, the United States risks giving up its current huge lead in commercial space to other jurisdictions willing to do the “hard” work of coordinating federal and commercial users.<sup>27</sup>

#### **4. Spectrum Allocations Must Be Made for In-Space Operations**

As non-communications space businesses begin in earnest, there will be a desperate need for frequencies for orbital operations. The FNPRM addresses this, and TechFreedom fully supports the Commission’s efforts to address these needs.<sup>28</sup> Several commenters discuss this issue and the need for spectrum and efficient licensing regimes.<sup>29</sup>

---

study-of-the-sls-rockets-affordability/; U.S. Gov’t Accountability Off., James Webb Space Telescope: Project Nearing Completion, but Work to Resolve Challenges Continues, GAO-21-406 (May 13, 2021), available at <https://www.gao.gov/products/gao-21-406>. Yet NTIA is steadfast that the spectrum currently allocated for federal uses must continue, with commercial users left with small scraps of spectrum. Comments of the National Telecommunications and Information Administration (NTIA) in Docket 13-115, filed Sept. 1, 2021 (“Expectations to accommodate new non-federal use of federal launch spectrum must be tempered by recognition of the critical and growing uses of that spectrum by federal agencies in bands that are already congested, such that non-federal users should be encouraged to develop alternatives, particularly for in-orbit and payload communications.”).

<sup>26</sup> NTIA Comments at 5.

<sup>27</sup> *See id.* at 3 (commercial user “accommodation to date, however, does not mean that coordination has been easy for any of the parties, federal or non-federal, or that it can be expected to get easier as demand increases.”).

<sup>28</sup> FNPRM, ¶¶ 139-144.

<sup>29</sup> There is consensus among commercial launch providers that the licensing framework for launch frequencies must be transparent, streamlined, and efficient. *See* Comments of Axiom Space, Inc. in Docket 13-115, filed Aug. 12, 2021; Comments of Relativity Space, Inc. in Docket 13-115, filed Aug. 11, 2021; Comments of Space Exploration Technologies Corp. in Docket 13-115, filed Aug. 11, 2021. Multiple commentors urge the FCC to treat space vehicles the same, regardless of the specific stage of the mission, largely because commercial launch providers do not use the same stage classification, and some providers’ stages are bundled into one launch stage. *See* Comments of Rocket Lab USA, Inc. in Docket 13-115, filed Aug. 11, 2021; Comments of Spaceflight, Inc. in Docket 13-115, filed Aug. 11,



Similarly, the FCC should adopt frequency allocations for launch vehicle to payload communications.<sup>30</sup> With the advent of larger launch vehicles,<sup>31</sup> combined with smaller and more sophisticated payloads, we will soon see the possibility of deploying hundreds of satellites from a single launch vehicle.<sup>32</sup> Spectrum is needed to allow the launch vehicles to communicate with the deployment mechanism(s), and then with the payloads to assure a safe deployment into their intended orbits, some of which may involve precise “formation flying.”<sup>33</sup> Since many of these needs are for rendezvous and proximity operations (RPO), the relative power needed is sufficiently small to allow for the reuse of frequencies over a number of orbits.

## **5. The FCC Should Consolidate Space Frequencies in a New Part of Chapter 47**

A fully mature allocation and licensing system calls for the placement of the “space rules” in its own part within the FCC’s rules. TechFreedom therefore supports those

---

2021; Joint Comments of Astroscale U.S. Inc., Axiom Space Inc., Atomos Space, Sierra Space Corp., and Scout Inc. in Docket 13-115, filed Aug. 11, 2021.

<sup>30</sup> FNPRM ¶ 145.

<sup>31</sup> SpaceX claims its Starship will have the capability to launch over 100 metric tons to LEO. *See* FLIGHT TEST STARSHIP SN15, SPACEX, <https://www.spacex.com/vehicles/starship/> (last visited Sept. 8, 2021). Blue Origin’s New Glenn vehicle is designed to launch 45 metric tons to LEO and 13 metric tons to geostationary transfer orbit (GTO). *See* NEW GLENN, BLUE ORIGIN, <https://www.blueorigin.com/new-glenn#:~:text=New%20Glenn%2C%20our%20orbital%20launch,tons%20to%20low%20Earth%20orbit> (last visited Sept. 8, 2021).

<sup>32</sup> Spaceflight’s Sherpa deployment system, for example, can deploy multiple smaller satellites. *See* Comments of Spaceflight; *see also* Glenn Farley, *Spaceflight Inc.* in Kent Valley preparing to launch satellites into orbit aboard SpaceX mission, KING-TV (May 27, 2021, 4:20 PM) (Spaceflight set to deploy satellites for 36 customers from a SpaceX rocket), <https://www.king5.com/article/tech/science/kents-spaceflight-inc-preparing-to-launch-satellites-into-orbit-aboard-spacex-mission/281-297ae07c-c08c-4b2d-bc8c-72b678059fd2>. SpaceX’s “Transporter 2” mission, launched June 30, 2021, included 88 satellites that were separately deployed. *See* Jeff Foust, *SpaceX launches second dedicated rideshare mission*, SPACENEWS (June 30, 2021), <https://spacenews.com/spacex-launches-second-dedicated-rideshare-mission/>.

<sup>33</sup> *See, e.g.,* Soon-Jo Chung, et al., *Review of Formation Flying and Constellation Missions Using Nanosatellites*, 53 *Journal of Spacecraft and Rockets* 567 (2016).

commentors who argue that the FCC should consolidate its rules into a new “Part 26” or equivalent.<sup>34</sup> Having space spectrum uses consolidated under a single part will ease coordination and spectrum choices by new entrants.

As suggested by SpaceX,<sup>35</sup> using the broad term “spacecraft” as the focal point of the regulation is both consistent with existing definitions withing Part 2, but also allows the types of definitional flexibility necessary to properly regulate the types of activities discussed above, involving multiple payloads being deployed from a single launch vehicle, the “mission” not complete until all of the spacecraft are delivered to their proper orbits.

### CONCLUSION

This proceeding represents a true watershed in the role of the FCC in the future of space commerce. As it did after World War II, the FCC is faced with the opportunity to create a regulatory environment that advances this nation’s interests in space in a safe, efficient, and business friendly way. Get it right, and America will maintain its prominent position in space enterprise for the next century. Get it wrong, and the U.S. will see the slow inevitable bleed off of companies and technologies to other countries, more visionary than the United States. The stakes are that high.

Respectfully submitted,

\_\_\_\_\_/s/\_\_\_\_\_  
James E. Dunstan  
General Counsel  
110 Maryland Ave., NE  
Suite 205  
Washington, DC 20002

Dated: September 10, 2021

---

<sup>34</sup> See FNPRM ¶¶ 62-65. See also Comments of SpaceX at 9-11; Comments of Rocket Lab USA at 2-3; Comments of Spaceflight, Inc. at 3; Joint Comments of Astroscale U.S. Inc. at 5-6.

<sup>35</sup> Comments of SpaceX at 10.