

**Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554**

Application of)	
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THE BOEING COMPANY)	Call Sign: S2966
)	
For Authority to Launch and Operate a)	File No. SAT-LOA-20160622-00058
Non-Geostationary Low-Earth Orbit Satellite)	
System in the Fixed Satellite Service)	
)	

COMMENTS OF SPACE EXPLORATION TECHNOLOGIES CORP.

Space Exploration Technologies Corp. (“SpaceX”) files these comments in response to the application by The Boeing Company (“Boeing”) for authority to launch and operate a non-geostationary orbit (“NGSO”) satellite system in the Fixed-Satellite Service (“FSS”).¹ Boeing proposes to provide broadband services to users in the United States and internationally using a constellation of up to 2,956 low-Earth orbiting satellites operating in V-band spectrum.² The Boeing application and associated requests to waive several rules should be supported inasmuch as they provide the policy context for the continued development of rational rules for NGSO satellite systems generally.

¹ See Application of The Boeing Company, IBFS File No. SAT-LOA-20160622-00058 (filed June 22, 2016) (“Boeing Application”).

² The Commission has accepted for filing Boeing’s request to operate in the 37.5-40.0 GHz, 40.0-42.0 GHz, 47.2-50.2 GHz, and 50.4-51.4 GHz bands, while deferring consideration with respect to operations in the 42.0-42.5 GHz and 51.4-52.4 GHz bands. See Public Notice, “Boeing Application Accepted for Filing in Part,” DA 16-1244 (rel. Nov. 1, 2016) (“Boeing Public Notice”).

A. Encouraging Efficient Use of V-Band Spectrum for Satellite-Based Systems

In its application, Boeing proposes an NGSO satellite system that is designed to make efficient use of spectrum resources using various advanced technologies. The proposed system would employ phased array antennas, adaptive beam-forming, and advanced digital processing technology to generate narrow spot beams with low sidelobes with the goal of reducing unwanted emissions. As a general matter, the Commission should incentivize the employment of systems that enable good spectrum stewardship, including spectrum sharing among satellite systems (both geostationary orbit (“GSO”) and NGSO) and with terrestrial systems as well.³

The V-band spectrum requested for use with Boeing’s NGSO system has long been identified as a resource for high-capacity satellite systems providing bandwidth-intensive applications and services.⁴ To date, the challenges presented by propagation and other characteristics of this particular spectrum have delayed satellite use of the band.⁵ Modern spacecraft design and improved software now permit advanced satellite systems to unlock the value of this spectrum. Applications⁶ have already been filed in the processing round established by the Commission for applications to operate V-band NGSO systems that remains open until March 1, 2017.⁷ This indicates a renewed interest

³ See Comments of Space Exploration Technologies Corp., IBFS File No. SAT-LOI-20160428-00041, at 4-14 (Aug. 15, 2016).

⁴ See, e.g., *Allocation and Designation of Spectrum for Fixed-Satellite Services in the 37.5-38.5 GHz, 40.5-41.5 GHz and 48.2-50.2 GHz Frequency Bands*, 18 FCC Rcd. 25428, ¶ 3 (2003) (finding that FSS spectrum allocation “will ultimately provide consumers with new services and benefits by accelerating the deployment and increasing the efficiency of telecommunications in a largely unexploited portion of the radio frequency spectrum”).

⁵ Regulatory impediments have also challenged satellite development of the V-band, necessitating some of the waiver requests discussed below.

⁶ See IBFS File Nos. SAT-LOA-20161115-00117 (application of Audacy Corporation), SAT-LOI-20161115-00120 (application of ViaSat, Inc.).

⁷ See Boeing Public Notice at 3 (establishing March 1, 2017 processing round cut-off).

in satellite-based services in V-band, and the Commission should promote its development.

As with any large proposed constellation, Boeing's application heightens the importance of ensuring the safety of space operations. This concern will be especially significant for Boeing, which must not only safeguard the operations of its own satellite fleet, but must also co-exist with the NGSO system proposed by OneWeb, which will operate at the same orbital altitude (1,200 km).⁸ Both OneWeb and Boeing indicate that they are aware of the need to develop an effective strategy for collision avoidance.⁹ While there is no reason to believe that these two operators cannot achieve that goal, the Commission should keep close contact with both operators to ensure that the resulting arrangements safeguard the ongoing use of space for the benefit of all interested parties.

B. Granting Boeing's Waiver Requests Would Serve the Public Interest By Enabling Productive Use of Spectrum and Orbital Resources Without Harm to Other Operators

Boeing has requested that the Commission waive a number of its rules in whole or in part in order to accommodate the operations of its proposed NGSO system.¹⁰ The Commission may grant such waivers where there is a showing of good cause to do so and the waiver will serve the public interest.¹¹ As the D.C. Circuit has explained, "a general

⁸ See IBFS File No. SAT-LOI-20160428-00041 (application of WorldVu Satellites Limited d/b/a OneWeb).

⁹ See Letter from Jennifer D. Hindin to Marlene H. Dortch, IBFS File Nos. SAT-LOI-20160428-00041 and SAT-LOA-20160622-00058 (Sep. 19, 2016) (discussing OneWeb's "focus on safety and collision avoidance" and expressing "its willingness to work with The Boeing Company"); Comments of The Boeing Company, IBFS File No. SAT-LOI-20160428-00041, at 4 (Aug. 15, 2016) ("Boeing is confident that OneWeb and Boeing can operate their respective constellations at or near 1,200 kilometers by making slight adjustments upwards or downwards in their planned constellation altitudes.").

¹⁰ See Boeing Application at Section IV.

¹¹ See 47 C.F.R. § 1.3; *National Broadcasting Co. v. United States*, 319 U.S. 190 (1943).

rule serving the public interest for a broad range of situation will not be rigidly applied where its application would not be in the public interest.”¹² The Commission’s rules for V-band satellite operations were adopted over a decade ago, and have not been tested under real-world conditions. The requested waivers will help to clarify the policy environment necessary to provide the enhanced capabilities and operational flexibility that can enable NGSO systems to optimize use of valuable spectrum resources. Accordingly, and as discussed more specifically below, SpaceX supports the grant of those waiver requests.

Boeing’s proposed system does not conform to two rules, Sections 2.106 and 25.202(a)(1), that limit spectrum use.¹³ First, although the Commission has allocated the 50.4-51.4 GHz band for FSS in the Table of Frequency Allocations, the band is not identified in the rules as available for use by FSS uplinks as Boeing proposes. Second, although the 37.5-40.0 GHz band is available for use by FSS systems, that use has been restricted to gateway operations only and is not available for user terminal operations as Boeing proposes. Without full access to these bands, any NGSO system operating in the V-band would face significant capacity constraints that could compromise its overall commercial viability. Boeing has identified the methods and technologies it intends to employ to utilize these bands without harming the operations of other systems in the same and adjacent spectrum.¹⁴ To the extent that Boeing proposes more efficient use of

¹² *Bellsouth Corp. v. FCC*, 162 F.3d 1215, 1224 (D.C. Cir. 1999).

¹³ Boeing also seeks a waiver with respect to use of the 42.0-42.5 GHz and 51.4-52.4 GHz bands. Because the Commission has deferred consideration of those bands, SpaceX does not discuss them here.

¹⁴ *See* Boeing Application at 73-98.

this spectrum while protecting other systems, the requested waivers will serve the public interest and thus should be granted.

Boeing also seeks a waiver of the power flux-density (“PFD”) limits in Sections 25.114(c)(8) and 25.208(r) of the Commission’s rules. The Commission has adopted limits in the 37.5-40.0 GHz band that are 12 dB more stringent than the international PFD limits for NGSO systems in that band and the Commission’s own rules in the neighboring 40.0-42.0 GHz band. Here again, Boeing has submitted an analysis demonstrating that NGSO operations at the internationally-approved PFD levels would introduce a negligible amount of interference to terrestrial systems operating in the band, which the PFD limits were designed to protect.¹⁵ In the context of its ongoing *Spectrum Frontiers* proceeding, the Commission has acknowledged that it is appropriate to review this regime “in light of evolving technology permitting new options for co-existence of terrestrial and FSS.”¹⁶ Given that Boeing is willing to accept a waiver conditioned on the outcome of that proceeding,¹⁷ a grant would serve the public interest.

Section 25.143(b)(2)(ii) of the Commission’s rules imposes geographic coverage requirements on NGSO operations. Boeing seeks a partial waiver of those requirements, solely with respect to international coverage. In particular, Boeing’s system would comply with the literal requirements of the rule, even though the envisioned level of service available at high latitudes would be less robust and require larger user terminals. This should be deemed sufficient to justify a waiver, especially given that multiple

¹⁵ See *id.* at 73-79, 84-89.

¹⁶ See *Use of Spectrum Bands Above 24 GHz For Mobile Radio Services*, Notice of Proposed Rulemaking, 30 FCC Rcd. 11878, ¶ 126 (2015).

¹⁷ See Boeing Application at 64.

additional NGSO systems are likely to operate in this band and offer service over a wide variety of areas.

The Commission's modified processing round regime includes a provision (Section 25.157(e)) that calls for dividing spectrum in a specified manner depending upon the number of qualified NGSO FSS satellite applicants participating in the round. As SpaceX has asserted in other proceedings, the Commission should not reflexively impose the automatic band segmentation approach upon the current generation of participants in NGSO processing rounds, and should instead proceed with a regime based on avoidance of in-line interference events.¹⁸ This more efficient approach could potentially enable all NGSO FSS systems in the round to use all the available V-band spectrum, though it will put a high premium on successful frequency coordination among those systems in order to optimize spectrum use. Advanced satellites such as those in Boeing's proposed system feature characteristics (including a large number of narrower beams that can be dynamically allocated) that should facilitate such coordination.

Boeing also seeks a waiver of the requirement in Section 25.164(b) that an NGSO system licensee bring all satellites in its licensed system into operation within six years of license grant. The Commission has established such milestone requirements for satellite system implementation in order to deter warehousing, which in this context "refers to the retention of preemptive rights to use spectrum and orbital resources by an entity that does not intend to bear the cost and risk of constructing, launching, and operating an authorized space station, is not fully committed to doing so, or finds out after accepting the license that it is unable to fulfill the associated obligations."¹⁹ The

¹⁸ See IBFS File No. SAT-LOA-20161115-00118, Waiver Requests at 5-8 ("SpaceX Waiver Requests").

¹⁹ *Comprehensive Review of Licensing and Operating Rules for Satellite Services*, 30 FCC Rcd. 14713, ¶ 53 (2015).

rules are intended to offset the incentives for warehousing that could harm both competition and consumers, while also encouraging the rapid deployment of new spacecraft and the optimal utilization of scarce orbital and spectrum resources.²⁰ As applied to large NGSO constellations, where a licensee could launch and begin operating hundreds or thousands of satellites yet still not reach full deployment, SpaceX has argued that the proper scope and application of such a milestone may need to be reconsidered.²¹ In this instance, Boeing proposes that the milestone be applied to its Initial Deployment of 1,396 satellites, a level of deployment that should be viewed as sufficient to demonstrate an NGSO licensee's intention to make use of the resources licensed to it, making waiver of the milestone appropriate.

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The Commission should encourage systems that facilitate spectrum sharing among licensed users. The waivers Boeing seeks will help to build a sensible regulatory environment for NGSO operations while honoring the goals of the rules at issue.

²⁰ *Id.* See also, e.g., *Amendment of the Commission's Space Station Licensing Rules and Policies*, 18 FCC Rcd. 10760, ¶ 173 (2003); *TerreStar Networks, Inc.*, 22 FCC Rcd. 17698, ¶ 6 (Int'l Bur. 2007).

²¹ See SpaceX Waiver Requests at 8-10 (discussing application and associated waiver of final implementation milestone to proposed NGSO constellation).

Respectfully submitted,

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December 1, 2016

CERTIFICATE OF SERVICE

I hereby certify that, on this 1st day of December, 2016, a copy of the foregoing Comments was served via electronic mail and First Class mail upon:

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