

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

In the Matter of)	
)	
Revising Spectrum Sharing Rules For)	IB Docket No. 21-456
Non-Geostationary Orbit, Fixed-Satellite)	
Service Systems)	
)	
Revision of Section 25.261 of the Commission's)	
Rules to Increase Certainty in Spectrum Sharing)	RM-11855
Obligations Among Non-Geostationary Orbit)	
Fixed-Satellite Service Systems)	

REPLY COMMENTS OF TECHFREEDOM

TechFreedom hereby files these Reply Comments in response to the Notice of Proposed Rulemaking (NPRM), released December 15, 2021.¹ The NPRM was issued to explore more efficient ways for Non-Geostationary Orbit (NGSO) satellite systems to share spectrum between licensees within the same processing round, and possibly between licensees in different processing rounds. TechFreedom submits:

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

¹ Revising Spectrum Sharing Rules for Non-Geostationary Orbit, Fixed-Satellite Service Systems, IB Docket No. 21-456 (Dec. 15, 2021) (“NPRM”). The NPRM was published in the Federal Register on January 24, 2022. 87 Fed. Reg. 3481 (January 24, 2022). The Federal Register Notice set the comment date as March 25, 2022 and reply comment date as April 25, 2022. These reply comments are timely filed.

ultimate resource: human ingenuity. TechFreedom and undersigned counsel have a long history advocating for innovative uses of outer space.²

2. Because of Scarce Space Spectrum and the Proliferation of Proposed Systems, The Commission Should Demand, and Reward, Innovation

There is no question but that we are in the midst of a satellite revolution. The unrealized dreams of Bill Gates and cellular telephone mogul Craig McCaw to create Teledesic in 1990 to bring the Internet to the planet³ have finally borne fruit. SpaceX's Starlink system is approaching 2,500 satellites in orbit, with continuing launches at roughly two-week intervals, transporting 60 satellites per launch.⁴ OneWeb has launched 394 satellites, almost 60 percent of its constellation.⁵ Amazon's Project Kuiper recently signed

² 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), <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-frontier-exploringhow-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-sogiant-a-leap-for-space-law/>; *Revived National Space Council Could Mean Space Policy Rethink*, TECHFREEDOM (July 7, 2017), <https://techfreedom.org/revived-national-spacecouncil-mean-space-policy-rethink/>; J. Dunstan, "Space Trash:" *Lessons Learned (and Ignored) from Space Law and Government*, 39 J. OF SPACE L. 23 (2013).

³ See Sharon Pian Chan, *The birth and demise of an idea: Teledesic's 'Internet in the sky'*, THE SEATTLE TIMES (Oct. 7, 2002), <https://archive.seattletimes.com/archive/?date=20021007&slug=teledesic070> ("the pairing was akin to Elvis and the pope on tour together. They were Seattle's most prominent business leaders, both having defied conventional wisdom in their industries to build billion-dollar companies. McCaw's fortune was freshly minted after he sold McCaw Cellular Communications to AT&T. Gates had his Microsoft empire."). Yet Teledesic failed because of the high cost of launch and high cost of building the satellites.

⁴ See *Launches*, SPACEX (2022), <https://www.spacex.com/launches/>.

⁵ See *OneWeb Confirms Successful Launch of 36 Satellites, After Rapid Year of Progress*, ONEWEB (Dec. 27, 2021), <https://oneweb.net/resources/oneweb-confirms-successful-launch-36-satellites-after-rapid-year-progress>.

contracts for up to 83 launches to deploy the bulk of its proposed 3,236 satellite constellation.⁶

Running in parallel with the breakneck speed of deployment of these systems is continued iteration and innovation of the satellites themselves. Not even in full operation, for example, Starlink is already deploying a third generation of satellites into its system,⁷ and is deploying upgraded ground segment dishes.⁸ And unlike traditional geostationary satellites, which often operate for multiple decades,⁹ NGSO satellites operate in much lower orbits, with each designed to operate for only five years before it is deorbited.¹⁰ As such, the FCC can expect, and indeed, can demand, that satellite operators continue to improve their systems to make more efficient use of spectrum. The *NPRM* addresses this issue, but only within the context of good faith coordination:

We also seek comment on how the Commission might encourage NGSO FSS operators to build and deploy systems capable of sharing beam-pointing data and enabling other methods of spectrum sharing through coordination. How could the Commission encourage the development and deployment of systems

⁶ See Loren Grush, *Amazon's Project Kuiper books up to 83 rockets to launch its internet-beaming satellites*, THE VERGE (Apr. 5, 2022), <https://www.theverge.com/2022/4/5/23010245/amazon-project-kuiper-megaconstellation-arianespace-ula-blue-origin>.

⁷ See Brian Wang, *Version 2 Starlink with Lasers and Gen 2 SpaceX Starlink Bigger and Faster*, NEXTBIGFUTURE (Sept. 27, 2021), <https://www.nextbigfuture.com/2021/09/version-2-starlink-with-lasers-and-gen-2-spacex-starlink-bigger-and-faster.html>.

⁸ See Michael Kan, *SpaceX Unveils Redesigned Second-Gen Starlink Dish*, PC MAGAZINE (Nov. 11, 2021), <https://www.pcmag.com/news/spacex-unveils-redesigned-second-gen-starlink-dish> (“The new dish also features a 3x3, MU-MIMO router, meaning it can simultaneously transmit data via three bandwidth streams to three devices without suffering network congestion. That’s an improvement over the 2x2, MU-MIMO router found in the original Starlink dish.”).

⁹ The undersigned author has been critical of the FCC for authorizing operations of GEOSATs beyond their design life. James E. Dunstan, *Do we care about orbital debris at all?*, SPACENEWS (Jan. 30, 2018), <https://spacenews.com/op-ed-do-we-care-about-orbital-debris-at-all/>.

¹⁰ See, e.g., Subspace Team, *SpaceX is Giving the Internet Lift with Starlink*, SUBSPACE (Jan. 5, 2022), <https://subspace.com/resources/spacex-is-giving-the-internet-lift-with-starlink> (“Starlink satellites have a five-year projected lifespan and the design of new satellites being launched is improved with each successive deployment.”).

that are more spectrally efficient? How might the Commission modify its NGSO sharing rules to incentivize flexible and efficient deployment?⁶

Chairwoman Rosenworcel and Commissioner Starks both directly called for the revised rules on spectrum sharing to emphasize innovation, and, by implication, spectrum efficiency:

Today, we are taking note of the significant increase in innovative low-Earth orbit satellite systems seeking to offer broadband with higher speeds and lower latencies. This is exciting! But the rush to develop these new space opportunities requires new rules that keep competition and innovation front of mind. Because despite the revolutionary activity in our skies, the regulatory frameworks we rely on to shape these efforts are dated. They were built for an era when heading to space was strictly for government superpowers. They did not imagine a world where space entrepreneurship and competition could take hold.¹¹

Chairwoman Rosenworcel's comments echo the findings the undersigned author contributed to in "Fast Space: Leveraging Ultra Low-Cost Space Access for 21st Century Challenges"¹²:

Regulatory systems – and some underlying laws – for space launch were not designed to support ULCATS and need to be redesigned: While public law for commercial space transportation has evolved beneficially over 3 decades, the regulations which implement it have not, and lag far behind technological and business developments. As such, the government organizations and processes that deal with launch providers are still largely aligned with launch being a high-cost, infrequent, risky, and very specialized activity. However, the law as well as regulations for customers of commercial space launch are much less progressive, and will restrict potential increases in demand that would reinforce improvements in space transportation supply.¹³

¹¹ *NPRM*, Statement of Chairwoman Rosenworcel at 18. *See also NPRM*, Statement of Commissioner Starks at 20 ("Commission policies must keep pace with these changes so we can encourage innovation while preserving a level playing field between incumbents and new entrants.").

¹² AIR UNIVERSITY, MAXWELL AFB, FAST SPACE: LEVERAGING ULTRA LOW-COST SPACE ACCESS FOR 21ST CENTURY CHALLENGERS (2017), https://www.airuniversity.af.edu/Portals/10/Research/Space-Horizons/documents/Fast%20Space_Public_2017.pdf (declassified version).

¹³ *Id.* at C-3-C-4.

In undertaking this rulemaking, therefore, the Commission should look to adopt rules that can create a forcing function on further innovation while at the same time requiring licensees to fully deploy their systems in order to qualify for interference protection.¹⁴ This should apply to both the space segment and ground segment components of the NGSO system.¹⁵ In no instance should the rules require later-round applicants to coordinate with or protect “paper” satellite systems.¹⁶ To fully reap the benefits of this satellite revolution, the FCC should not reward “moat building” by incumbents in any form.

¹⁴ See, e.g., Comments of SpaceX at 11 (“An approach more aligned with the objectives of this proceeding would be to reward operators that design their systems to best share the spectrum. Operators with more spectrally efficient systems would have first choice of spectrum, effectively allowing them to access more usable spectrum during in-line events.”).

¹⁵ See Remarks of Chairwoman Rosenworcel to Mobile World Congress on “New Frontier Partnerships” at 3 (Mar. 1, 2022) (“But going forward I think we also need a change in orientation. In the past, our discussions of spectrum efficiency have been a one-way effort. They have focused almost exclusively on transmitters. We’ve put a lot [of] rules in place about how and when transmitters can operate in order to control interference levels. But here’s the thing: Wireless communications only exists when transmitters are connected to receivers. Both are vital. Both matter. And going forward policymakers need to consider both transmitting and receiving. Not just the former at the expense of the latter. That’s because minimally performing receivers can make it more difficult to introduce new services in the same or nearby frequencies. They can diminish broader opportunities with radiofrequency and put constraints on what is possible in the new wireless world.”).

¹⁶ See NPRM ¶ 18 (“Requiring applicants to perform interference analyses for the potentially thousands of satellites authorized through previous processing rounds, many of which may never be launched, could also place undue burdens on new entrants, especially those with limited resources.”). See also Comments of Intelsat, p. 5 (“An ‘operational’ NGSO system needs to have merely one space station at its intended orbit that has initiated transmission and reception of radio signals (which appears to include telemetry, tracking, and command signals). Thus, providing interference protection rights as soon as an NGSO system becomes ‘operational’ (under this definition) could incentivize spectrum warehousing through the deployment of a de minimis number of space stations (relative to the grantee’s total number of authorized space stations). The Commission could avoid this outcome and incentivize the rapid deployment of NGSO services by setting a reasonable and objective standard for when a licensee receives interference protection rights.”).

3. The “Good Faith Coordination” Rules Should Include a Requirement to Share All Necessary Information, Including Beam Locations

Coordination between NGSO systems using the same frequencies is possible, but certainly not easy. From the comments filed in this proceeding, however, it is clear that this isn’t an engineering issue so much as a business and marketing issue: many operators and proposed operators don’t want to reveal the technical workings of their system for fear that other operators will gain a competitive advantage.¹⁷ Lawyers and policy makers should adopt rules that get the engineers the data they need while protecting the confidential business interests of all parties. As proposed in the *NPRM*, the rules could require the use of protective orders¹⁸ or non-disclosure agreements.¹⁹ The Commission could also consider the use of third-party coordinators, as it has done in other frequency bands such as Part 90 services, if operators are so distrustful of their competitors.²⁰

¹⁷ See, e.g., Comments of Telesat Canada at 7 (“beam-pointing data reveals commercially and customer-sensitive information such as customer locations. Having to share this information with competitors would have negative consequences. For example, potential customers needing the location of military units or other confidential location information to remain unknown might be unable to use NGSO systems that are subject to a sharing requirement. A sharing requirement also could skew the market by giving NGSO operators an unfair ability to target their competitors’ customers.”); Comments of Viasat at 16 (“sharing of beam-pointing information would reveal confidential and proprietary traffic trends that otherwise would not be shared with competitors. The use of confidentiality or non-disclosure agreements would not adequately ensure that this information ‘is not used by competitors for any purpose other than avoiding interference.’” Citing *NPRM* ¶ 22); Comments of O3B at 16 (“Information regarding where and when beams are active is also competitively sensitive.”).

¹⁸ *NPRM* ¶ 23.

¹⁹ *Id.* ¶ 22, citing SpaceX Petition at 12, RM-11855.

²⁰ See *Industrial / Business Licensing*, FCC (Sept. 26, 2019), <https://www.fcc.gov/wireless/bureau-divisions/mobility-division/industrial-business/industrial-business-licensing> (“Frequency coordinators are FCC certified to recommend the most appropriate frequencies for applicants in the designated Part 90 radio services. Applications for new frequency assignments, changes to existing facilities or operation at temporary locations must include a showing of frequency coordination.”).

4. To Spur Innovation, Protections Should Sunset

The *NPRM* asks whether any protections afforded earlier-round licensees by later-round licensees should sunset. “SpaceX proposes that the protection of earlier-round systems from later-round systems sunset after a period of time. SpaceX argues that a sunset provision would encourage earlier-round licensees to coordinate with later-round licensees and avoid entrenching incumbents and stymieing future innovation.”²¹ Proposed sunset periods range from “six years after licensing to coincide with the first NGSO system deployment milestone, ten years after licensing, or fifteen years after licensing.”²² A number of commenters support a sunset on protection for earlier-round licensees.²³ TechFreedom supports the shortest period possible without imposing undue costs on operators.²⁴ Again, given that the satellites in NGSO systems must be replaced at least every five years, a shorter protection window would force operators to innovate and become more spectrally efficient to survive.²⁵ A shorter protection window, especially if running from the license grant date, would also encourage operators to deploy systems more quickly, bringing that added benefit to the public. In no instance should the protection window extend more than ten years. The *NPRM* further asks: “What protection should apply to an NGSO FSS

²¹ *NPRM* ¶ 24.

²² *Id.* (citing Amazon, SpaceX, and Kepler proposals, respectively).

²³ *See* Comments of Kepler at 10 (“A limited duration sunset period, rather than any open-ended protection, ensures that satellite licensees will not continuously rely upon stagnant technology, but are encouraged to continuously integrate newer, more efficient technologies into their satellite platforms and services.”).

²⁴ *Id.* ¶ 24 (“Would a shorter sunset period better promote competition?”).

²⁵ *Id.* (“Should we expect that advances in technology for second-generation NGSO FSS systems will make sharing with new entrants easier?”).

system after any sunset?”²⁶ TechFreedom suggests that the Commission provide protection post-sunset only equivalent to the then-current capabilities of the most recently deployed systems. In other words, if the current generation of systems can tolerate more interference through adaptive coding and modulation (ACM) technologies, or can operate at a higher C/N ratio than the pre-sunset level, then the post-sunset level should be no greater than that new ratio. In doing so, the rules effectively would require legacy operators to continue to adopt the best technologies for their newest generation of satellites as well as ground segments.

5. To the Extent Possible, the New Rules Should Apply to All Operators

Finally, the *NPRM* asks whether the new rules should be applied only to new processing rounds, or to all licensees.²⁷ TechFreedom urges the Commission to apply the new rules to as many licensees as possible. Allowing legacy systems to continue to deploy outdated satellite replacements does nothing to further spur innovation, spectrum efficiency, and good faith coordination. If, instead, the Commission only applies the new rules to new processing rounds, that will entrench existing licensees, and existing technologies, for generations of satellites, and possibly generations of consumers. In this instance, innovation must win out over regulatory stability.²⁸

CONCLUSION

Chairwoman Rosenworcel put it best in her statement accompanying the *NPRM*: “To help usher in this new era, the Federal Communications Commission will need to make changes.”

²⁶ *Id.*

²⁷ *NPRM* ¶ 26 (“we invite comment on whether applying rule changes to existing grantees or pending applicants would advance competition and encourage new entry into the market.”).

²⁸ *Id.*

TechFreedom welcomes those changes, which can lead to a more frictionless regulatory system. TechFreedom supports the efforts of the Commission to update its spectrum sharing rules for NGSO systems in this proceeding. In doing so, it should take the opportunity to reward innovation and spectral efficiency and combat “moat building” by earlier-round licensees. Only in this way can the FCC truly capitalize on the satellite revolution we are currently witnessing.

Respectfully submitted,

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